Acoustics BULLETIN

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Traffic noise exposure in cities

Aircraft noise index study 20 years on

Good Practice Guide for strategic noise mapping

IOA Spring Conference report

Institute of Acoustics

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Contents

Institute of Acoustics

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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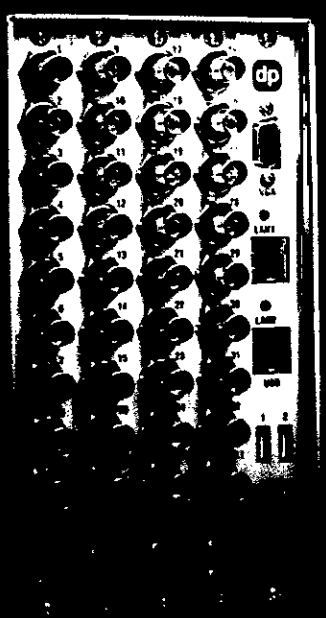

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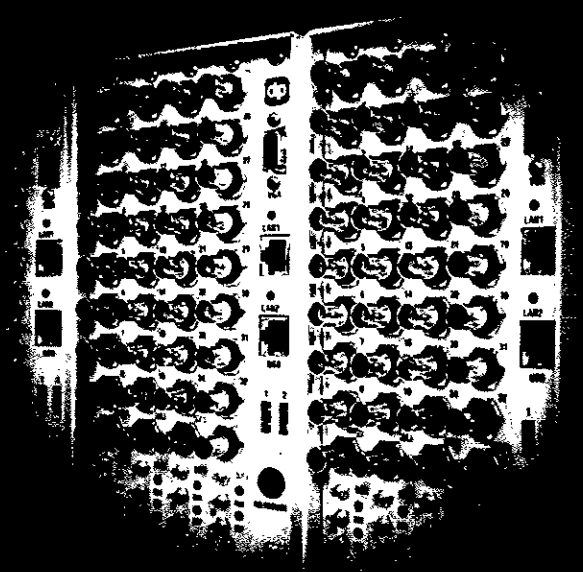

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Dear Members

It is with some trepidation that I write my first President's letter, largely because I have seen the tremendous effort my predecessor, Geoff Kerry, has expended on the Institute's behalf over the past two years. This has been a period in which the standing and activities of the Institute of Acoustics have been further strengthened, and I am sure you will all join me in expressing gratitude for Geoff's endeavours. Whereas Council and I will benefit from Geoff's continued presence as Immediate Past President, by relinquishing that role Mark Tatham retires from Council. Some of you know that Mark was injured in a traffic accident and has had to endure a long period of convalescence. I am glad to say that he is now well on his way to recovery and I am sure we will be benefiting from his renewed contribution in some capacity in due course. I am honoured to have been made President of the Institute of Acoustics and will do my best to continue the sterling work of my predecessors.

Although much progress has been made, Council is aware of the need to look to the future and safeguard the Institute's development in a continually changing environment. To this end Council has been considering the initial reports from the Strategic Development Group, which have highlighted a forecast of reduced membership over the next decade and the need to promote the Institute better to the outside world. The time scale of the anticipated demographic change is such as to provide some leeway, but nevertheless it is prudent to take action now. Council has determined that a factual basis is needed for the development of a firm strategy, and that an early step will be to establish the views of the Institute's membership and others using a carefully constructed questionnaire. This is likely to be conducted primarily via the Institute's website, which Council has also decided to update in accordance with a recommendation from the Publications Committee. It will be a little while before the new-style website is unveiled, but I feel sure that this in itself will be a significant step forward.

Having thanked the outgoing Honorary Officers, I am pleased to welcome Colin English as President Elect and Bernadette McKell as Vice President (Engineering Division), both of whom will, I know, play prominent roles in the evolution of the Institute.

I look forward to the challenge of the Presidency and to working with you all towards the development of the Institute.

Tony Jones
President

Meet our new President

Anthony (Tony) Jones BSc(Hons) PhD FIOA CPhys MInstP

Tony Jones graduated from the University of Salford in 1969 with a first class honours degree in Physics. He then undertook research into the subject of human sensitivity to whole body vibration, leading to the award of his doctorate in 1973 and the publication of papers in scientific journals.

He joined Acoustical Investigation & Research Organisation Ltd (AIRO) in 1972 as a Consulting Engineer and, after accumulating considerable experience in all aspects of the company's activities, was appointed Chief Consulting Engineer in 1974 and Managing Director in 1978. AIRO is a long established acoustical consultancy firm that also operates measurement services from its permanent laboratory and on site.

During his employment with AIRO, Tony has been engaged on a wide variety of commissions in the fields of acoustic design and noise control in buildings of various types, sound insulation, transport noise, industrial noise control, noise impact appraisals, and the measurement and assessment of vibration. He has prepared and presented expert evidence for planning inquiries, court cases and public inquiries, for example in proposed road schemes, industrial, entertainment and aircraft noise, and neighbourhood noise nuisance. Tony has also acted as a Technical Assessor for the Department of the Environment in planning appeal proceedings, and was a member of the Department's Noise Review Working Party which reported its findings in 1990.

Dr Jones is a Fellow of the Institute of Acoustics, a Chartered Physicist, a Member of the Institute of Physics and a Member of The Acoustical Society of America. Throughout the 1980s he was a visiting lecturer for the MSc course in environmental design and engineering at University College London and served as a Member of the Council of the Association of Consulting Scientists, including five years as Honorary Treasurer. From 1986 to 1992 he held the post of Honorary Secretary of the Association of Noise Consultants, and was elected Chairman of the Association over the period 1992 to 1995.

Tony served as Honorary Secretary of the Institute of Acoustics from 1995 to 2001, and in 2002 was made the Institute's President Elect, leading inevitably to his election as President from May 2004. He has served on several other committees and is presently a member of the Building Acoustics Technical Committee of the British Standards Institution and of the Acoustics Industry Technical Committee of the United Kingdom Accreditation Service.

IOA HONORARY FELLOWSHIP

Citation for Professor R G White

Robert George White has made many outstanding contributions to acoustics, particularly in the field of vibration control. In recognition of his early work in the broad field of acoustics he was awarded the *Tyndall Medal* of the Institute of Acoustics in 1984.

His research interests in vibration focused on experimental techniques in the vibration and shock response of structures; the dynamic properties and structural application of carbon fibre reinforced plastics; and theoretical and experimental use of power transmission techniques in the analysis and design of machinery installations. Bob has supervised over forty postgraduate students and published over 200 papers in refereed journals.

In addition to his research work, Bob undertook major administrative duties. He was director of the Institute for Sound and Vibration Research (ISVR) at the University of Southampton from 1982 to 1989, where he started a new research group in signal processing and developed underwater acoustics research by building an underwater acoustics tank and associated laboratory. Subsequently he became director of the University of Southampton Institute of Transducer Technology of which he was a founder member. He also served the University as Head of the Department of Aeronautics and Astronautics for a number of years.

Bob's route to academic excellence and the award of a Doctorate of Science by the University of Southampton was not a straightforward one. He started at Farnborough Technical College where he gained an ONC while working at the Royal Aircraft Establishment as a scientific assistant, followed by an HNC and then a

graduateship of the Institute of Physics. Once at the University of Southampton, his academic skills were truly allowed to flourish, starting with a PhD which was awarded without oral examination.

Bob is a Fellow of the Royal Academy of Engineering, a Chartered Engineer, a Chartered Physicist, a Fellow of the Royal Aeronautical Society, a Fellow of the Institute of Physics and a Fellow of the Institute of Acoustics. He has chaired many panels on acoustics and vibration and has fostered many links around the world.

He has served the Institute's Engineering Division since its establishment in 1989, working alongside Peter Lord as an interviewer for CEng candidates. Bob later became Chairman of the Engineering Division and a Vice-President of the Institute. He has continued to serve as a committee member and interviewer, specialising in mature candidate interviews, for which he has also been an accredited Engineering Council interviewer.

For his outstanding contributions to research and teaching in acoustics and his services to the profession of acoustical engineering, the Institute of Acoustics is proud to award an Honorary Fellowship to Robert George White.

NEW MEMBERS

At Council on 11 March 2004 the following were elected to the membership grades shown:

Fellow

Bloomfield A P
Xiang N

Member

Beaman A L
Clack D E
Dangerfield N
Elliott A C
Evans C J
Johnston-Wood C R
Kennedy J W C
Kroeff G
Mart B L
Metcalfe J M
Parr F M
Raisborough M J
Rickard G S
Rossetti S
Rudman E C
Rushforth I M
Scarbrough P H
Stubbings R
Taylor A
Trew D C
Wang L

Associate Member

Bentley R W
Blakeman D R
Cecil T
Christodoulou C
Claessens H
Cockings T S
Evans R C
George R E
Keeble R A
Magloire E
Miller S A
Monaghan A
Morales L
Priddle N
Sibanda C C
Tucker C P
Wigham S
Wright R M
Young R K

Affiliate

Alzoubaidi F S
Palmer R J

Student

Cho Y
Hardy J
Howell J M
Jackson T D
Varley H L

The Anglo-French Physical Acoustics Conference 2004

Diverse range of topics explored

French and English Acousticians joined together for the Anglo-French Physical Acoustics Conference (AFPAC'04), held this year in the Kent countryside from the 14 -16 January 2004. This meeting, now held annually on opposite sides of the Channel, was organised by the Joint Physical Acoustics Group of the Institute of Physics and Institute of Acoustics and GASPUS of Société Française d'Acoustique.

Some 60 delegates assembled in the Witherdane Conference Centre at the Wye Campus of Imperial College for the meeting. The Conference covered many aspects of physical acoustics research with six invited papers and 25 contributed presentations, several being given by PhD students on their own research projects.

The contributed papers covered an incredibly diverse range of topics, including propagation and scattering in fibre composites, periodic structures and colloidal dispersions, cavitation in ultrasonic fields, guided waves in plates and structures, optical imaging of surface waves, non-destructive evaluation, ultrasonic assessment of curing of thermosets, phased arrays for imaging, transducer optimisation, and photoacoustic techniques for medical imaging. A very strong theme running through the meeting was the practical application of ultrasound to measurement problems, and the need for a thorough understanding of the science underlying such techniques.

The invited papers, which illustrated the wide subject matter, started with **Daniel Royer** (Université Paris 7) describing two methods of measuring the vibration of transducers and their ultrasonic fields in air or a fluid in his presentation on *Metrology of ultrasonic fields*. This included the use of both optical and ultrasonic probe beams to measure the field under investigation.

Trevor Esward (NPL) considered the *Challenges of applying finite element modelling to ultrasonic and underwater applications*. His presentation reminded the delegates of the tests that could be applied to ensure the accuracy of numerical models and outlined some of the difficulties likely to be encountered.

Jacques Attal (Université Montpellier II) illustrated the potential of very high frequency ultrasound to image structures in his presentation, *Acoustic microscopy: from micro to nano range*. Optical sensors for measuring ultrasonic fields were considered by **Paul Beard** (University College London). His talk, *Fabry Perot polymer film sensors for broadband ultrasonic field characterisation and imaging applications* showed the potential of these devices for field measurement and other imaging applications.

The second day concluded with **Victor Humphrey** (Institute of Sound and Vibration Research) describing the consequences and applications of nonlinear propagation, in his presentation *Nonlinear acoustics and medical ultrasound*.

The conference banquet was well received, with good food served in a very pleasant and historic setting, even though the delegates had to leave the hall before the cheese course, as a result of a fire alarm. Undaunted, they simply adjourned to a lecture theatre across the road where port was served!

The final invited talk, given by **Gérard Maze** (LAUE UMR CNS), was entitled *Resonant acoustic scattering*. He described acoustic scattering from cylindrical structures and how the characteristics of this scattering could be interpreted in terms of resonances of different acoustic waves that propagate on the surface of the shells.

In all, the meeting promoted a good deal of interaction and discussion, and was generally agreed to have been very useful. The delegates left satisfied and ready to return for **AFPAC'05**, to be held during January 2005 at Le Havre in France.

Victor Humphrey FIOA

Eastern Branch Meeting

The Resistance to the Passage of Sound was the theme explored at our meeting held on 25 March 2004 at the Corn Exchange, Ipswich. Through his presentation, Richard Scuttle (Chief Building Control Officer for Ipswich Borough Council) provided a comprehensive guide to Part E of the Building Regulations and homed in on the changes which will impact on building design. In particular the talk highlighted the requirements of 'performance standards' and 'noise transmission testing'. Richard also provided excellent photographic examples of common constructional faults, caused by contractors taking short cuts or failing to adhere to proper building design methods. Such failures, if not discovered by Building Control Officers during their inspections, are likely to give rise to noise transmission problems and ultimately may lead to noise complaints once the properties are occupied.

The talk provided a welcome insight into Part E of the Building Regulations and was followed by a lively forum of questions and discussion.

Editor's Notes

Ian F Bennett BSc CEng MIOA
Editor

Welcome to another issue of the *Bulletin*, with yet another national conference to report. My thanks go to all the individual session chairmen at Southampton, to Brian Mace in particular, for pulling together all the constituent parts of the write-up that appears in this issue, and to John Tyler for taking the photographs. Whilst a report in this particular publication will never replace the actual conference proceedings (nor is it so intended) it is always helpful to have a flavour of the event as well as a reasonable idea of the content, for those who missed out (myself included this time, I'm afraid).

Through this column could I take the opportunity to thank Geoff Kerry for his two years of presidency, especially for his enthusiastic support of your editor's efforts, and also to apologise for his having to suffer two years of my regular 'nagging' for copy every couple of months. In fairness, Geoff was never late with his President's Letter, and the new incumbent has a hard act to follow. Welcome to the hot seat, Tony: there are only another eleven of them to write.

More seriously though, I know that many members involved in acoustic consultancy are finding, as I am, that their workload is snowballing as old projects get dusted off, and new funding becomes available for new developments. Geoff, throughout his presidency, made it a top priority to encourage more students to consider engineering in general, and acoustics in particular, and viewing the problem from the 'output end' of higher education I fervently hope his efforts will bring success.

As editor, the brand-new *Bulletin* dropping on my doormat every two months is something of an anti-climax, as I already know what's in it. One 'perk' of the job which I do enjoy, however, is the regular supply of *Acoustics Australia* and *New Zealand Acoustics*, and my regular contact with the respective editors. We continue to pool knowledge and information, and the article by Brown and Bullen is another example of that cooperation. My thanks go to Marion Burgess and her colleagues for permission to reproduce *Exposure to road traffic noise in Australia* and Stuart Camp for several of the bloopers. Watch this space for more antipodean acoustics.

Copy date for the July/August issue is 4 June: please let me have submissions by e-mail in good time as we approach exam time, closely followed by the holiday season.

Ian Bennett
Editor

Spring Conference 2004 reviewed

Southampton University's Avenue Campus, our conference venue

Dr Brian Mace, chairman of the Technical Committee, wecomes delegates

As usual, the IOA's Spring Conference comprised a mix of plenary sessions, three parallel sessions on various subject areas, and lively debate both formal and informal

The **Opening Address** was given by *Prof J K Hammond* (ISVR), who welcomed delegates to the Avenue Campus of Southampton University at the rather unsocial hour of 9am on a Monday morning. His well-chosen words were followed by the first plenary lecture, by *Wolfgang Kropp*, on **Tyre/road noise generation - modelling and understanding**. His paper was co-authored by *K Larsson, F Wullens* and *P Andersson*, all from Chalmers University of Technology.

◇ Transportation noise and vibration

Six papers on the broad topic of transportation noise and vibration were presented in the first of the parallel sessions. To begin, *V B Georgiev, V V Krylov* and *R Windward* (Loughborough University) dealt with **Finite element analysis of structural acoustic interaction in simplified models of road vehicles**. Next, *R Gorman* and *V V Krylov* discussed the use of reduced-scale simplified models to investigate the acoustic properties of vehicle compartments.

R Rashid and *R S Langley* (Cambridge University), together with *R Cornish* (Birmingham Technology Innovation Centre), presented their paper on **Modelling and analysis of in-vehicle boom noise**, and *K Janssens et al* proceeded to evaluate the sound quality resulting from structural design modifications in a virtual car sound environment. *Rupert Thornely-Taylor* (Rupert Taylor Ltd) then presented Part 1 of his paper **The prediction of vibration, groundborne and structure-radiated noise from railways using finite difference methods**, and finally in this session the paper, **Interaction between a moving wheel and a periodically supported rail,** was given by *X Sheng, D J Thompson* and *C J C Jones* (ISVR, Southampton University).

◇ Waves in structures

In another parallel session, six papers were given, on waves in structures. All authors were affiliated with either the ISVR, Southampton University or the Department of Aeronautical and Automotive Engineering, Loughborough University. The first, **Effects of asymmetry on vibration transmission in jointed beams** was delivered by *Jane Horner* (Loughborough University). This was concerned with vibration transmission in non co-linear beam frameworks and the effects of changing the angles between the different beams. Results were presented for both flexural and longitudinal wave impingement and included the effects of wave coupling at the junction.

Wolfgang Kropp gives the first plenary lecture

Jenny Muggleton (ISVR) presented the second paper on **The effects of wall discontinuities on low frequency axisymmetric wave propagation in fluid-filled pipes**. The work presented was part of an investigation into methods to determine the position of leaks in buried water pipes. It concentrated on the effect of introducing different types of mechanical discontinuity, such as a pipe of different material, and the subsequent effect on the transmission of leak noise energy.

The next paper, **Reflection and transmission coefficients using the spectral element method: application to crack modelling in beams,** presented by *Simon Shone* (ISVR) was concerned with the problem of developing a vibration-based method for the assessment of cracks in beams. Results were presented for using a combination of translational and rotational springs to model a static crack in a beam and the conversion of the model to spectral beam elements. *Yang Gao* (ISVR) then discussed **Cross-correlation for leak detection in buried plastic water pipes**. This was concerned with detecting leaks by using measurements made on hydrants connected to the pipe. The paper considered three different types of sensors

and compared results to test data from working water pipe systems.
Victor Krylov (Loughborough University) gave the next presentation on **Coupled-wave theory approach to understanding resonant vibrations on non-circular cylindrical shells**. This was part of a project on the modelling of interior vehicle noise using a simplified shell model which allows the quick prediction of resonant vibration modes in numerous thin walled structures containing quasi-flat surfaces. The finial presentation in this session, given by *Seung Kyu Lee* (ISVR) was **Wave propagation, reflection and transmission in non-uniform beams**. This considered polynomial variations in geometry in beams carrying both bending and compressive waves. Results were presented for the transmission of waves in a beam system containing a linearly tapered section.

◇ Environmental noise

The third of the morning parallel sessions included four papers on environmental noise in its widest sense, taking us from industry to the offshore environment, then to aircraft noise. *Messrs Postlethwaite* and *Stephenson* had but a short walk along The Avenue from Bureau Veritas to present **Noise mapping of industrial sites** and *S J Stephenson, R Beaman* and *S J Ient* then discussed the application of the ALARP (As Low As Reasonably Practicable) principles to noise control in the offshore industry. *P Bite* and *I Flindell* (ISVR) then compared A-frequency weighting and loudness-level weighting methods for the assessment of environmental noise, and *I S Jopson* (CAA Environmental Research and Consultancy Department) brought the session to a close with his paper **Presenting aircraft noise information - experiences from a UK public consultation**.

◇ Acoustics I

Two papers under this 'catch-all' title followed the environmental noise session. *Keith Attenborough* and his colleagues at the Universities of Hull, Cambridge and Southampton discussed **Sonic cleaning using laser-generated shocks**, and then **Support mathematics for acoustics research.**

◇ Aeroacoustics

The second plenary lecture, **Aircraft noise reduction: progress and prospects** was delivered after the lunch interval by *Nigel Birch*, who gave an informative and entertaining presentation on current programmes to reduce aircraft noise. He began with a review of certification procedures and described the technologies which are currently being developed and exploited to achieve the ACARE target of a 10 EPNL dB reduction by 2020. The lecture was enhanced by sound clips illustrating the character of aero-engine noise for different sources and different engine conditions.
Dr Birch also highlighted potential areas of future research. These included the exploitation of flow control for noise reduction, understanding and predicting broadband noise (fan and jet), and the noise shielding by airframes. In response to questions from the audience he agreed that the aerodynamic and cabin noise implications of engines mounted over the wing had yet to be fully assessed. In terms of new liner materials and active liners, he expressed the view that active-passive liners which could re-tune themselves to different engine conditions were more likely to prove useful in the near future in aero-engine applications than full active noise control.
The contents of the papers in the aeroacoustics session which followed the plenary talk were varied. All speakers in this session were from the ISVR.
Prof Peter Davies and *Dr Keith Holland* presented papers at the beginning and end of the session on predicting and measuring flow generated noise in pipes and exhaust systems. The first focused on modelling flow noise generated in an expansion chamber. A knowledge of the flow and vorticity distribution was sufficient to predict noise even when large levels of trapped energy were present. In a complementary talk at the end of the session, Dr Holland showed how selective averaging could be used to measure sound levels in highly reactive pipe systems. A lively discussion followed each of the presentations.
The other two papers in the session were on coupled RANS modelling of jet noise (*Allesandro Bassetti*) and propagation modelling in aero-engine bypass ducts (*Rie Sugimoto*).
Mr Bassetti described how the RANS coupled acoustic model was constructed by using experimental turbulence statistics to model the spectral shapes and spatial scales associated with the power spectral density and fluctuating Reynolds stress extracted from a CFD model for the jet with a turbulent closure model. Close correspondence was achieved for single isothermal jets, but further analysis was needed to extend it to coaxial and non-isothermal jets.
Dr Sugimoto presented a method for characterising the broadband power transmission characteristics of an acoustically lined annular bypass duct by combining multiple finite element solutions for transmission of uncorrelated cut-on modes. The insertion loss calculated by this procedure was validated against measured data for a one-sixth scale duct without flow and also against a full FE/IE analysis including radiation. Correspondence was very close except at low frequencies where the assumption of an anechoic exit plane was not valid. In response to a question from the audience (Dr McCulloch) regarding the exterior propagation model in the presence of flow, Dr Sugimoto responded that when flow was present the radiated field was calculated by using a ray code coupled to the modal field predicted at the exit of the bypass duct.

continued on page 8

IOA AWARDS

During the conference, the President, Geoff Kerry, made the following presentations

Bob White (left) receives his Honorary Fellowship

Prof Tim Leighton (left) receives his 2002 Tyndall Medal

Simon Richards (left) receives his 2002 A B Wood Medal

Anthony Lyons (left) rceives his 2003 A B Wood Medal Certificate

Spring Conference 2004 reviewed

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◇ Standards

The sole paper in this category was presented by *Roger Higginson* (Higginson Acoustics) who brought his specialist knowledge and experience to bear on **Making standards in the 21st century**.

◇ Vibroacoustics

Frank Fahy started the afternoon parallel sessions in Lecture Room B in inimitable style, with a demonstration that perforated plates are less good sound radiators than plane plates. This is well-known of course, but perhaps surprisingly in view of the obvious potential applications, has never been modelled. The paper, **The effect of perforation on the radiation efficiency of vibrating plates,** by *Fahy* and *Thompson* (ISVR) took us through the main features of the analysis illustrating the difficulties of modelling the baffle, and some results which indicate that the open area ratio is not the only important parameter as is often thought.

Thomas Eck presented his work with *Stephen Walsh* (Loughborough University) on **Structural intensity measurement using electronic speckle pattern interferometry (SIMESPI)**. This provides a non-contact method as an alternative to accelerometers to measure the structural intensity in beams and potentially also in plates. Thomas took us through some of the processing required to 'clean up' the data, and presented results for an experimental rig using 'infinite' beams which showed promising agreement with direct measurement of power input.

Matthew Wright (ISVR) then described his work on **Quantum chaos in linear acoustics: the problem of acoustic morphology**. He showed that the Schrodinger equation can be cast in the form of the Helmholtz equation, hence the quantum connection. He described the billiard ball model in which the Green's function of a membrane of any shape can be found from repeated reflections of a 'billiard ball' at the boundaries. Simple shapes display self-repeating patterns, but other shaped membranes are highly sensitive to the angle of the first 'ray', hence chaotic.

The session finished with *Andy Moorhouse* (Salford University) who described measurements to obtain the blocked forces of an operating electric motor for use in Virtual Acoustic Prototypes in his paper with *Richard Cookson* and *Gary Seiffert* (Liverpool University): **Testing of an electric motor as a structure-borne sound source.** Two measurement methods were described, using force transducers and an inverse method. Results were validated illustrating good agreement at low frequencies and some measurement difficulties above 500Hz.

◇ Vibrations

David Thompson (ISVR) presented work also by *Choi* and *Thite* on the related inverse problem of how to obtain unknown exciting forces from a measured response. The paper, **Methods for selecting sensor locations for improving indirect force determination**, described various ways to minimise the condition number of the accelerance matrix. The results illustrated the importance of selecting suitable measurement points in that inverse estimates based on accelerations measured at 'bad' positions produced poor results, whereas 'good' positions on the same plate gave a reliable measure of the unknown forces.

The next paper was **Nonlinear transient response of a single degree of freedom model to shock excitation** by *Schaedlich* and *Ferguson* of ISVR. Theory was presented of the excitation of a single degree of freedom to a shock wave from a blast, with nonlinearities accounted for by a varying spring stiffness. Various simple schemes for point selection produced close to optimum values.

The final paper by *Inacio, Antunes* and *Wright* **On the violin family string/body dynamical coupling** was a good example of 'industrial' type techniques applied to an altogether more refined area. The presence of 'wolf tones' in a cello was predicted by accounting for the finite admittance of the bridge. A plot showing the onset of the wolf tone to occur at a different finger positions in an up and a down glissando caught the imagination of the audience, and the speculations as to the cause continued well after the official closing time of the session.

The quality of presentations was good and both afternoon sessions were well-attended and generated lively questions.

◇ Soundfield control

This session contained six papers on a variety of topics in soundfield control. The first paper, by *T Papadopoulos* and *P A Nelson*, dealt with crosstalk cancellation and in particular the need for regularisation to limit the loudspeaker signal amplitude and make the cancellation robust.

The second paper, by *I Chun* and *P A Nelson*, was concerned with soundfield reproduction over a zone, and included the effect of scattering bodies. Good reproduction of the pressure field was achieved in simulations of a headset using only nine sources and was independent of the scattering from the pinna.

In the third paper, by *S J Elliott* and *T Bravo*, systems were investigated attenuating the sound from one headrest at the head position in an adjacent headrest to generate 'personal audio'. The geometry which appears to give the best attenuation is an array of loudspeakers adjusted to maximise the acoustic contrast between the mean square pressure at the two headrest positions.

The fourth presentation, by *C F Cardoso* and *P A Nelson*, changed direction somewhat being concerned with the directivity of spherical arrays of microphones. It was shown that a ring of microphones mounted on a solid sphere gave a better resolution of front/back ambiguity than a line array. Again, the topic changed in the fifth paper by *L Rees* and *S J Elliott*. This described a system which attenuated and enhanced different engine orders in a car to reproduce a target spectrum, designed to enhance sound quality. The reduction in the complexity of the controller was investigated by only controlling orders which were not masked by stronger sounds. Finally, *S Yaacob et al* (Universito Malaysia Sabah) spoke about their work in using neural networks in a feedforward controller for active noise control. Laboratory experiments were described in which the neural network was trained using a modification of the backpropagation algorithm.

The first day's parallel sessions were followed on the Monday evening by a reception and conference dinner in the Hartley Suite. For those unaware of the connection, Hartley University College was the early antecedent of the University of Southampton, opening in the early 1900's. The name is also perpetuated in *Hartley News*, the newspaper circulated regularly to all Southampton alumni, and in the name of the university library on the main campus in University Road.

A view of the Conference Dinner, held in the Hartley Suite

◇ Acoustics of liquids and tissues 1

The second day's proceedings got under way with the *2002 Tyndall Medal Lecture* by *Prof Tim Leighton,* who discussed **From sea to surgeries, from babbling brooks to baby scans: bubble acoustics at ISVR**. He then went on to chair the parallel session covering his various fields of interest, which included four papers and the *A B Wood 2002 Medal Lecture*. The first was **Tortuosity measurements in air-saturated stereolithographical models of bone samples using audio frequency acoustic pulses** by *Keith Attenborough* and others, which was followed by **High intensity focused ultrasound in the treatment of cancer: clinical devices and exposure protocols** from the Institute of Cancer Research, Sutton. Next, *Fiametta Fedele* (St Thomas' Hospital) described **A new sensor for detecting and characterising acoustic cavitation in vivo**, then authors from the Universities of Bath and Southampton, and from the Royal United Hospital, Bath, described **Numerical indicators of nonlinear propagation in medical ultrasound fields**.

The parallel session was followed by the *2002 A B Wood Medal Lecture*, by *Simon Richards* (QinetiQ) who spoke about **Underwater acoustics and sonar performance in turbid environments**.

◇ Uncertainty and structural acoustics

Application of the transformation method to assess response uncertainty of a vibro-acoustic system was the title of the joint paper from LMS International, Noesis Solutions, and the Katholieke Universiteit Leuven (Netherlands) that opened this session. It was followed by a paper by *E Hills, B R Mace* and *N S Ferguson* (all ISVR, University of Southampton) on **Response statistics of uncertain structures**.

LMS International and the Katholieke Universiteit Leuven were again in the

Simon Richards delivers his 2002 A B Wood Medal lecture

spotlight with the paper by *T Peuvrel et al* on **Global iterative solver for parallel computation of numerical coupled vibro-acoustic systems - implementation and validation**. *L Ji* and *B R Mace* then presented **Dynamic interaction between long and short wavelength substructures: effective mass and effective damping**. *J W Yoo, D J Thompson* and *N S Ferguson* gave **Investigation of the coupling of a beam-plate structure in terms of statistical energy analysis**, and *Mace* and *Ji* completed the session with **The statistical energy analysis of coupled oscillators**. These last three papers were all by researchers at the ISVR, University of Southampton.

◇ Acoustics II

The subjects covered by the second 'Acoustics' parallel session ranged from music to audiology. *I Paraskevas* and *E Chilton* (University of Surrey) discussed **Phase as an assistive feature vector for audio classification**, then *A Earis* and *B M G Cheetham* (University of Manchester) presented **Extraction of expressive performance parameters from acoustics recordings of piano music**.

Acoustic classification using time-frequency distributions was another paper from the University of Surrey's Centre for Vision Speech and Signal Processing, written by *H Marvi, I Paraskeves* and *E Chilton*, and the session was completed by *H Aazh* and *A A Peyvandi* (Shaheed Beheshti University of Medical Sciences) and *B C J Moore* (Cambridge University) on the **Influence of ear canal occlusion and static pressure difference on bone conduction thresholds: implications for mechanisms of bone conduction**.

◇ Acoustics of liquids and tissues II

This two-paper session was preceded by the *A B Wood Medal Lecture 2003*, given by *Anthony P Lyons* of Pennsylvania State University, on **High technology and high frequency seafloor acoustics**.

The two presentations which followed were **Microfabricated acoustic resonators for manipulating particles within a fluid** by *M Hill* and his colleagues at Southampton, and proceedings in Lecture Room A were brought to a close by *J A Hession* and *B A O McCormack* (Institute of Technology, Sligo) on **Modelling the acoustic transmission of biological tissue at low frequencies**.

◇ Vibration control

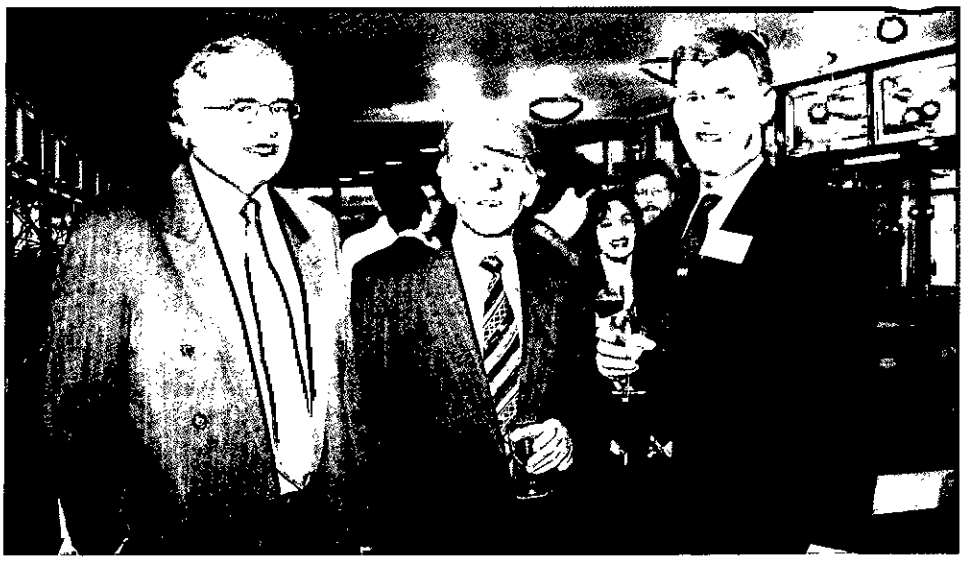
This was the other final parallel session of the conference, taking place on Tuesday afternoon. All the speakers were from the ISVR and the presentations dealt with various aspects of passive or active vibration control. *Dr Philip Bonello* presented work, undertaken with *Professor Mike Brennan* and *Professor Steve Elliott,* on two novel designs of tunable vibration absorber, each incorporating a variable stiffness element. The next two papers, presented by *Mr Hassan El-Khatib* and *Ms Hanim Salleh*, and co-authored by *Professor Brennan* and *Dr Brian Mace,* focused on the passive control of flexural waves in a beam using either one or a number of mass-spring-damper systems in various configurations.

The final two papers were concerned with strategies for active control. *Dr Luca Benassi* presented work undertaken with *Professor Elliott* on a novel device for active control, based on an inertial actuator with a displacement sensor and local PID controller. The session then ended with a paper presented by *Mr Wouter Engels*, again undertaken with *Professor Elliott*, on the active control of the flexural vibrations of a beam using a velocity feedback controller with a collocated force actuator.

Following the end of the formal conference and a welcome tea break, there was a tour of the ISVR for all interested parties.

As always, the Institute of Acoustics is grateful to the ISVR, and especially *Brian Mace*, for hosting and organising another successful conference.

Sotonians past and present: Bob White, Peter Wheeler and Phil Nelson



The UK Aircraft Noise Index Study
20 years on

Peter Brooker

In the early 1980s the UK Department of Transport (now the Department for Transport: the abbreviation DfT is used throughout this article to cover all its various incarnations) commissioned a study to determine what index should be used to assess aircraft noise disturbance near major airports. This Aircraft Noise Index Study - ANIS - which was completed in 1984 and published shortly afterwards (*ANIS Report,* Brooker et al, 1985), included extensive social surveys and noise measurements around these airports, plus detailed statistical analyses. The main result of the study was that L_{eq} (A-weighted) would be an appropriate index. Following publication of the ANIS Report, consultation, and some further work (Critchley and Ollerhead, 1990), the decision to use the 16-hour L_{eq} for the UK aircraft noise index was announced in September 1990. The standard calculation method is described in Ollerhead et al (1999).

This article presents a review of the methodology of the ANIS work and the subsequent criticisms of ANIS and L_{eq}, looking back over the last 20 years. Obviously, with such a large subject it is only possible to give a flavour of the material, so reference should be made to the source documents regarding detailed questions. Unless otherwise noted, references are to data in the ANIS Report.

Before ANIS

The growth of aviation in the 1950s and 1960s led to increased disturbance of people near airports, particularly around Heathrow. Jet traffic, at first in the mid-1950s with the Comet, and then in the 1960s with a variety of different aircraft types, produced considerable increases in the noise environment.

The 'problem of noise' was investigated by the government's Wilson Committee, which reported in 1963. Although covering all kinds of noise, it made some very specific recommendations about a suitable index to measure the disturbance caused by exposure to the aircraft using an airport. The terms 'disturbance' and 'annoyance' were somewhat loosely used as synonyms: they did not include sleep disturbance (or difficulty getting to sleep), nor any possible long-term medical or psychiatric effects. The convention has developed that a phrase such as 'noise exposure' is generally used to describe the noise climate around an airport rather than the noise levels etc. produced by a single aircraft. The convention is not always fully appreciated, which has led to difficulties in explaining the results of work such as ANIS to general audiences.

The Wilson Committee's aircraft noise studies, both social surveys and noise measurements, led it to the conclusion that a good noise index would be of the form

$$NNI = L + 15 \times \log N - 80$$

where NNI is the Noise and Number Index.

Here L is the logarithmic (base 10) average (again a source of confusion with general audiences) of the noise events 'heard' and N is the number of such events. 'Heard' was taken to be $\geq$ 80 PNdB during the average summer day (0700 to 1900 local time, for the three peak summer months). The use of PNdB was actually not much more than an attempt to link the index with aircraft noise certification. The work to support the development of NNI in 1963 actually used an early version of dB(A). In practical assessments, L was measured in dB(A) and increased by 13 (or more) complex variants dependent on the ICAO guidance about conversion factors. NNI contours were produced for Heathrow, and subsequently other airports, until L_{eq} replaced NNI. Such contours were used in planning inquiries and departmental guidance about building development. An NNI of 35 was taken to signify 'low annoyance' and an NNI of 55 NNI 'high annoyance'. The relationship between annoyance and disturbance was recognised as a complex issue.

By about 1980, the DfT had become concerned that the NNI was out of line with the various aircraft noise nuisance indices used in other countries, which tended to be based on L_{eq}. The Department commissioned the studies that led up to ANIS. CAA used expert contractors, in particular John Ollerhead of Loughborough University and Chris Rice of Southampton University, to help in the design of a study that would assist the DfT in creating a better - methodologically and statistically sound - aircraft noise index. Ollerhead also carried out for the DfT a number of small-scale studies to investigate various aspects of aircraft noise exposure and disturbance. Thus began ANIS.

Problems and design solutions

To understand the nature of the problem, it is necessary to go back to basics, or at least to a 'Holy Grail' version of the basics. *Figure 1* shows this ideal: there is something called the Dose and something called the Response, and the relationship between them is a monotonic sigmoid curve. The Response is something like the expression of annoyance and the Dose is some physically measurable combination of noise parameters. There is some value of the Dose that gives the 'Onset' of rapidly increasing Response. Policy makers would value

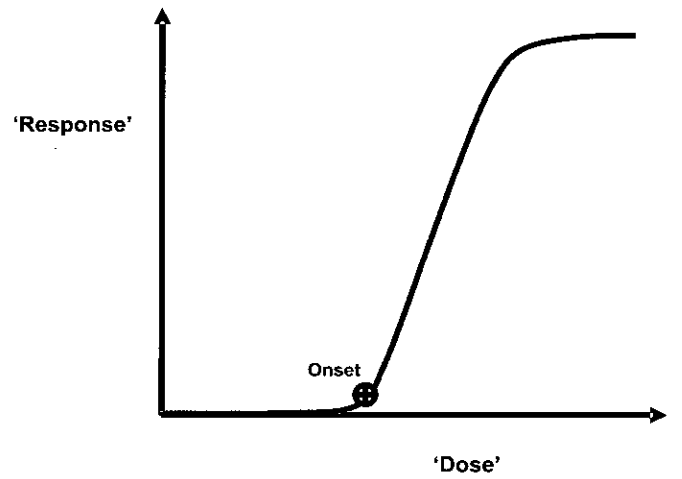
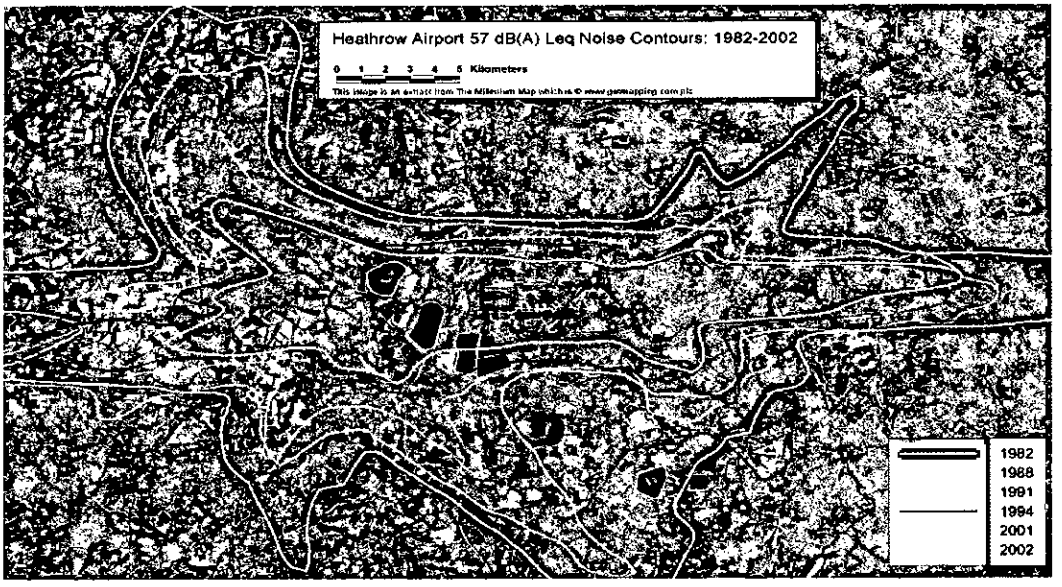


Figure 1: ideal dose-response relationship



Much of the criticism (about L_{eq}) comes from environmental groups focusing on Heathrow

knowing if there were some Dose below which people were not annoyed, and hence did not need to be taken into consideration in decision-making. For NNI, the Onset was often taken to be 35 NNI, although the Wilson report did not equate Low annoyance with such an onset. However, some press notices and policy statements tended to give that impression.

Response and Dose are very different things:

- Dose is a combination of objective physical, measurable parameters about aircraft noise at a particular location;
- Response is a measure, or a combination of measures, of people's feelings about aircraft noise for someone in that location.

The ANIS aim was to find something that measures Response accurately, and then to find a Dose that best matched it. So why is this so difficult? There are several reasons.

The most important reason is the huge variability in people's feelings about the same exposure to aircraft noise. Consider one of the response scales used, ANAS, when people are asked how much aircraft noise bothers or annoys them:

- *very much?*
- *moderately?*
- *a little?*
- *not at all?*

ANAS is the prime example of a simple annoyance-based scale. Note that it has no middle ranking choice, so the interviewee is not able to take the easy way out by choosing an 'average' figure. When this question is asked in small geographical communities near an airport, *ie* areas with about the same noise exposure, there is considerable variation. People's responses to the same noise exposure vary widely, and are probably traceable back to inherent psychological differences. Even at one of the noisiest ANIS sites near Heathrow, Feltham site A, (from Table C2) 52% were 'very much annoyed', but 48% rated annoyance as less than that, and 2% said they were 'not at all annoyed'. Much further down the noise exposure spectrum, at Willesden, 11% were 'very much annoyed' and 42% were 'not at all annoyed'. This wide range of people's responses implies that any statement about Response has either to be about some kind of average person, or about the proportion of people getting the same noise exposure who are (say) 'very much annoyed'. Both approaches were used in ANIS.

This wide variation in individual responses produces both statistical and public relations problems. Statistical problems are considered below, but in terms of public relations it is sometimes very difficult for residents who are themselves 'very much annoyed' to accept that their feelings are not universally shared in their local community. This leads to distrust of data that has been honestly collected and properly analysed.

Another important problem is to determine the 'right' scale of annoyance or disturbance - the Response variable. Social scientists have devoted considerable effort to finding out what might be 'good' scales (but there is no 'recipe book'). Two questions quickly arise. Is annoyance meaningful in itself or does it have to be characterised by reference to *(eg)* activities being disturbed? To what extent is a possible scale cardinal in nature (*ie* corresponding to the properties of integers, rather than just being ordinal - ranking responses) and hence capable of being manipulated by the rules of arithmetic?

Another type of scale used focused on acceptability. The argument was that people might have different and subtle views about annoyance but would be more able to provide a clear yes or no answer. So, they were asked:

'All things considered, do you personally think the amount of aircraft noise here is acceptable or unacceptable?'

More complex scales based on the interference with someone's activities were used to construct Guttman annoyance scales (GAS). The ANIS report provides references to the literature. For example, interviewees would be asked if aircraft noise interfered with their relaxation, compelled them to close windows, interfered with listening to radio, TV or music, and if so how annoyed they were. By analysing the responses to such questions and ranking their intensity, a GAS was constructed with individuals scoring from zero (no annoyance) to 6 (highest annoyance). It should be noted that aircraft noise annoyance and exposure are measured in the height of summer, when people tend to have their windows open and spend leisure time outside. Thus more activities can be interfered with, and aircraft noise results in annoyance.

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necessarily because there had been any deterioration in the noise climate. For example, *Figure 2* illustrates the typical variation of 'Aircraft noise unacceptable' with L_{eq}. The number increases from around 15% at 57dB L_{eq} to around 75% at 69dB L_{eq}, roughly in a straight line.

These numbers are used in *Table 1* for some recent Heathrow contours (DfT, 2004). This takes the proportion rating unacceptable (at the lower end of each L_{eq} band) and multiplies it by the population in the band. This produces an ANIS-based estimate of the population within each band who rate aircraft noise unacceptable. The numbers increase for lower L_{eq} values because the larger contour area more than matches the smaller proportion of people deeming the aircraft noise unacceptable. This explains *inter alia* why airports receive quite high numbers of complaints from people living in areas of comparatively low noise exposure. Moreover, the 57dB L_{eq} contour should only be used for comparison when it is calculated accurately and cautiously on a standardised basis (Rhodes and Ollerhead, 2001).

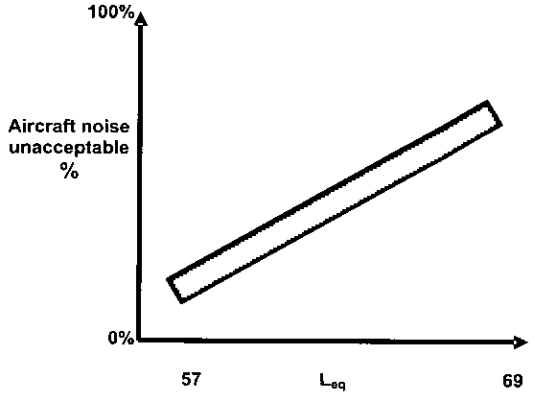

Figure 2: percentage of survey respondents saying that levels of aircraft noise are unacceptable (rough trend approximation to Figure 9.10, ANIS Report)

L_{eq} band, dB(A)	population in band, thousands	% unacceptable	number rating unacceptable, thousands
>72	1.4	90	1.3
69-72	4.7	75	3.5
66-69	14.6	60	8.8
63-66	36.2	45	16.3
60-63	54.2	30	16.3
57-60	132.3	15	19.8
		total	66.0

Table 1: illustrative comparison of populations in L_{eq} bands for Heathrow and rating unacceptable percentage (standard contours for 2001, with very few Concorde flights)

The point is that ANIS dealt with representative samples of people, and therefore provided a good picture of the variation with L_{eq}, both in terms of the typical person and the variation in response for people receiving the same noise exposure.

Moreover, the Inspector did not recognise the relevance of research done in other countries. Disturbance caused by aircraft noise is not special to these islands. There have been dozens of good-quality aircraft noise disturbance studies carried out (as well as studies of noise from other transport modes). Recent relevant work includes Miedema *et al* (2000), and Fidell (2003), each of which gives a wide range of further references. The central message is that L_{eq}-derived indices fit people's responses well: there are no compelling examples of 'N' variation in responses.

The Inspector was concerned about

- *21.3.35 people's perceptions of noise may well have changed in the 18 years since the ANIS report was produced. The Department recognised that it was very difficult to establish the true underlying relationship between the noise of individual events and their number and accepted that it would have been useful if further social surveys had been carried out. I strongly endorse this view. If parties are to have confidence on the indices used to measure the noise climate they need to be founded on a sound basis of up-to-date research. Unfortunately the Department's own evidence suggests that this does not apply to the use of L_{Aeq}, in spite of their argument that research had guided the choice of noise indices since 1967.*

On research, the comment can again be made that this seems a rather 'insular British' view. The kind of model that the inspector would want to test might have the form:

annoyance = $K \times P(t) \{ L_{eq} + Q(t) \times N \}$

N would be the number of aircraft heard above some

appropriate threshold (presumably markedly less than 80 PNDB). P and Q are unknown functions of time t, where t extends over several years. K is a normalising constant. A simple hypothesis of a logarithmic N dependence would equate to $Q(t) \approx 0$, reasonable if international research has merit. A hypothesis that annoyance characteristics change over time would be that $P(t) \neq 1$, which is possible given that people's habits, behaviour, and attitudes to environmental issues can develop over time (so 57dB L_{eq} would not correspond to the same proportion of people 'very much annoyed'). This would need substantial research commanding the widest possible confidence, with objectives such as surveying sufficient people to provide the same degree of accuracy about community annoyance as in ANIS; or surveying at least as many people - and as thoroughly - as in previous major UK studies. The DfT has not chosen to carry out further statistically decisive studies of this kind.

Further criticisms from environmental groups

The Terminal 5 Inquiry was not the end of environmental group concerns about L_{eq}. Much of the criticism comes from groups focusing on Heathrow. These have been exacerbated by the suggestions for further development there, made in the recent White Paper on

> **13.1.3 Moreover, if my view that Terminal 4 is necessary in the national interest is accepted by the Secretaries of State, I am strongly of the opinion that all possible steps should be taken to satisfy those living around Heathrow that this is the last major expansion at the airport**
>
> **98 I agree with BAA that the evidence placed before me demonstrates that a third main runway at Heathrow would have such severe and widespread impacts on the environment as to be totally unacceptable.**

Figure 3: from Inspectors' Reports on Terminal 4 Inquiry, 1979, and Terminal 5, 1997

Air Transport (DfT, 2003), in the context of *Figure 3.*

The problems at other UK airports are significant and important to those affected, but they are not in any way of magnitude comparable with those at Heathrow.

HACAN and other environmental groups produce many documents criticising airports policy and operations. One of the themes appears to be to 'detach' L_{eq} from its roots in measured disturbance of communities exposed to aircraft noise. *HACAN ClearSkies* (2003) is a recent document on L_{eq}, which provides some examples of current arguments.

One of the problems with such documents is what might kindly be called 'semantic shift'. *Table 2* is an example: the words are slightly simplified (but not distorted) quotes. Thus, what starts as a scientific statement intended to indicate statistical precision is 'spun' into a spurious admission of failed research.

the fact	The disturbance ratings of communities exposed to aircraft noise correlated very highly with L_{eq}.
the ANIS expert witness	L_{eq} indicates average, long-term noise impact: it does not provide answers to all possible questions.
the Inspector	The expert witness for the Department did not attempt to hide the deficiencies of L_{Aeq} measures. The evidence confirms the Department's view that the contours are not faultless...
the environmental group	An admittance by the Government that the way it currently assesses aircraft noise is faulty.

Table 2: how the message about L_{eq} changes

The major fallacy in the *HACAN ClearSkies* arguments is that they ignore the derivation of L_{eq} through ANIS from the disturbance ratings of people and communities exposed to aircraft noise. L_{eq} is a physical measure but it was chosen specifically because it matches the annoyance responses of people.

To take some points from the *HACAN ClearSkies* press release (in italics):

[DfT] Gives undue weight to the noise of each aircraft passing overhead and not enough weight to the number of planes.

Not so: the weighting is what matches people's annoyance responses best.

[DfT] Refuses to measure low-frequency noise - the rumble and roar of an aircraft ... dB(C) should be used to allow low-frequency noise to be captured.

A-weighted dB was used because dB(A) correlates well with certification units PNDB and EPNDB, which are specifically chosen to match people's perception of individual noise events. The measured high correlation was between disturbance and L_{eq} dB(A). Nevertheless, dB(C) may be preferable for the evaluation of sounds whose low-frequency components are responsible for secondary effects such as the shaking of a building, window rattle, and perceptible vibrations.

[Leq] Doesn't reflect the real level of noise people experience when a plane passes overhead. This is because the Department includes the quiet times of the day, and the quiet days of the year, when averaging out the noise.

In fact, L_{eq} values are calculated for an average summer day, rather than for those days in which the airport operational mode produces the highest noise for the location in question - the 'worst mode'. If worst mode were to be used, then someone receiving worst mode for 75% of the time would be equated with someone else receiving the same L_{eq} value for 25% of the time. In ANIS, three-month average mode L_{eq} correlated highly with people's annoyance.

At Sydney Airport...maps are produced showing the density of air traffic, and also maps giving information such as the number of noise events above 70dB(A) on an

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average day...

The number of such noise events does not correlate as well with community disturbance as L_{eq}, so the data would paint a misleading picture.

Weightings: L_{eq} versus L_{den}

L_{den} is the day-evening-night noise index. If L_{day}, $L_{evening}$, L_{night} are the L_{eq} values for those periods, covering 12, 4 and 8 hours respectively, then L_{den} is the (logarithmic) average of L_{day}, $L_{evening}$ + 5, L_{night} + 10. So it is the same as the ordinary L_{eq} except that flights in the evening have 5dB added to their energy value, and those at night have 10dB added. A variant DNL has no weighting applied to the evening and a 9 *[sic]* hour night-time period. L_{den} has been put forward as the European Union common indicator (EU, 2002 and 2004).

Statistical evidence from ANIS yielded no support for the inclusion of a night weighting in a noise exposure index, and indicated that an appropriate evening weighting would be less than 3dB. The experimental and statistical justification for these 'precise' weightings in the acoustics research literature is weak. The origins for them are discussed in section 2.5.1 of Critchley and Ollerhead (1990), referring back to Ollerhead (1978). The weightings first started to appear (as hypothesised values?) in USA literature in the 1960s and 1970s, but they were not supported by statistically significant quantitative evidence.

Fields (1986) found considerable variations in the estimates of evening and night-time weightings from a detailed re-analysis using multiple regressions of previous studies. Fields explained that these estimates of the weightings from multiple regressions were unreliable because the day, evening and night noise environments were highly inter-correlated (so the clever de-correlation of ANIS could not be extended: 24-hour L_{eq} and L_{den} would match the ANIS annoyance data about as well). There was certainly a high correlation between day and evening exposures in the ANIS areas, but a marked change in the diurnal pattern would be an additional reason for properly designed follow-up to ANIS. In recent work, Miedema *et al* (2000) found evidence to support a 10dB night-time weighting, but no strong evidence for an evening penalty (which remains an unverified hypothesis). However, when they reanalysed the ANIS data, their techniques reportedly weakly supported such a weighting. Remember that UK noise policy treats night disturbance, mainly through sleep interference, as distinct from annoyance.

Final comment

The DfT civil servants gave every indication that they wanted ANIS to be objective and unbiased. The Report was ready in December 1984, but publication was delayed until the next month because the DfT did not want to be accused of burying it at Christmastime.

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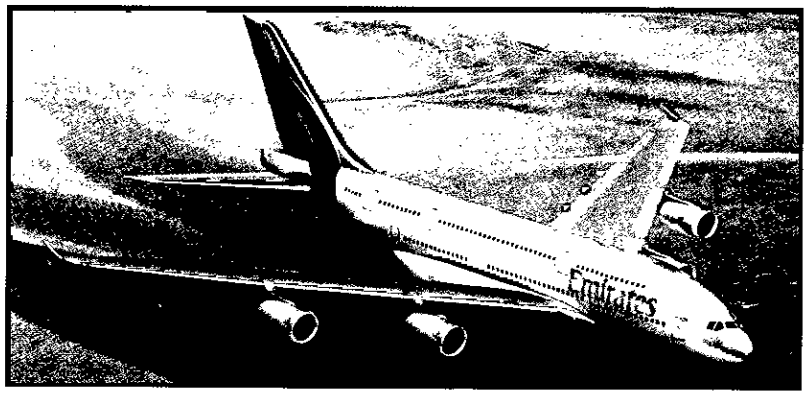

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A Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure

During its preparation, a significant challenge for the EC Working Group was to balance the need for consistency across Europe with the flexibility required by individual member states to meet national needs

John Hinton and Alan Bloomfield

In December 2003 the European Commission's Working Group on the Assessment of Exposure to Noise (WG-AEN) produced the first version of a Position Paper entitled: *Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure* (the Guide). This document can be downloaded from a Commission web site **(1)**.

Its purpose is to assist member states (MS) and their competent authorities to undertake noise mapping and produce the associated data as required by a Directive relating to the assessment and management of environmental noise **(2)** (commonly referred to as the Environmental Noise Directive and, hereafter, referred to as the END). The Guide mainly addresses those requirements of the END associated with the first round of strategic noise mapping, that must be completed by 30 June 2007.

A significant challenge faced by WG-AEN when preparing the Guide was to consider how much guidance should be provided. WG-AEN has attempted to find an appropriate balance between the need for a consistent approach across Europe and the flexibility required by individual MS to develop noise-mapping programmes which meet their own national needs.

The Guide contains discussions on the general issues and specific technical challenges that MS may encounter in relation to implementing the first round of strategic noise mapping and provides recommendations for dealing with such issues and challenges. It also provides options for dealing with a number of the technical challenges in the form of a series of toolkits.

The current Guide is merely a first version of the document. WG-AEN will produce revised and extended versions as appropriate.

The purpose of this article is threefold: firstly, to draw attention to the existence of the Guide; secondly, to provide a brief summary of the contents; thirdly - and most importantly - to invite members' comments on some of the difficult issues raised in the Guide.

SUMMARY OF THE GUIDE'S CONTENTS

In ***Chapter 2*** of the Guide the following general issues and specific technical challenges are addressed:

2.1 *Strategic noise maps (and mapping).* The acquisition of input data required for noise strategic noise mapping and the limitations of such a strategic noise mapping exercise.

2.2 *Assessment methods.* The limitations of using noise measurement methods for strategic noise mapping purposes.

2.3 *Most exposed façade.* The definition of such a facade.

2.4 *Assessment point (grid spacing, contour mapping and reflections).* The anomalies concerning the location of assessment points.

2.5 *Assignment of noise levels to residential buildings.* The possible methods of assigning these levels.

2.6 *Assignment of population to residential buildings.* The possible methods of assigning the population.

2.7 *Assignment of noise exposure levels to population.* The possible methods of assigning these levels.

2.8 *Dwelling.* The inconsistent use of the terms 'dwelling', 'dwelling units' and 'buildings'.

2.9 *Determination of the number of dwelling units per residential building and population per dwelling unit.* The possible methods of determining these levels.

2.10 *Agglomeration.* The lack of a clear definition for an agglomeration.

2.11 *Area to be mapped.* The determination of the extent of the area to be mapped alongside major roads and railways and around major airports.

2.12 *Area outside area to be mapped.* The determination of the area outside the boundary of an agglomeration in which noise sources are likely to have an affect on noise levels inside the agglomeration.

2.13 *Places near major roads, major railways and major airports.* The determination of the places where action plans need to be drawn up.

2.14 *Quiet areas in an agglomeration and in open country.* The lack of clear definitions for such areas.

2.15 *Quiet façade.* The lack of a clear definition for such a facade.

2.16 *Relevant year as regards the emission of sound.* Clarification on what is the relevant year.

2.17 *Average year as regards the meteorological circumstances.* Clarification on what constitutes an average year.

2.18 *Reviewing strategic noise maps.* The determination of criteria for reviewing maps.

2.19 *Special insulation against noise.* The lack of a clear definition for what constitutes special insulation.

2.20 *Action plans.* The development of detailed action plans from the results of a strategic noise mapping exercise.

In ***Chapter 3*** of the Guide the following toolkits of solutions relating to specific challenges posed by the requirements of the END are provided:

Determining the 'most exposed facade' has been identified as one of the most difficult issues

Toolkits for source related input data

Toolkit 1 Road traffic flow
Toolkit 2 Average road traffic speed
Toolkit 3 Composition of road traffic
Toolkit 4 Train speed
Toolkit 5 Sound power levels of industrial sources

Toolkits for geographic input data

Toolkit 6 Building heights
Toolkit 7 Obstacles
Toolkit 8 Cuttings and embankments in the site model
Toolkit 9 Sound absorption coefficients α_r for buildings and barriers

Toolkits for meteorological input data

Toolkit 10 Occurrence of favourable sound propagation conditions
Toolkit 11 Humidity and temperature

Toolkits for demographic input data

Toolkit 12 Assignment of population data to residential buildings
Toolkit 13 Determination of the number of dwelling units per residential building and the population per dwelling unit

Toolkits for miscellaneous issues

Toolkit 14 Determination of agglomerations
Toolkit 15 Area to be mapped
Toolkit 16 Area outside the area being mapped

IDENTIFICATION AND DISCUSSION OF DIFFICULT ISSUES

Chapter 2 of the Guide provides a series of recommendations regarding the practical implementation of strategic noise mapping to meet the requirements of the END. In doing so, a number of issues where difficult choices must be made between accuracy and practicality, or in the interpretation of the words used in the END are raised. Comments are invited on all aspects of the Guide. WG-AEN would be particularly interested to receive comments on the suggestions made regarding the most difficult choices and the Guide's recommendations.

WG-AEN considers that the most difficult issues arise in the following sections of the Guide:

Section 2.3 *Most exposed facade*
Section 2.4 *Assessment point*
Section 2.7 *Assignment of noise exposure levels to population*
Section 2.14 *Quiet areas in an agglomeration and in the open country*

A full explanation of the issues and the reasoning leading

continued on page 20

The EU Noise Expert Network

In 1998, on the occasion of the Copenhagen conference, the European Commission created an EU Noise Expert Network, whose mission was to provide assistance in the development of the European noise policy.

A noise steering group was established, comprising representatives of all the interested stakeholders - Member States, local authorities, industry, NGO....

In order to provide guidance, a set of working groups was also established. Initially, five working groups were dealing with the perception and transmission related aspects, three were dealing with sources of noise (road, rail and outdoor equipment), and two more working groups were responsible for noise research and for costs and benefits of noise abatement policies. The Environment Directorate-General published a 26 page booklet: *The Noise Policy of the European Union Year 2 (1999-2000),* presenting the network's initial structure and aims.

The Steering group and its associated working groups assisted the Commission in the development of its July 2000 proposal for an Environmental Noise Directive COM(2000) 468. In particular, the position paper of working group 1 on EU noise indicators provided a useful basis for the choice of common noise indicators to be used throughout Europe for the assessment of environmental noise.

Another position paper, prepared by working group 2, provides guidance on the dose-effect relations to be used for the assessment of numbers of people annoyed by noise from transports (rail, road and air). In 2003, working group 6 'Railway noise' has adopted a position paper on European strategies and priorities for railway noise abatement. This was presented to the stakeholders concerned during a workshop held by the Commission services on 29 October 2003 in Brussels (summary reports of the position paper are available in all Community languages).

Considering the new needs linked to the evolution of the environmental noise policy (in a nutshell, from developing to implementing a proposal), it was proposed in 2001 to reshape the EU noise expert network. The aim was to streamline its work and ensure a better co-ordination between the actual needs of the different stakeholders and the work undertaken by the network. To this end, it was decided with the support of the Noise Steering Group to create a working group dedicated to airport noise and to merge the former working groups dedicated to perception and the working group on costs and benefits into two working groups, namely:

- ❑ Working group 'Health and socio-economic aspects' or WG HSEA (merger of 'dose and effect relations', 'abatement' and 'costs and benefits' former working groups); and
- ❑ Working group 'Assessment of exposure to noise' or WG AEN (merger of 'noise mapping' and 'computation and measurement methods' former working groups).

A Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure

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to the Guide recommendations is contained in these sections of the Guide. The key points can be summarised as follows:

2.3 *Most exposed facade*

According to the END Annex I (1), the most exposed façade will be the external wall facing *'onto and nearest to the specific noise source'*. This is a geometric rather than an acoustic definition. Where, for example, a facade is exposed to the noise from more than one road it may have the highest noise level for that building but it may not face onto or be the closest facade to any of the roads in question. To avoid confusion, the Guide suggests that the acoustic definition should be applied, *ie* 'that the most exposed façade should be taken to be the façade exposed to the highest noise level from the specific category of noise source under consideration (*eg* road traffic)'.

2.4 *Assessment point*

Here the difficulty arises in that the END uses different descriptions of the assessment point. The Guide lists these descriptions in full. Briefly:

(i) 'at the most exposed facade' is used in Annex I (1) and 'on the most exposed facade' is used in Annex VI (15);

(ii) but in this same section of Annex VI and also in (25), for 'a quiet facade', the position is to be 'two metres in front of the facade';

(iii) finally, a further complication is that noise levels at grid points must also be calculated for purposes such as producing noise contours

The difficulties are compounded by the issue of reflections from a facade at which an assessment is to be made. For the 'most exposed facade' *(i)*, reflections from the facade itself are to be ignored; for assessments two metres in front of the 'quiet facade' *(ii)*, it is unclear whether or not reflections from that facade should be included; and, for grid point calculations *(iii)* - which by their nature are not generally linked to any particular facade - either all reflections (as far as computing power allows), or (in a simplified calculation) none, should be included.

One other area where considerable difficulty still remains is in the definition of 'quiet areas' both in agglomerations and in open country

The consequence of these difficulties could be that three sets of calculations might have to be made to cover the three conditions.

To avoid the complication and confusion which could arise from making three sets of calculations (in particular, when presenting the results, which in some cases could show different values at the same façade, to non-specialists), the Guide recommends that grid point calculations should be made, including reflections from all facades, but that for assessments of the noise exposure of people living in dwellings, and for determining quiet facades, 3dB should be subtracted from the grid point facade levels to estimate the noise immission levels. However, the Guide does offer advice if the more complex alternative of calculating different sets of maps for each situation is preferred.

The Directive on Environmental Noise

Its four main objectives are:

Further to the Commission proposal for a Directive relating to the assessment and management of environmental noise (COM(2000)468), the European Parliament and Council have adopted Directive 2002/49/EC of 25 June 2002 whose main aim is to provide a common basis for tackling the noise problem across the EU. The underlying principles of this text, are similar to those for other overarching environment policy directives:

❑ Monitoring the environmental problem; by requiring competent authorities in Member States to draw up 'strategic noise maps' for major roads, railways, airports and agglomerations, using harmonised noise indicators Lden (day-evening-night equivalent level) and Lnight (night equivalent level). These maps will be used to assess the number of people annoyed and sleep-disturbed respectively throughout Europe.

❑ Informing and consulting the public about noise exposure, its effects, and the measures considered to address noise, in line with the principles of the Aarhus Convention.

❑ Addressing local noise issues by requiring competent authorities to draw up action plans to reduce noise where necessary and maintain environmental noise quality where it is good. The directive does not set any limit value, nor does it prescribe the measures to be used in the action plans, which remain at the discretion of the competent authorities.

❑ Developing a long-term EU strategy, which includes objectives to reduce the number of people affected by noise in the longer term, and provides a framework for developing existing Community policy on noise reduction from source. With this respect, the Commission has made a declaration concerning the provisions laid down in article 1.2 with regard to the preparation of legislation relating to sources of noise.

2.7 *Assignment of noise exposure levels to the population*

Assigning noise values to the facades of buildings may result in a multi-occupied residential building having a range of values at its various facades. Unless precise information is available on the position of each dwelling unit within the building, it will be necessary to derive an estimate of how many people are exposed to each noise value affecting the building. Where this happens, the Guide recommends estimating the proportions of the building envelope (*ie* the sum of all the facades around the building) which are exposed to each 5dB(A) band of noise. The total population of the building is then assumed to be exposed in the same proportions as the building envelope (*eg* if 40% of the envelope is exposed to a given band of noise, it is assumed that 40% of the population is exposed to that band).

2.14 *Quiet areas in an agglomeration and in the open country*

One other area where considerable difficulty still remains is in the definition of 'quiet areas' both in agglomerations and in open country. WG-AEN believes that further research will be required before the Group can make firm recommendations in this area (in a future version of the Guide). Nevertheless, WG-AEN would still welcome comments, in particular on quiet areas in agglomerations, which need to be addressed in the first round of END action plans in 2008.

CONCLUSIONS

WG-AEN invites comments from all potential stakeholders on the contents of the first version of the Guide and in particular on the difficult issues identified and discussed in Section 3 of this article in order to assist in the development of the Guide. Comments from noise mapping software specialists on the technical solutions that may be available, in particular in relation to the issues raised in section 24, would be most welcome.

References

1 http://www.europa.eu.int/comm/environment/noise/home.htm
2 Directive 2002\49\EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise

John Hinton, *Birmingham City Council and Chair of EC Working Group - Assessment of Exposure to Noise*
Alan Bloomfield, *Greater London Authority and member of EC Working Group – Assessment of Exposure to Noise*

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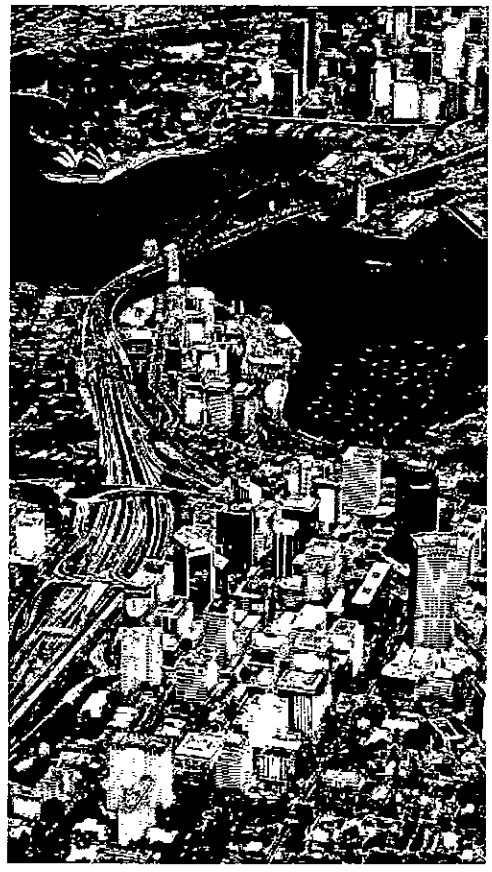
goodpracticeguide@dslpipexcom

Please note that the deadline for such comments is 30 September 2004

Exposure to road traffic noise in Australia

A L Brown and Rob B Bullen

This article describes the exposure of dwellings in Australian mainland capital cities to road traffic noise. The exposure of Australian dwellings has been reported previously, but the current study, based on a sample of 200 dwellings per city, provides estimates of exposure in each city. Estimates were based on rigorous sample selection and on predicted levels using measured traffic and geometric data. Some 8-20% of dwellings were exposed to $L_{A10,18h}$ levels above 63dB, and 5-11% to levels above 68dB. The results suggest that efforts to date to ensure that Australian urban populations are not exposed to high levels of road traffic noise have had little success. An analysis of jurisdictional responsibility for the roadway sources confirms that management of this problem must be accepted by local and State authorities.



Study samples were drawn from the urban centres of five cities, including Sydney (above)

Reliable quantitative information on the extent and intensity of exposure to pollutants is essential for their proper consideration as policy matters and in determination of the appropriate level of resources that should be devoted to the pollutant's management.

Road traffic noise is largely an urban problem and in highly urbanised Australia the population exposed to noise is concentrated in metropolitan areas. As most effects of traffic noise are on people in their own homes, the problem of estimating the community's exposure to road traffic noise is effectively one of estimating the levels of road traffic noise incident on the facades of the population of dwellings in Australian cities. Different methodologies can be used to obtain estimates of road traffic noise exposure of populations (Brown and Cliff, 1988) but any methodology must be based on rigorous sampling of the specific population of interest to provide a measure of exposure that has known sampling errors.

Brown (1994) reported the exposure of the population of Australian dwellings to road traffic noise. That national study, based on a random sample of Australian dwellings located in urban centres with populations in excess of 100,000, provided a definitive estimate of the exposure to road traffic noise of the Australian urban population as a whole. Confidence limits were provided for these exposure estimates and this distinguishes these estimates from those of previous studies of road traffic noise exposure in Australia.

The national study used a sample of 264 dwellings selected randomly across eleven of the country's largest cities. The national sample included sub-samples of 80 dwellings in Sydney, 72 dwellings in Melbourne, and 112 dwellings across the remaining nine urban centres. That study was designed to estimate the exposure of the Australian population in order to be able to compare Australian exposure with exposure of other OECD countries, so the small sub-sample size for any particular city meant that estimates of the exposure to road traffic noise within Australian cities, and comparisons between them, were not possible.

This article reports the results of a similar, but much larger, study designed to provide adequate estimates of road traffic noise exposure in each of Australia's mainland state capital cities. A two-stage methodology was used. It drew a random sample of dwellings from each of five state capital Urban Centres with subsequent estimation of road traffic noise exposure at each dwelling in the sample. As in the 1994 work, this study used traffic noise calculation at individual dwellings, rather than traffic noise measurements.

The choice of calculation over measurement was one of economy and efficiency. As Brown (1994) points out, errors on studies that estimate traffic noise exposure of a population arise from two sources: sampling errors, and errors in noise estimation. Considerable tolerances are acceptable in the latter because errors in noise estimates obtained by measurement or prediction should be largely random, not systematic, (providing adjustment is made for any systematic error in the prediction model) and this has little effect on the estimated levels of exposure of the population (of course, it does affect the estimate of exposure at any individual site, but this is of no interest for current purposes). Thus limited study resources are better expended in reducing the sampling error by increasing the sample size, and by reducing bias through rigid enforcement of a random sampling regime, rather than in reduction in the magnitude of the error in the noise estimate.

noise level $L_{Aeq,24h}$	assumed true proportion of dwellings (based on Brown, 1994)	lower and upper 95% confidence limits for the true proportion, based on a sample size of 100 to 250 dwellings			
		100	150	200	250
70dB	1.5%	0 – 3.8	0 – 3.3	0 – 3.0	0 – 2.9
65dB	8.3%	2.6 – 13.5	3.6 – 12.8	4.3 – 12.0	4.9 – 11.8
60dB	16.7%	9.5 – 24.1	11.0 – 22.6	11.8 – 21.7	12.2 – 21.3
55dB	31.1%	22.1 – 39.7	23.7 – 38.4	24.7 – 37.5	25.2 – 36.7

Table 1: Confidence limits for the proportion of dwellings exposed to noise levels greater than a specified value

Noise levels were calculated using the best available methodology, including the inclusion of corrections based on validations conducted under Australian conditions. To further reduce error in the noise estimate it would have been necessary to replace prediction by expensive noise measurement procedures. Within the constraints of resources available to this study, this would have been possible only with a large reduction in the size of the sample of dwellings in the cities for which noise level exposures were to be estimated, with consequent increase in sampling error of the estimates.

Sample selection and field procedures

Determination of sample size in each city

The areas to be covered by the sample in the present study consisted of the 'Urban Centres' (as defined by the Australian Bureau of Statistics) of each of the five cities of Sydney, Melbourne, Brisbane, Perth and Adelaide.

To ensure that different city results were comparable (in terms of sampling error in the proportion of dwellings exposed to various levels of traffic noise) the same sample size was required for each city. Within each city, the study rigorously selected a random sample of dwellings within the boundaries of the Urban Centre, and predicted the level of traffic noise at the facade of each sampled dwelling.

The expected sampling error was estimated by using data from Brown (1994). If it is assumed that in a particular city the true proportion of dwellings exposed to various levels of traffic noise is equal to the proportion found in the national study, then the error in estimating that proportion for samples of various sizes can be estimated. Of course, the true proportion would differ between cities, and could not be known ahead of time, but errors calculated in this way gave the best estimate of prediction errors for different sample sizes, and could therefore be used to determine a sample size that provided a compromise between study costs and sampling error.

Table 1 (above) shows 95% confidence limits (two-tailed) for the proportion of dwellings in a city with noise levels above specified values, for various city sample sizes.

Table 1 illustrates the trade-off between sampling error and sample size. It was believed that for the survey results to be valuable in detecting future changes in noise levels, and differences between cities, the percentage of dwellings with noise levels greater than 60dB $L_{Aeq,24h}$ should be able to be specified to within better than five percentage points in each city. Based on the results from Brown (1994), an overall change of 3dB in noise level would result in a change of about five percentage points in percentage of dwellings exceeding 60dB $L_{Aeq,24h}$, and this is the magnitude of change which it was considered important to detect. From *Table 1*, this dictates a sample size of 200 (confidence limits for the percentage of dwellings then range from 4.9 points below the estimated value to 5.0 points above it). Expanding the sample size to 250 per city provides only small gains in terms of sampling errors. For this reason, it was determined that the appropriate sample size for this project was 200 dwellings per city.

Selection of dwellings

The acquisition of a truly random sample of dwellings within each of Australia's five largest urban centres was a difficult task, and consumed a large proportion of the resources for this study.

Addresses of dwellings in each Urban Centre were randomly selected from lists based on electoral rolls. In these lists, multiple entries for the same dwelling had been deleted. The available electoral roll data were current to 1994 for Sydney and 1993 for Brisbane, Melbourne, Perth and Adelaide.

Data based on electoral rolls are available by postcode area only, and postcode boundaries are not necessarily contiguous with the boundaries of Urban Centres. To overcome this problem 300 dwellings were randomly selected from each city from a list of all postcodes that were either wholly or partially within the Urban Centre. Addresses in postcodes which lay only partially within the Urban Centre were then individually checked and deleted if they fell outside the Urban Centre boundaries.

Of these 300, the first 200 were given to field operatives as the primary sample, while the remaining addresses (in randomised order) were used for possible replacement dwellings.

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The study showed that Adelaide had the lowest percentage of dwellings exposed to 63dB or above

Exposure to road traffic noise in Australia

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The use of electoral roll data was preferable to alternatives such as telephone connections since it provides a more comprehensive coverage of dwellings. Even so, it was known that this sampling procedure would result in some non-representation of the city population of dwellings. Those constructed since the preparation of the rolls would not be included in the sample, and dwellings demolished since roll preparation (without constructing a replacement at the same address) would result in 'non-response' at that address.

In addition, the sample based on electoral rolls would not include dwellings where no resident was on the roll. This would include: unoccupied dwellings; dwellings where all residents were either not Australian citizens or were under 18 years of age; and dwellings containing Australian citizens over 18 who were, illegally, not on the electoral roll. The proportion of dwellings in the first two of these categories can be estimated from census data and *Table 2* shows the proportion of dwellings in each of these categories for each city.

urban centre	proportion of dwellings unoccupied	proportion of dwellings occupied only by non-Australian citizens or people under 18
Sydney	6.3%	10.7%
Melbourne	8.2%	9.2%
Brisbane	5.7%	7.7%
Adelaide	5.8%	7.7%
Perth	6.7%	10.7%

Table 2: Estimated percentages of dwellings in urban centres not included in the electoral roll sampling frame

To the extent that unoccupied dwellings, and dwellings occupied solely by non-Australian citizens or people under 18 years of age, could have exposure to traffic noise which differed from the rest of the population, this non-representation could represent possible bias in the sample, though the effect of the bias could not be quantified without further study.

Field assessments were conducted on a total of 996 dwellings, approximately 200 in each of the five cities. The sampling procedures ensured that, irrespective of type, every dwelling unit had an equal chance of inclusion in this sample (whether the structure of the dwelling unit was detached, a duplex, terrace house, unit, flat, apartment or part of a high-rise building complex).

Survey procedures

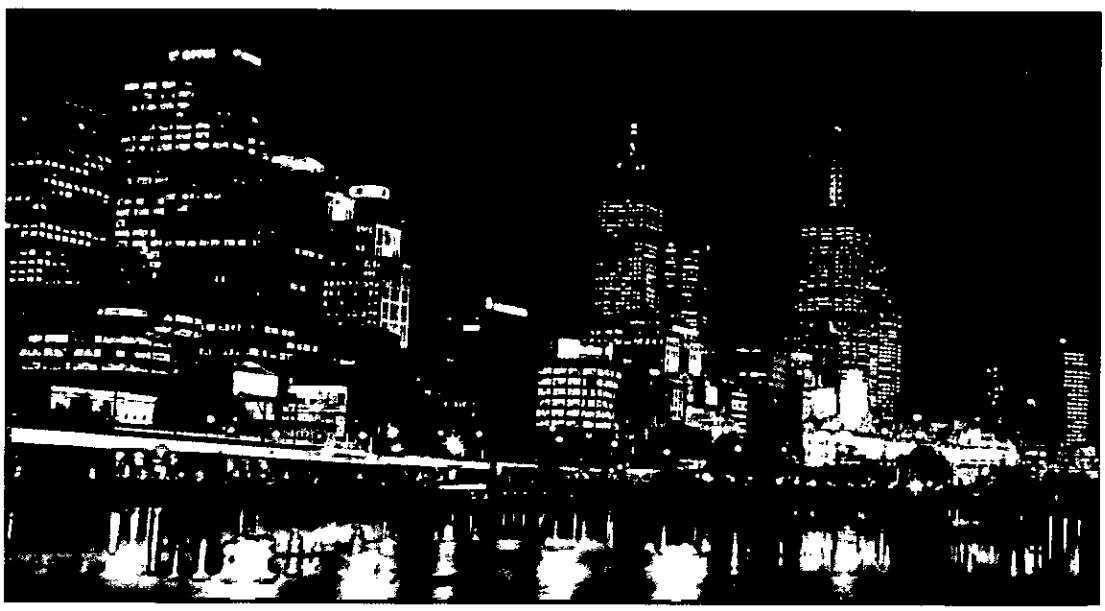
Operatives trained in survey work were used to conduct the field study. A one-day training course was conducted in each city, including field trials, to ensure that the operatives were familiar with the techniques required.

On arrival at a site, operatives selected the window on the dwelling facade that was exposed to the highest level of traffic noise. This could be at the front, back or side of the residence. The name of the road causing the greatest traffic noise at this location was noted, together with any other roads if they also were the source of noticeable road traffic. The distance to the road(s) was measured, as well as the angle of view from the dwelling to the roadway, or if the road was not visible, the approximate location and height of barriers. The road gradient, speed limit and road surface material were noted. A plan and cross-section to the most important road(s) were sketched.

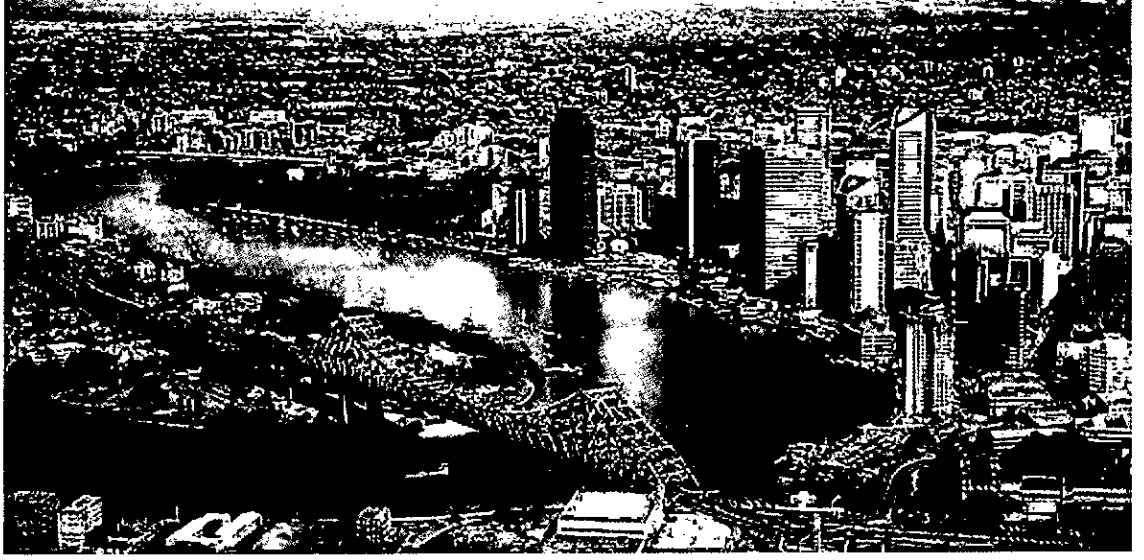
In addition, a 15 minute L_{Aeq} noise measurement check was made, one metre from the most exposed facade of the dwellings. The purpose of the short-term noise measurements was to identify those dwellings in the sample where it was unlikely that even moderate (>55dB L_{Aeq}) road traffic noise levels would exist, obviating the need to collect the expensive traffic parameter data for these sites, and hence reducing the resource requirements of the study. All field work was conducted over 1997/1998.

Noise level calculation

Road traffic noise levels were calculated at all dwellings where the measured 15-minute level (from road traffic) exceeded 55dB(A). The measured $L_{Aeq,15min}$ noise level provides a conservatively high estimate of the $L_{Aeq,24h}$ value, so that locations excluded by this procedure will almost certainly have $L_{Aeq,24h}$ levels below 55dB. At sites where the measured 15-minute noise levels exceeded 55dB(A) it was necessary to obtain information on the traffic flows and percentage of heavy vehicles for



The Melbourne sample reveals a marginally higher proportion of dwellings exposed to moderate to high levels of road traffic noise



Brisbane, the capital of Queensland: this state has different planning noise levels for differing categories of urban roadway

the road(s) identified as generating traffic noise at the residence. These traffic data were obtained by the relevant road authority, either from existing records or by purpose-made counts.

Based on the road traffic flow information, together with the geometric and other site-specific information recorded for each dwelling, the CRTN prediction method was used to calculate the noise level exposure at the site (Great Britain 1988). The following assumptions were made in the calculations:

- 18 hour traffic volumes were scaled as 0.94 times the Annual Average Daily Traffic;
- traffic speed was estimated as the speed limit for the roadway;
- for sites with more than 50% soft ground between source and receiver, a ground effect mid-way between the CRTN hard and soft ground calculations was used;
- standard corrections to the CRTN calculations, derived from validation under Australian conditions were applied. A uniform correction of –1.7dB (Saunders *et al*, 1983) was applied to all calculated levels (to remove the known systematic error in the prediction estimates);
- the CRTN procedure was used to predict $L_{A10,18h}$ levels. In addition to reporting exposure in terms of this noise scale, results are also reported in the L_{Aeq24h} scale obtained by applying linear translation of $L_{Aeq,24h} = L_{A10,18h} - 3.5$dB (Brown 1989).

Results

The study estimated the proportion of the population of each city exposed to road traffic noise in excess of any nominated level of noise exposure above about 55dB L_{Aeq24h}.

Based on the sample of dwellings in each city, *Figure 1* provides an estimate of the proportion of dwellings within the Urban Centres of Sydney, Melbourne, Brisbane, Adelaide and Perth for which the calculated traffic noise level exceeds various values of $L_{A10,18h}$. *Figure 2* shows the same results, but using the L_{Aeq24h} scale.

For Sydney, over 11% of the population are exposed to $L_{A10,18h}$ of 68dB or above and 19% of the population are exposed to $L_{A10,18h}$ of 63dB or above. Confidence limits can be calculated for the estimated proportions (Zar, 1984). The confidence limits are not symmetrical. For example, the confidence band for the percentage of dwellings in Sydney exposed to 68dB or above is 7.7% to 15.5%, and for the percentage of dwellings exposed to 63dB or above is 14.6% to 24.3% ($p < 0.05$). For Adelaide, over 4% of the population are exposed to $L_{A10,18h}$ of 68dB or above and 8% of the population are exposed to $L_{A10,18h}$ of 63dB or above. The confidence band for the percentage of dwellings in Adelaide exposed to 68dB or above is 2.2% to 7.2% and for the percentage of dwellings exposed to 63dB or above is 5.2% to 12.0% ($p < 0.05$). The exposures for the other cities lie generally between the exposures for these two cities.

The results can also be compared to the estimates from the national sample obtained in 1994. *Figure 3* replicates the data from *Figure 1*, but adds to it the previously estimated exposure of the Australian urban population. The results are reasonably consistent. Note that the Australian urban population data, representing exposure of dwellings in all urban centres greater than 100,000 across the country, drew near 60% of its sample from

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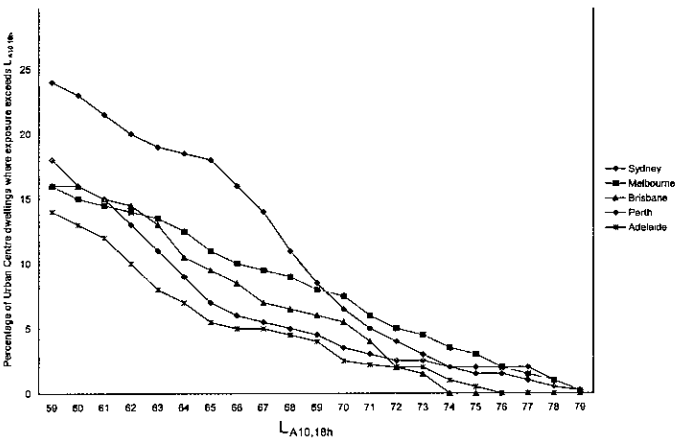

Figure 1: cumulative noise exposure of dwellings in Australian capital cities, $L_{A10,18h}$

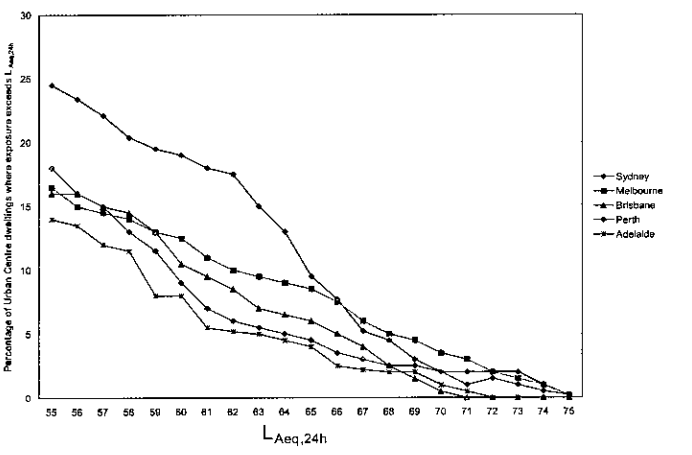

Figure 2: cumulative noise exposure of dwellings in Australian capital cities, L_{Aeq24h}.

Exposure to road traffic noise in Australia

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the two cities of Sydney and Melbourne alone. This is apparent in *Figure 3* at the lower noise exposures, but the Australian urban population results are somewhat lower than the results from the current study at the higher noise exposures. There is no obvious explanation for this, and in fact the differences are small relative to the confidence limits to the estimates of the proportions. It should be noted that the national results, as published in Brown (1994), did not include the -1.7dB Australian correction to the CRTN model. This correction has been applied to all results in *Figure 3*.

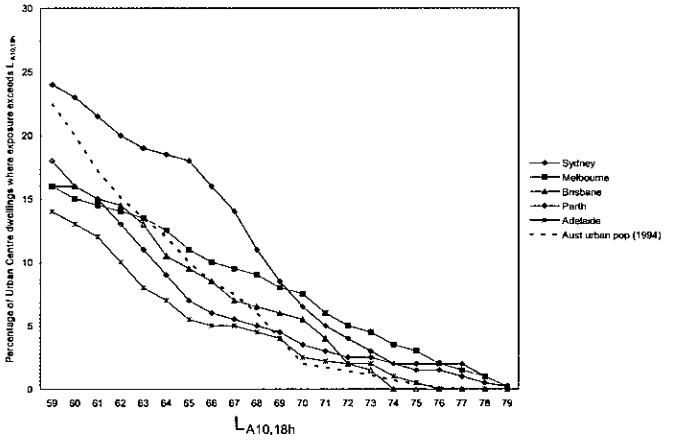

Figure 3: comparison of the noise exposure of dwellings in Australian capital cities estimated in the current study with that of the noise exposure of the Australian urban population of dwellings estimated in 1994 (Brown, 1994)

In *Figure 1*, there is quite remarkable consistency across all cities in the proportions of the population exposed to levels above about 70dB and across all cities, other than Sydney, to levels below 70dB. Most of the apparent (small) differences between the sample proportions for the cities are not significant for the population's proportion when the confidence limits of each of the city estimates are taken into account. However, in the sample data, there is a trend for some correlation between city size and exposure, with Sydney and Melbourne recording a higher proportion of dwellings exposed to moderate to high levels of road traffic noise, with Brisbane, Perth and Adelaide generally having lower exposures. The Melbourne sample has a marginally higher proportion of dwellings exposed to levels above 70dB than do other cities. The proportion of dwellings in Sydney exposed to levels of 60-70dB is somewhat higher than any of the other cities. Such differences presumably result from a different pattern of road location and use in Sydney, with its road system constrained by topography.

In this respect it is unfortunate that Canberra, a planned city in which there has been considerable effort in design of a hierarchical road system and separation of residential land uses adjacent to the upper end of the road hierarchy, was not included in the study. It would be hoped that Canberra results would have shown a significantly lower level of traffic noise exposure than all of the other cities where there has not been similar opportunities to achieve noise control through land use planning.

Road traffic noise exposure generated by state-controlled or local authority-controlled roadways

While it is a matter of little interest to any resident exposed to high levels of road traffic noise, there is an important jurisdictional distinction regarding roads in Australian urban areas. In each city, a certain number of roads are designated as state-controlled roadways, or 'declared' roadways, which are the responsibility of the respective State road authority. The rest of the city's road system is the responsibility of the local government or municipality. Such jurisdictional differences can become very important in terms of action with respect to road traffic noise control. For example, Queensland has different planning noise levels for these different categories of roadway (Queensland Government, 1997). To date, in any data on urban road traffic noise exposure, quantitative information on jurisdiction has not been available.

In the current study the jurisdictional control of the roadways generating noise exposure of the sample was identified. The results, shown in *Figure 4*, distinguish the proportion of dwelling in each city exposed to noise generated from State-controlled roads from the proportion exposed to noise generated from local authority-controlled roads. *Figure 4* shows, as would be expected, that the very highest noise exposures in each city are generated from State-controlled roadways but, at all other exposure levels, the source of noise exposure is shared between State-controlled and local authority-controlled roadways.

Conclusions

This study has provided a definitive estimate of the exposure of the population of dwellings in Australian capital cities to road traffic noise. The results demonstrate that the situation in all capital cities is poor. Some 8-20%

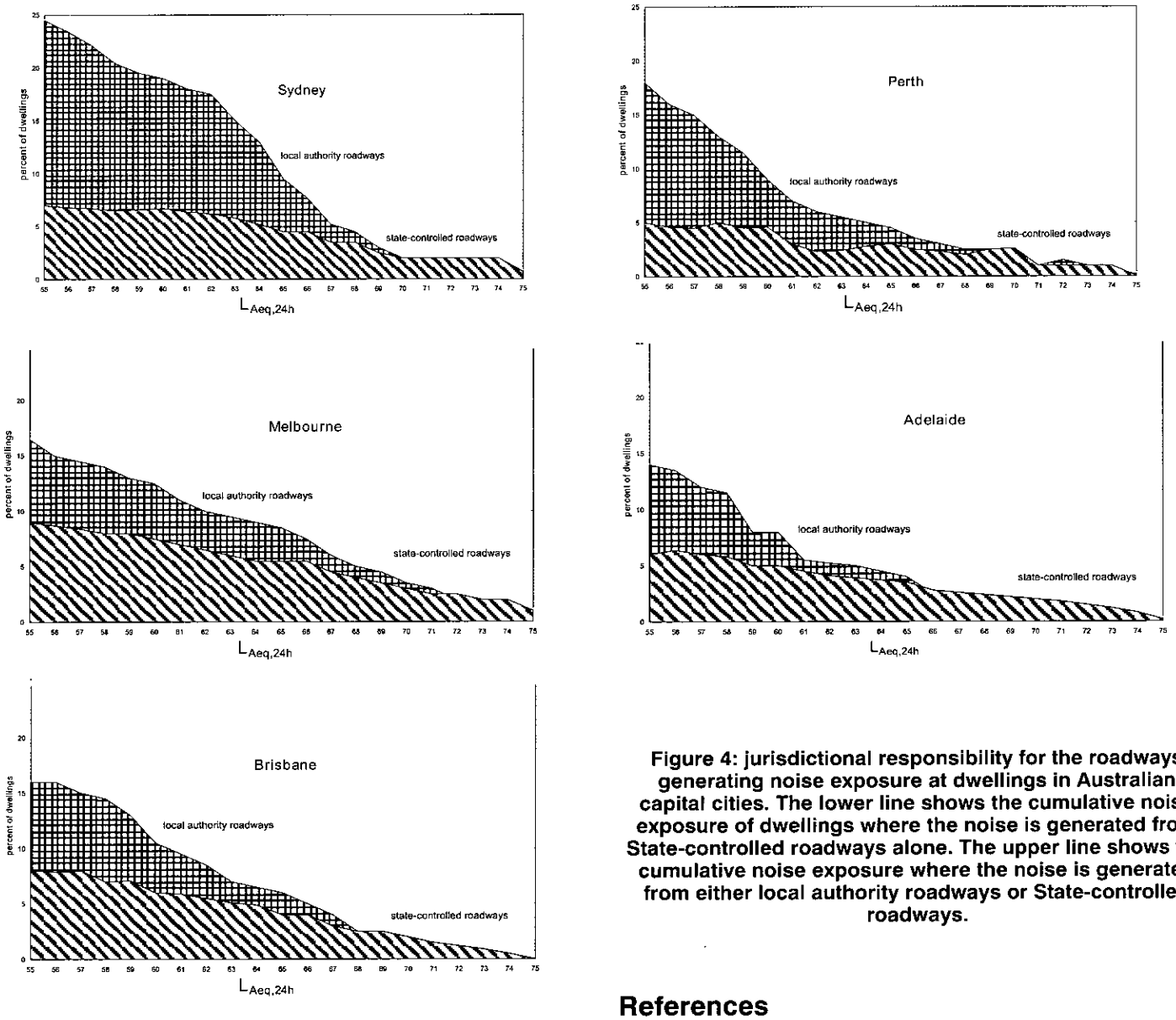

Figure 4: jurisdictional responsibility for the roadways generating noise exposure at dwellings in Australian capital cities. The lower line shows the cumulative noise exposure of dwellings where the noise is generated from State-controlled roadways alone. The upper line shows the cumulative noise exposure where the noise is generated from either local authority roadways or State-controlled roadways.

of dwellings are exposed to $L_{A10,18h}$ levels above 63dB, and 5-11% of dwellings are exposed to $L_{A10,18h}$ levels above 68dB. These are unacceptably high proportions particularly given that the above levels, variously adopted as criteria in Australian states, are considerably higher than were recommended by a WHO expert task force (WHO, 2000), as being necessary to protect against annoyance and sleep disturbance. The results suggest that efforts to date have had little success in ensuring that Australian urban populations are not exposed to high levels of road traffic noise.

The jurisdictional analysis confirms that the responsibility for management of this problem must be accepted by both local and state authorities responsible for roadways, land use controls and building controls. There would be little doubt that most expenditure and effort in the control of noise from roadways has been directed at limited-access controlled roadways such as freeways. While road traffic noise from these sources warrants attention, they represent only the tip of the iceberg in terms of the number of urban dwellings exposed to high noise levels. A concerted effort in management of the road traffic noise problem, not only the road traffic noise problem from newly constructed roadways, needs to be an area of national, state, and local authority priority.

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Heinrich Hertz

1857-1894

To most people, the inventor of radio (or wireless telegraphy, as it was then called) was an Italian named Marconi. As is often the case with major scientific and technological discoveries, the background to the invention was laid down by the work of several different people over a number of years. Moreover, several of our 'Pioneers of Acoustics' had connections with the work of Hertz, including Rayleigh himself, Helmholtz, and Blumlein.

Wireless broadcasting is a case in point. James Clerk Maxwell, a British scientist living in the 1860s, predicted that it would be possible to generate electromagnetic waves which would travel at the speed of light. Twenty years later the German physicist Heinrich Hertz demonstrated this radiation, from which ultimately the word 'radio' was derived. He found that when he generated sparks between two metal balls they could be detected by a metal loop with a gap in it. Smaller sparks were seen jumping across this gap.

Hertz's achievements heralded the beginning of a new electric age

Later experimenters managed to increase the distance across which Hertzian waves could be transmitted, and in 1894 a British scientist, Oliver Lodge, sent Morse-code signals over a distance of half a mile. Evidently, Hertz and Lodge had both managed to transmit radio waves in laboratory experiments, but failed to exploit the practical consequences.

Heinrich Rudolf Hertz was born in Hamburg on 22 February 1857. His father was a lawyer, and later in life became a judge, and his mother a doctor's daughter. The family was originally Jewish, but had converted to Christianity. While at school, young Heinrich showed an aptitude for sciences as well as languages, learning Arabic and Sanskrit. He received a comprehensive education in the humanities and natural sciences, going on to study science and engineering in the German cities of Dresden, Munich and Berlin.

He was at various times a student of Gustav Kirchhoff and Hermann von Helmholtz. He obtained his PhD in 1880 magna cum laude, and continued to study under Helmholtz and work as his assistant until 1883. It was in fact Helmholtz who suggested that he work on a proof of Maxwell's theory of electromagnetic forces. Hertz took a post as lecturer in theoretical physics at the University of Kiel, but after only two years he moved in 1885 to the University of Karlsruhe as professor of experimental physics.

It was while at Karlsruhe that he followed up Michelson's 1881 experiment (the precursor to the more famous Michelson-Morley experiment in 1887) which disproved the existence of the lumeniferous ether. He re-derived the equations proposed by Maxwell to admit the new discovery. Maxwell's theory had been based on unusual mechanical ideas about the ether and had not been universally accepted, but had predicted that electromagnetic disturbances ought to propagate through space at the speed of light, exhibiting the wave-like characteristics of light propagation.

Hertz first established the existence of electromagnetic waves by experimentation, using a fairly simple apparatus consisting of a pair of metre-long wires with a spark gap in the centre, connected to an induction coil to make an electrical spark jump across a small gap. Large spheres at the ends of the wires were used to adjust the capacity of the circuit for resonance, so that the current oscillated between the two spheres. He detected the electrical signals with a receiver placed several metres from the oscillator, also consisting of a dipole aerial and metallic reflector. This work established most of the basic concepts of transmission and reception, and the use of aerials and reflectors. In simple terms, electrical signals could travel through open air as had been predicted by Maxwell and Michael Faraday.

Between 1885 and 1889 Hertz consistently produced electromagnetic waves in the laboratory and measured their wavelength and velocity. He showed that the nature of their reflection and refraction was the same as that of light, confirming that light waves are also a form of electromagnetic radiation obeying the Maxwell equations. He demonstrated that electrical conductors reflect the waves, and that waves could be focused by concave reflectors. He also found that non-conducting materials allowed most of the waves to pass through.

With his oscillator experiment, Hertz solved two problems. First, he demonstrated in practice what Maxwell had only been able to show in theory, that the velocity of radio waves was the same as the velocity of light; second, that the electric and magnetic fields could be detached from wires and transmit freely, as would Maxwell's waves.

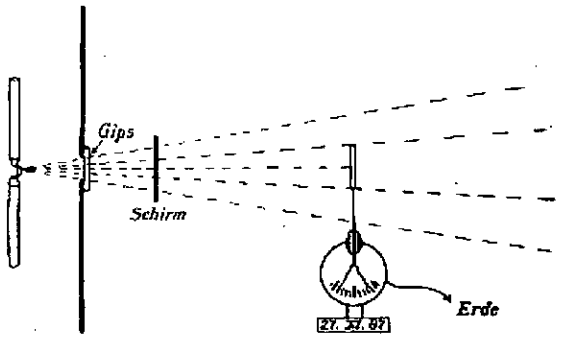
Hertz's students were reportedly impressed by the demonstration, and wondered to what practical uses this marvellous phenomenon might be applied. But the great man thought his discoveries no more practical than Maxwell's theories, despite establishing beyond any doubt that light and heat are forms of electromagnetic radiation. He is supposed to have said that the phenomenon was of no use whatsoever. It was merely an experiment to prove that Maestro Maxwell was right: there were just these mysterious electromagnetic waves that cannot be seen with the naked eye. But there they were. One of his students then asked: "So, what next?" Hertz, being a modest man of no pretensions and little ambition replied: "Nothing, I suppose."

Nevertheless, even at a purely scientific and theoretical level, Hertz's achievements were latched onto by others, and heralded the beginning of a new electric age. The English mathematical physicist, Sir Oliver Heaviside, is supposed to have said just a few years later, in 1891: "Three years ago, electromagnetic waves were nowhere. Shortly after, they were everywhere". Hertz's experiments dealing with the reflection, refraction, polarisation, interference and velocity of electric waves would trigger the invention, soon afterwards, of the wireless telegraph and of radio broadcasting.

In 1889, he was appointed professor of physics at the University of Bonn, where he continued his research on the discharge of electricity in rarefied gases. His scientific papers were translated into English and published in three volumes: *Electric Waves* (1893), *Miscellaneous Papers* (1896), and *Principles of Mechanics* (1899). He did not even live to see the full impact of his work, although he does have his name remembered in the unit of frequency.

A young man in his teens happened to read an article about Hertz's experiments whilst he was on holiday in the Alps. The discovery gave him the idea of using the waves set off by a spark oscillator for signalling. That young man was, of course, Guglielmo Marconi (1874-1937). He is supposed to have rushed straight back to Italy to try the idea, and the rest is history.

Four drafts and the final manuscript for the *Prinzipien der Mechanik*, some geophysical graphs and sketches,



Grundversuch der lichtelektrischen Entladung.
Between 1885 and 1889, Hertz consistently produced electromagnetic waves in his laboratory

and the manuscript for a lecture in 1889 are at the Deutsches Museum in Munich. In the collection of the Science Museum in London are two early manuscripts (on *Theory of Magnetism* and on the *Demonstration of Electrical Effects in Dielectricity*) and the manuscripts for several chapters of *Electric Waves* and of *Miscellaneous Papers*. The Universitätsarchiv Karlsruhe keeps the original *Laboratory Notes* of 1887 and also some rare Hertziana. The recent biography by Albrecht Fölsing (1997) draws on a vast amount of previously unconsidered source material. A great deal of this comes from an otherwise unidentified Nachlaß Mathilde Hertz.

What we today call microwaves also followed from the experiments of Heinrich Hertz. He was first to demonstrate the transmission and reflection of electromagnetic radiation by various objects and materials. An important discovery was made in 1894 by Sir Oliver George, and advanced theoretically in 1897 by Lord Rayleigh (John William Strutt), but this was forgotten until the 1930s. This discovery was the waveguide, a vital device for the transmission of microwaves. It was not until the Second World War that microwaves received the attention that they deserved.

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Heinrich Hertz
1857-1894

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During the war it was their application in RADAR (from radio detection and ranging) that was of special interest for obvious reasons.

Hertz is also regarded as having discovered the photoelectric effect (which was later explained by Albert Einstein) when he noticed that a charged object loses its charge more readily when illuminated by ultraviolet light.

When Hertz died in Bonn on 1 January 1894, Sir Oliver Lodge gave him the credit for accomplishing what the great English physicists of the time had been unable to do. Not only had he established the validity of Maxwell's theorems, he had done so in a particularly modest and unassuming way. One writer marked his passing with the words: 'He was a noble man who had the singular good fortune to find many admirers, but none to hate or envy him; those who came into personal contact with him were struck by his modesty and charmed by his amiability. He was a true friend to his friends, a respected teacher to his students, who had begun to gather around him in large numbers, some of them coming from great distances'.

He had died after suffering a long illness caused by blood poisoning, and left a wife and children. However, his family connections with scientific research did not end there. His nephew Gustav Ludwig Hertz was a Nobel laureate, and Gustav's son Carl Hellmuth Hertz was the co-inventor with Inge Edler of medical ultrasonography.

The great Hamburger is not only remembered as a cycle per second. The Hamburg Television Tower is officially named the Heinrich-Hertz-Turm in his honour: it is by far the highest tower in the city. The architects were Fritz Trautwein and Fritz Leonhard, and it was built between 1965 and 1968 as the telecommunications tower for Deutsche Bundespost. It is also a reminder of the Cold War, since it was built in response to a tower built by the former DDR in East Berlin. It has an overall height of 280m, and its conical concrete shaft ends 204m above the ground. At heights of 128 and 132 metres there is a two-storey viewing platform and restaurant. Above this, at 150m high and projecting further out from the shaft, is the operations platform, then even further up six smaller antenna platforms. Nord Deutsches Rundfunk (NDR) broadcasts most of its radio programmes from there, and the television companies Sat1 and RTL also use the facility.

The Hamburg Television Tower is officially named the Heinrich-Hertz-Turm in his honour: it is by far the highest tower in the city

The tower stands as an elegant landmark in the north west corner of the public garden Planten und Blomen and is reached from the park via a footbridge over Renzelstrasse. Two high speed lifts take the visitor to the viewing platform (with two self-service restaurants) in roughly 30 seconds. From here there is a magnificent panoramic view over the city, the river Elbe and the Port of Hamburg, and further to Schleswig-Holstein and Lower Saxony. The restaurant above the viewing platform revolves a full 360° once every hour.

A Hamburg school is named after him, the Heinrich-Hertz-Grundschule, and there is a Heinrich-Hertz-Strasse in the city of his birth. His is one of 56 relief portraits of eminent citizens of Hamburg on the columns in the entrance hall of the Rathaus (Town Hall). The Nazis had removed his portrait, among others, as being too 'Jewish' but it was subsequently replaced.

The famous nephew, Gustav Ludwig Hertz, was born on 22 July 1887, also in Hamburg. With James Franck, he received the Nobel Prize for Physics in 1925 for work confirming the theory that energy can be absorbed by an atom only in definite amounts. He studied at the universities of Göttingen, Munich, and Berlin, and was appointed physics assistant at the University of Berlin in 1913, where he first worked with Franck. Their experiments showed that when an electron strikes an atom, it must possess a certain minimum energy in order to displace another electron from the atom. This energy is called ionization potential and varies for different elements. Their measurements showed that the distinct wavelength of light emitted by each element corresponds to the series of possible energy states for the atoms of that element. This had been foreseen by Niels Bohr, who used quantum theory to explain the nature of the atom.

In 1925 Gustav Hertz was appointed professor of physics at the University of Halle and in 1928 professor of physics at the Technische Hochschule, Berlin. In 1932 he devised a method of separating the isotopes of neon. After the Second World War Gustav Hertz found himself in the part of Germany that was overrun by the Russians, and was thus engaged in research in the Soviet Union from 1945 until 1954. He returned to the DDR in 1954 and was professor of physics and director of the Physics Institute in Leipzig until 1961. He died on 30 October 1975 in East Berlin.

His son, Carl Hellmuth Hertz (1920-1990) served as a soldier for Nazi Germany. He was captured by US troops and taken overseas. However a friend of his father was able to arrange for him to be freed, and found him a job at the University of Lund, Sweden so that he could leave the United States but not be obliged to return to Germany. At Lund, he went on to develop medical uses of ultrasound, collaborating with several eminent medical and scientific figures of the 1950s and 1960s. He became the first professor of electrical measurements at Lund.

Commons debates

3 March 2004

Prime Minister's questions

Dr Jenny Tonge (Richmond Park) *(LD)*: Will the Prime Minister confirm that a limit of 480,000 air traffic movements a year at Heathrow was accepted by his government after the terminal 5 inquiry, and that the Government White Paper is now calling for runway alternation so that 560,000 air traffic movements a year can take place? That will make noise pollution unbearable and could cause catastrophe in the skies over Heathrow. If that happens, will the Prime Minister take responsibility or will he blame somebody else?

The Prime Minister: I understand the hon. Lady's constituency preoccupation. It is of course important that she represent the views of her constituents, and I am sure that they are opposed to any extension at Heathrow. It is in the nature of such developments that it is very difficult to find people who are in favour of them.

On the other hand, we have to try to take a strategic view in the interests of the country as a whole, in view of the fact

'Heathrow as an airport is of massive strategic importance to the whole of the UK' - *Tony Blair*

that air travel has increased dramatically and will increase dramatically again over the next few years. A whole series of issues, including environmental issues, must be resolved. That is why we said what we did in the aviation White Paper. The hon. Lady will have to understand - it is difficult to say, but none the less true - that in the end we will have to take a decision based on what we believe to be in the long-term interests of the country; and Heathrow as an airport is of massive strategic importance to the whole of the UK.

Adjournment debate

30 March 2004

Motorway noise (Leicestershire)

Mr Andrew Robathan (Blaby) *(Con)*: I am grateful for the opportunity to raise a matter of great concern to

FROM HANSARD

my constituents in Leicestershire, particularly in light of the government's stated intentions to reduce motorway noise. One only needs to visit Enderby in my constituency, for instance, or the surrounding areas of Whetstone, Narborough, Littlethorpe and Cosby to appreciate the full extent of the noise that my constituents suffer on a daily basis and have suffered for nearly 40 years. It is often impossible to stand outside their houses and hold a normal conversation. My constituents cannot sit in their gardens in the summer; they cannot open their windows; and they cannot sleep at night. There is an endless roar, which gets a little quieter between 1.30 and 4.30 in the morning, but then starts up again and wakes them.

Last October I visited Cumberwell drive in Enderby, where an official from the Highways Agency had come to hear the grievances of a large group of residents, the most voluble of whom were Mrs Bingham and Mr Akiens. I urge the Minister to visit Enderby because he would then understand the unacceptable level of noise.

The M1, as I am sure you remember, Mr Deputy Speaker, was the first motorway in this country. It was opened to Lutterworth in 1962 and the stretch through Enderby was opened in, I believe, 1964. It bisects my constituency and south Leicestershire from the junction of the M1 and the M6 up to the Leicester Forest East service station. The noise problem affects people from Lutterworth all the way to Thorpe Astley and Braunstone. My house is about two miles from the motorway, but I can hear it clearly, although I am not arguing on my own behalf.

My constituents have suffered from the noise generated by the M1 for 40 years, but it is getting worse. Many people have bought their houses next to the motorway during those 40 years, but the M1 used to be relatively empty. A famous postcard, entitled *The most boring sight in Britain* and published in 1963, showed the M1 near Newport Pagnell with one car on it. That is no longer the case. As the Minister knows, traffic has increased dramatically during the last 40 years and especially during the last decade.

Last year, the Highways Agency told me that it plans to resurface the M1 between junctions 20 and 21 this coming summer. Resurfacing can reduce noise dramatically. I am not an authority on decibels, but I am told that resurfacing can reduce the noise impact by up to 50%. The Minister may tell me that I am wrong, but such a reduction would obviously be welcomed by my constituents. However, on 29 October, the agency told me that it was postponing the work for four years. That is unacceptable. The agency is a creature of the government, and that is why I called for this debate and asked the Minister to come here today. My constituents do not want to be fobbed off any longer by the agency or the government. Today, I seek clarification of the reasons for the delay in the work.

I asked the Minister a simple oral question on 6 January but failed to receive an answer, so I hope that I shall receive straightforward explanations and answers to my questions today. In a written reply to a question, numbered 140803, in which I had asked how many road resurfacing projects had been delayed due to value management work, the Minister stated:

'The re-phasing of projects is not the result of value management work, but arises from a reappraisal of factors that influence the appropriate timing of works to be undertaken, in the light of better information'.

Yet I received a letter dated 29 October last year from Richard Bennett, who is a board director of the Highways Agency, in which he stated that confirmation of the work was 'subject to the outcome of further value management work'. That is the process that the agency uses to assist us when deciding programming priorities. Mr Bennett's remarks directly contradict those of the Minister, and when the hon. Gentleman speaks I would be grateful if he clarified whether he stands by his remarks. I repeat the question from 6 January, 'Who is right: the Minister or the Highways Agency?'

The Minister also stated in a letter on 10 February that increased costs meant that a reassessment of the work's value for money was necessary. Yet, despite my requests no details about what exactly caused the rise in costs have been forthcoming. In a written answer to me, the Minister stated:

'Final cost details for resurfacing of the M1 between Junctions 20 and 21 will not be available until current investigations by the Highways Agency are completed'.

That suggests there has been no accurate and detailed costing for the work. Is the Minister saying that there has been a sudden increase in prices? If so, where is the evidence for it? The government's response seems entirely illogical. In the same set of written answers, the Minister told my constituents that priority would be given to those cases in which the actual noise levels exceed those predicted by at least three decibels.

The Highways Agency finds roadside noise levels in Enderby of 86dB, which is about 6dB over its own acceptable limit. The Minister might be interested to know that as I trawled through the Secretary of State's announcement of April last year, as the Minister suggested I do, I stumbled on one particular gem.

It stated that only since 1973 have: *'the adverse noise effects of road proposals on the surrounding environment and possible ways of minimising these effects been more comprehensively taken into consideration before the road is built'.*
In other words, according to the Secretary of State's paper, the effects of noise were not considered when the stretch of motorway between junctions 20 and 21 was built, and no serious sound reduction measures have ever been taken. Meanwhile, my constituents in Enderby, Narborough, Whetstone, Cosby, Littlethorpe, Lutterworth and Thorpe Astley continue to suffer. They have not benefited from noise reduction surveys or strategies since the road was built 40 years ago.
The noise is now worse than ever, and as the programme has been put back four years my constituents are condemned to another four years in the same situation. The Secretary of State's statement was, as the Minister suggested to me, a veritable treasure trove of information. Although the Minister told me that better value for money would be obtained by undertaking more work than simply resurfacing, and that 'priority is given to road surfaces that are broken up', the Secretary of State pointed to the need to prioritise work that would not normally need to be resurfaced within the plan period. In other words, that is work that would need to be undertaken for reasons other than simple maintenance - for reasons such as noise reduction, for instance.
The Highways Agency's own consultants, WS Atkins, open their noise survey paper dated 22 September, by stating: *'Following the government's Transport White Paper in 1998, a budget has been allocated to deal with specific noise problems on existing trunk roads and motorways.'*
Will the Minister contradict the remarks of the agency and the Secretary of State or will he accept that there is money ring-fenced for noise reduction separate from the needs of maintenance? In light of those facts the justification for postponing the work is simply not reasonable.

'The case for resurfacing the M1 this summer is overwhelming'

The agency website states that the government's two criteria for priority are that the road must have been opened before 1988 - the stretch of road under discussion opened before 1969 and has remained untouched - and that noise levels immediately adjacent to the road must be at least 80dB. As I have said, the agency found levels to be some 6dB higher at 86dB. The M1 between junctions 20 and 21 must surely fulfil those criteria and should surely be at the top of the list of motorway stretches to be resurfaced.
In the consultancy paper to which I referred, WS Atkins considered options for reducing the noise, particularly between Enderby and Cosby. They found 160 houses that were affected by noise levels of 68dB or more. I recollect that the Department of Transport even bought some houses in Roy Close in the early 1990s because of the impact of traffic.
The report considers erecting noise barriers in particular, and the costs of such noise screening are not horrendous. I urge the Minister to consider implementing noise screening along that stretch of the motorway as soon as possible - as happened, for example, in Luton, by junction 11, which I pass often. The conditions there are comparable.
The Atkins report found that a quieter road surface - a thin-wearing course - would reduce noise to all houses by approximately 3dB. Decibels are a logarithmic unit of measurement, which, with my O-level maths, I am not sure that I understand, but I listened to a reduction of 3dB on my computer less than an hour ago, and the effect was marked. I should like the road surfacing to be done now, and acoustic screening to be installed this year.
In his letter to me of 10 February, the Minister told me that the process for timetabling road improvements was 'subject to continued review'. This was reviewed, to the detriment of my constituents, in October. I hope that the Minister will say that he will review again the M1 from junctions 20 to 21, because the case for resurfacing the M1 this summer is overwhelming. My constituents are suffering now and have been suffering for 40 years: another wait of four years would be intolerable. The government has promised quieter road surfaces and,

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FROM HANSARD

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in the 10-year plan, claimed that reducing noise from motorways and other trunk roads was an important priority. Furthermore, paragraph 3 of the road projects section of the Highways Agency's website says it will 'Consider the length of time people have endured traffic noise.'

No one can have endured noise longer than those living next to the M1 because the M1 was the first motorway. Having had their expectations raised, my constituents demand that those promises be fulfilled and I look forward to the Minister giving them a satisfactory response.

The Parliamentary Under-Secretary of State for Transport (Mr David Jamieson): I congratulate the hon. Member for Blaby (Mr Robathan) on securing this debate, and giving us a firm opportunity to focus on the government's policy on quieter roads. In answer to an oral question in January, I told him that, were it not for this government having such a policy - one did not exist before 1997 - and had the money not been put in place, this debate would not have gone ahead at all. I remind him that we have made the policy a priority. He will appreciate that there are many other demanding priorities around the country which have been identified by hon. Members from both sides of the House who want roads attended to, but we have given that commitment.

Mr Robathan: The Minister is absolutely right that the government has made this policy a priority, and I remember being cheered up when I read about it in the 1998 transport White Paper. However, he will admit that quieter road surfaces, such as whisper concrete, were already being tested and installed before 1997.

Mr Jamieson : Yes, indeed, but this debate could not have taken place if it were not for the government's policy. The hon. Gentleman must be aware, particularly in his part of the midlands, of recent growth in the area, a downside of which is added traffic volume and noise. Leicester and much of the midlands are thriving under this government's economic policies. I am delighted that unemployment has fallen and employment is rising, and whenever I go there I find new enterprise coming into the area, but that generates traffic and movement of people. He asked me to visit Enderby, and if I have the opportunity to pop in when I am visiting, I would be delighted to do so and perhaps have a cup of tea with the hon. Gentleman.

Mr Robathan: The Minister is very welcome - I will even pay for the tea.

Mr Jamieson: I thank the hon. Gentleman for that welcome.

The hon. Gentleman was at pains to ensure that our approach is consistent and equitable, which I believe it is. Before I go into the detail of the situation on the M1 in Leicestershire, in which he is particularly interested, I want to say more about the government's quieter roads programme.

The strategic road network helps to support a healthy economy by providing the backbone for the effective distribution of goods and services and the easy movement of people.

However, it is not without its disadvantages. People who live close to major roads sometimes experience the effects of increased noise, and the expansion of the road network inevitably disturbs the local environment. A balance that satisfies our economic and environmental needs has to be struck, and much can be done to minimise any negative impact on the environment. I often say that the Highways Agency is the second largest planter of trees in this country after the Forestry Commission. In our guidance to the agency, we take environmental matters seriously.

'A balance that satisfies our economic and environmental needs has to be struck'

The government has recently addressed public concerns about road traffic noise and is dedicating funds to noise mitigation. We accept that traffic noise is a concern for many people, and in the White Paper, *A new deal for trunk roads in England*, published in July 1998, we gave the commitment:

'In future, whenever a road needs to be resurfaced, we shall ensure that the most appropriate noise reducing surfaces are used for those areas where noise is a particular concern'.

In March 1999, we announced sift criteria to identify the most serious and pressing cases and a ring-fenced budget of £5 million a year to deal with the most serious instances requiring practical and cost-effective noise-mitigation measures.

'We accept that traffic noise is a concern for many people'

The hon. Gentleman referred to those criteria, but for the sake of clarity it would help to have them on the record. First, trunk roads must have opened before June 1988, although priority attention is given to locations affected by roads that have remained unaltered since October 1969, the qualifying date for the introduction of noise mitigation measures. Secondly, current - that is, 1998 - noise levels immediately adjacent to the road must be at least 80dB. If the hon. Gentleman wants a small lesson in logarithms and decibels, I will assist him for a small consideration.

It may be useful to point out that the M6 Preston bypass between junctions 30 and 32 was the first motorway. It opened in the late 1950s, although that was probably before the hon. Gentleman was born. The third criteria is that in the case of roads opened or altered after October 1969, noise levels must be at least 3dB greater than predicted for the design when the road was planned. The aim is to address people's disappointment that noise levels mentioned during the planning process were different from those experienced when the road was eventually opened.

The hon. Gentleman will know that in November 1999, a list appeared in *Hansard* under cover of a letter from the chief executive of the Highways Agency, showing the most serious and pressing cases to be studied to ascertain the most practical and cost-effective solutions. That became familiarly known as the *Hansard* list, and by the time of the government's 10-year plan, published in July 2000, the agency had been set the target of installing quieter surfaces on more than 60% of the trunk road and motorway network, including all concrete stretches, by 2010-11. That will benefit approximately 3 million people living within a third of a mile of such roads. Indeed, I believe that some of the hon. Gentleman's constituents have already benefited from resurfacing work on the M69 which has reduced noise. He looks curious, but if he ever takes that route, he will be able to see for himself how his constituents have already benefited from the government's road noise reduction policy.

That policy over the period of the 10-year plan can be summarised as follows:

- a noise mitigation programme costing £5 million a year to address sites that meet the *Hansard* list criteria;
- resurfacing all concrete roads with quieter materials; and
- resurfacing black-top roads with quieter materials when normal maintenance is required.

About 5% of the trunk road network at 70 different locations is constructed with a concrete surface. Clearly, given the scale of the problem, work cannot be completed overnight. Attempting to do so would not be practical because it would create a great deal of disruption on the network, so we shall phase in the work over ten years. Concrete roads tend to be very robust, and often need resurfacing not because of deterioration but to ameliorate the effects of noise.

As part of the development of our road maintenance programme, the process of value management is applied to all major road renewal schemes to ensure that renewal schemes are technically robust and meet set standards. Proposed schemes are examined collectively to establish relative merits and priorities, and set criteria are used to assess schemes.

The criteria for the prioritisation of resurfacing flexible trunk roads are related to the condition of the surface and include surface crack intensity, assessment of levels of rutting, unevenness, skid resistance, general wear and tear of surface material and the frequency of accidents associated with the road condition. Those criteria are used to determine the programme for resurfacing. The aim is to maintain the trunk road network using the principle of minimising whole-life costs, taking into

'Mitigating noise from trunk roads and motorways is a complex subject'

account disruption to the road user and the need to keep the road in a safe and serviceable condition.

Turning to the condition of the M1 in Leicestershire, I fully understand the concerns of the hon. Gentleman and his constituents about noise from the M1. I accept that noise from roads is deeply intrusive to people who live near them, which is why we have developed a policy for tackling the noise from roads. In particular, I understand the specific concerns in the Narborough, Cosby and Enderby communities to the south of Leicester. That section of M1 was not identified as a specific site in the list published in *Hansard* in 1999, and therefore does not take as high a priority as those listed or other lengths of motorway and trunk road that have concrete carriageways.

To ensure that the most worthy sites are treated first, a nationwide ranking system has been developed. The section of road in question has what engineers call a flexible surface - a black-top surface - which means that it is not as noisy as roads with a concrete surface. Inevitably, therefore, the M1 in the hon. Gentleman's constituency will be given less priority in noise mitigation measures. Nevertheless, we have agreed that the Highways Agency should carry out noise surveys at particular locations where local people have expressed significant concern, and a number of locations in Leicestershire fall into that category.

A survey covering the communities of Narborough, Enderby and Cosby has been completed, and it indicates, as the hon. Gentleman said, that 190 houses are exposed to noise levels greater than 68dB. That has enabled the agency to rank those sites against other locations in the country in order of severity. I can confirm to the hon. Gentleman that the three sites are not the most severely affected by noise. They are ranked in the order Narborough, Enderby and Cosby, but because they are close to each other it is likely that they will all benefit at the same time when resurfacing work is undertaken on that section of the M1. When considering noise mitigation measures the rankings are used to prioritise the programming of works.

The agency is also undertaking a survey at Kirby Muxloe in Leicestershire, near junction 21A of the M1. That survey is in its final stages and we expect a report shortly. However, it is not only the desire to reduce noise from busy roads that gives rise to the need to provide a new surface; the condition of the road network is constantly monitored to ensure that maintenance is undertaken at a time that gives maximum value for money.

A process of continuous value management - some difficulty may have arisen in the understanding of the term - is carried out to prioritise the work to be done with the funds available. Depending on the deterioration of a particular stretch of road, it may move up and down the list of priorities. I am sure that the hon. Gentleman would expect us to do no less than that - to prioritise one road over another if it was deteriorating more rapidly.

The agency identified most of the motorway between junctions 20 and 21 as needing to be resurfaced within the next few years. The section is too long for the whole of it to be treated at once; hence the works are likely to be split into four phases. As the hon. Gentleman knows, the works were originally programmed to start in 2004 and to be completed over three years, starting with the section adjacent to junction 21. However, after being subjected to the process of continuous value management that I mentioned earlier, the works were reprogrammed, and they will be undertaken between 2005-06 and 2007-08. Depending on the condition of the road and further examination, the works will take place earlier or later in that period, so there will not necessarily be a delay of three years. I am sure that the hon. Gentleman will agree with me that a programme of work that takes place in 2005-06 is not that far away.

I realise that the hon. Gentleman is disappointed that the work has moved out of this part of the programme. However, if he has listened to some of the other debates held on such matters, and if he were to see some of the correspondence that I have received from hon. Members on both sides of the House, he would agree that it is fair to prioritise the works on the criteria set out.

I hope that what I have said has reassured the hon. Gentleman that the agency carefully and stringently analyses each road scheme in accordance with a list of priorities. I will ask agency officials to ensure that they keep him informed on the detailed in-year programme as it develops for the M1 in Leicestershire.

Although mitigating noise from trunk roads and motorways is a complex subject, I hope that the hon. Gentleman will agree that the government is doing all that it can to ensure that we have a fair system, which will benefit the greatest number of people over the next few years. We try to be as fair as possible but it is inevitable that those further back in the process are impatient to see the work closest to their homes completed.

I undertake to ensure that the agency keeps the hon. Gentleman informed, because I realise that the issue is important to people living in that area. I hope that he will recognise that we have put a substantial amount of extra money into the programme, and that we are tackling the list of works based on current priorities. The debate has been useful, and I hope that my explanation has been helpful. If the hon. Gentleman wishes for further explanation, I shall be delighted to correspond with him.

Commons written answers

25 February 2004

Wind turbines

Dr Murrison: To ask the Secretary of State for Environment, Food and Rural Affairs what research she plans to commission into the effects on health of low frequency noise from wind turbines.

Alun Michael: Defra is not currently researching the effects of low frequency noise from wind turbines on health. However, as part of Defra's research programme on noise and nuisance issues, research has been let to better understand the assessment, management and effects of low frequency noise as a whole.

25 February 2004

Road resurfacing

Mrs May: To ask the Secretary of State for Transport what percentage of the trunk road network has been re-surfaced and *(b)* re-surfaced with lower noise surfacing in each of the last three years.

Mr Darling: Government policy is

continued on page 36

FROM HANSARD

continued from page 35

to encourage the implementation of technologies that reduce the noise arising from road traffic wherever these are cost effective and do not have adverse consequences on safety. Categorisation of sites for low noise surfacing is primarily based on maintenance need. In addition, we have criteria for categorisation for noise reduction of roads with concrete surfaces. We announced these criteria on 17 October 2001. They are:

1 that wherever possible the application of quieter surfaces will fit in with normal maintenance needs;

2 that priority will be given to those sites where treatment would benefit the greatest number of people;

3 that the works will be carried out in such a way as to minimise disruption to general public and users of the network;

4 that priority will be given to roads, opened since June 1988, where actual noise levels have turned out to be significantly higher than predicted at the time of the Public Inquiry.

Priority is given to road surfaces that are deteriorating and to locations where road safety is an issue. Where the resurfacing is specifically for noise reduction purposes priority will be given to those cases in which the actual noise levels exceed those predicted by at least three decibels, or where more than 100 properties per kilometre are affected by excess noise. During 2000-01 4.3% of the Highways Agency's core network was resurfaced,

No standards have been set to regulate aerodynamically generated wind noise from tall buildings

including 3.5% with quieter surfacing. During 2001-02 the figures were 4.2% and 3.8% respectively, and in 2002-03 5.5% and 5.0% respectively. In the current year, 2003-04, the Highways Agency estimates these figures will be 5.0% and 4.6% respectively.

18 March 2004

Heathrow

Mr Hammond: To ask the Secretary of State for Transport whether the review of operations at Heathrow to establish the practicality and impact of mixed mode operation will include a review of existing noise preferential departure routes.

Mr McNulty: The further work announced in *The Future Development of Air Transport White Paper*, which includes consideration of how to make the most of Heathrow's existing two runways, may involve review of some existing noise preferential departure routes, but the extent to which this may be necessary will only become clear as the work proceeds. Noise preferential routes may in future need to be reviewed in any event in the light of the 'Single Sky' proposals. Any changes which might have a significant effect on the level or distribution of noise and emissions would require prior consultation.

18 March 2004

Buildings (aerodynamically generated wind noise)

Mr Cousins: To ask the Secretary of State for Trade and Industry what standards relating to *(a)* noise and *(b)* other factors regulate aerodynamically generated wind noise from *(i)* very tall and *(ii)* massive building structures in built-up areas; and what plans she has to re-examine such standards.

Keith Hill: I have been asked to reply. The Office of the Deputy Prime Minister has not set any standards relating to noise or other factors to regulate aerodynamically generated wind noise from very tall or massive building structures in built-up areas.

24 March 2004

Shooting

Mr Edwards: To ask the Secretary of State for the Home Department what representations he has received about

excessive noise from gunfire by clay pigeon shooters; and if he will require clay pigeon shooters to attach silencers to their guns.
Alun Michael: I have been asked to reply. My right hon. Friend, the Secretary of State, has not received any recent representations on excessive noise from gunfire by clay pigeon shooters. There are no plans to require clay pigeon shooters to attach silencers to their guns.
Mr Salter: To ask the Secretary of State for the Home Department if he will make a statement on his policy on responsible and safe shooting sports conducted in accordance with the law.
Caroline Flint: The government believes that shooting should be done in a responsible and safe way and in accordance with the law.
Mr Salter: To ask the Secretary of State for the Home Department when he last met representatives of the British Association for Shooting and Conservation; and what was discussed.
Caroline Flint: I met representatives of the Association on 8 September 2003 to discuss their concerns about the firearms related provisions in what is now the *Anti-social Behaviour Act*.

25 March 2004

Road noise

Shona McIsaac: To ask the Secretary of State for Transport *(1)* which concrete trunk roads have been resurfaced with low noise materials, broken down by cost of each project; and *(2)* how much funding has been allocated to resurface concrete trunk roads with low noise materials *(a)* in each year since the projects started and *(b)* for 2003-04.
Mr Jamieson: In year funding is not specifically allocated for resurfacing of concrete trunk roads with low noise materials. The following concrete trunk roads have been resurfaced with low noise materials and broken down by the cost of each project and the year of completion.

Concrete sections completed in	M20	Cost (£ million)
1999–2000	J3-J5	7.5
2000–01	J9-J10	6.0
2001–02	No schemes completed	No schemes completed

Concrete sections completed in 2002–03	Cost (£ million)
M1 80: Junction 2 to Beltoft	2.3
A12 Brentwood Bypass Phase 2	12.8
M11 Junction 8 (Stansted Slip Road Contract)	3.7
M20J11—Sellindge	7.4
M20 Sellindge—Smeeth	—
M27 Junctions 2–3	19.1
M27 Junctions 3–4	—
M11 J7–6 Southbound	3.2
M5 Junctions 26 to 27 Contract 1	1.6
Sub total	50.1

Concrete sections completed in 2003–04	Cost (£ million)
A1 Long Bennington	4.4
M42 Junctions 2–3a	7.4
M180 Sandtoft—Junction 2	4.0
M11 B1038 (Newport)—All	10.9
M1 Junctions 1–2	6.9
M20 Junctions 11a-11	7.8
M20 Junctions 13–11a	—
M25 J26–27	14.3
M5 Junctions 26 to 27 Contract 2	3.7
M5 J27 South to Willand	4.9
A12 Witham-Kelvedon	13.7
Sub total	78.0

M20 J11 to Sellindge and M20 Sellindge to Smeeth schemes were delivered as one project. The same applies to M20 Junctions 11a to 11 and M20 Junctions 13 to 11a schemes and the M27 Junctions 2 to 3 and M27 Junctions 3 to 4.
The Highways Agency has reported the following allocated expenditure for concrete trunk roads resurfacing with low noise materials since 1999:

	£ million
1999–2000	7.5
2000–01	6
2001–02	0.7
2002–03	51.4
2003–04	76

20 April 2004

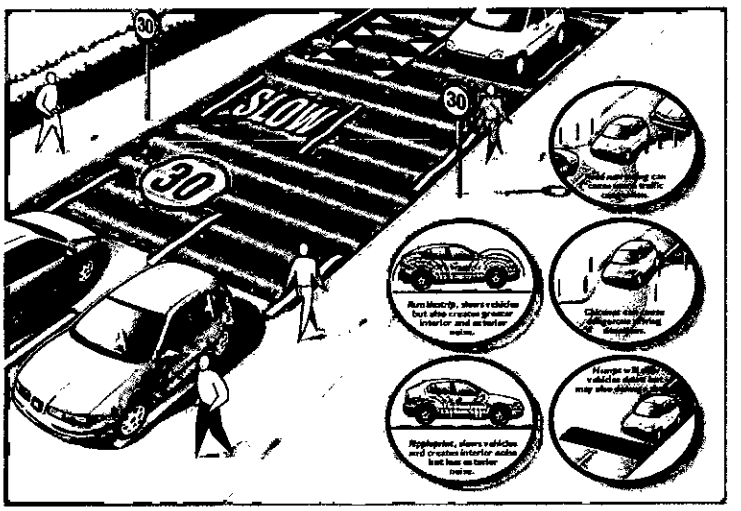
Noisy roads

Tony Baldry: To ask the Secretary of State for Transport when he next expects to meet the Chief Executive of the Highways Agency to discuss the issue of noisy roads.
Mr Jamieson: I am in regular contact with the Chief Executive of the Highways Agency on issues concerning noisy roads. I have recently agreed the Highways Agency's Business Plan for 2004-05, which includes a commitment to resurface 50 lane km of concrete road surface with lower noise surfacing. In addition, all maintenance work carried out on flexible road surfaces now uses quieter road surfaces.

20 April 2004

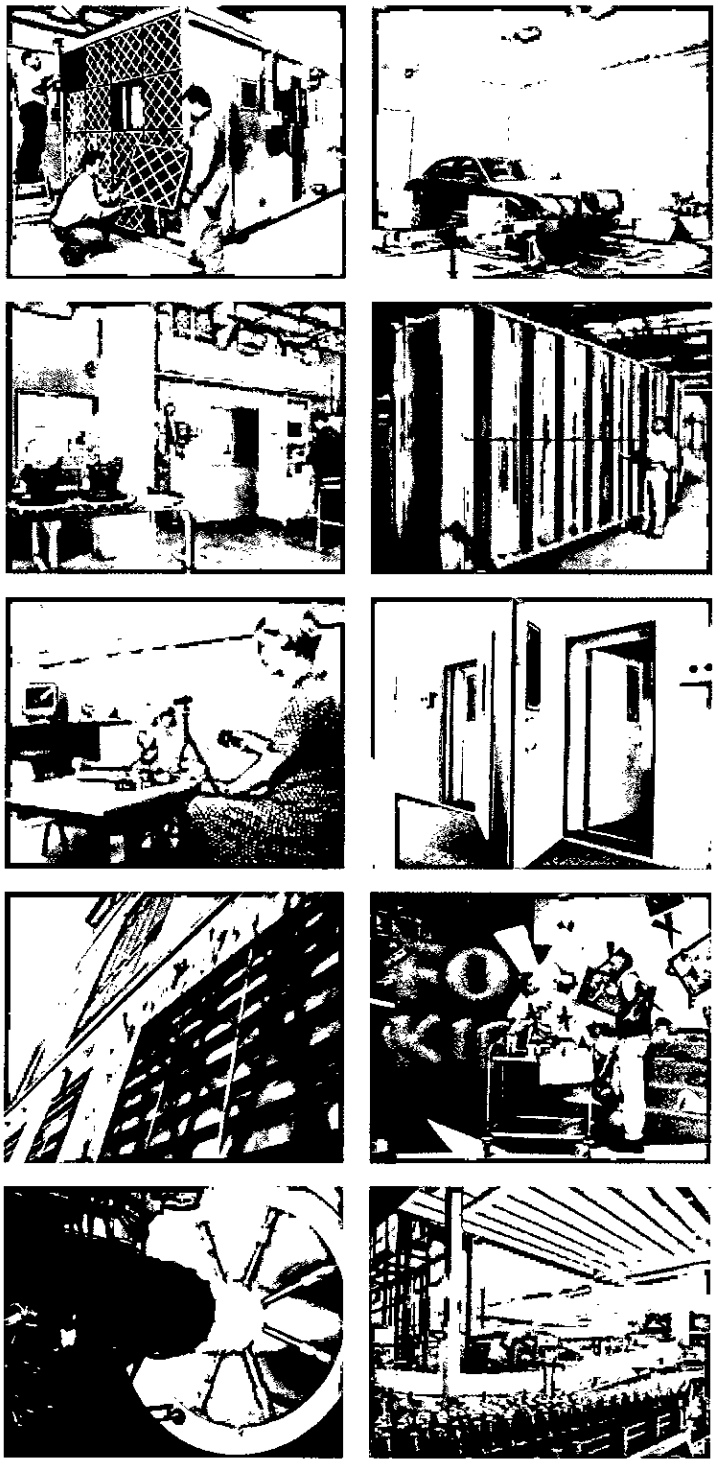
Road surface noise

Mr Watson: To ask the Secretary of State for Transport what assessment he has made of the use of ripple print pads on road services to reduce *(a)* accidents and *(b)* noise.
Mr Jamieson: The Department has been monitoring the effects of installing rumblewave surfacing (marketed as Rippleprint by Prismo Limited) at seven pilot sites. An initial report has been published by TRL Limited (TRL Report 545 Development of a novel traffic calming surface 'Rippleprint'), and I have placed copies of this report in the Libraries of the House. A final report will be published later this year.
Mr Watson: To ask the Secretary of State for Transport what assessment he has made of the effectiveness of sound-absorbing concrete in reducing traffic noise.
Mr Jamieson: The Highways Agency is keeping in touch with developments in Europe on work on noise absorbing concrete. In general, porous concrete has been shown to have similar noise absorbing properties to porous asphalt, with the same disadvantages of high cost and loss of benefit over time as the pores become clogged. Initial trials in European countries of a new surfacing using a resonant cavity formed in concrete below porous asphalt, have given lower noise reduction benefits than expected.
Mr Watson: To ask the Secretary of State for Transport how much has been spent on roadside noise barriers in each of the last ten years.
Mr Jamieson: Figures for the last ten years are not available. Spend on noise barriers that are provided in conjunction with highway improvement schemes is not separately identified in the scheme cost. Spend on the installation of noise barriers provided retrospectively on older trunk roads that commenced in 2000, has been met by the £5 million per year ring-fenced allocation.



The Department of Transport has been monitoring the effects of installing rumblewave surfacing (Rippleprint) at seven pilot sites

making the world a quieter place



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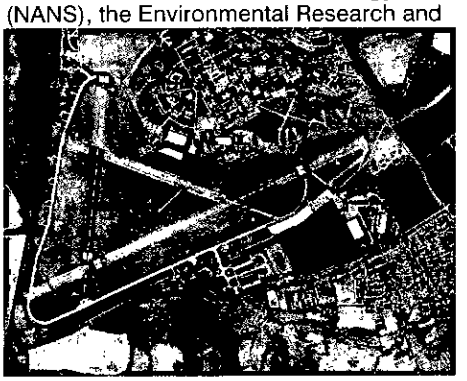
Noise mapping England research project

1. Aircraft traffic noise at Heathrow (ERCD 0306)

To assist in the implementation of the Environmental Noise Directive (2002/49/EC) (END) and the development of a National Ambient Noise Strategy (NANS), the Environmental Research and



Aircraft noise mapping has effectively already been undertaken for many years at some airports

Consultancy Department of the Civil Aviation Authority has prepared a comprehensive report. This is the final report on the subject of aircraft traffic noise, commissioned by the Department for Environment, Food and Rural Affairs (DEFRA) in February 2003.
Aircraft noise mapping has effectively already been undertaken for many years at some airports in the form of the production of aircraft noise contours. These usually relate to an average summer day and cover the 16 hour period between 0700 and 2300. At some airports, night contours are produced from time to time covering 2300-0700. The contours are presented in terms of the A-weighted equivalent continuous noise level (L_{Aeq}).
In order to comply with the Environmental Noise Directive, aircraft noise mapping (or contours) have to be produced for an annual average day (rather than a summer average day), and have to be produced in terms of a new noise indicator (the L_{den}) and for an annual average night (2300-0700). The new indicator takes account of all aircraft movements throughout an average 24 hour period, but adds 'penalties' to the noise arising in the evening (+ 5 dB) and the night (+10 dB). Evening is defined as 1900-2300. The separate night contours show the noise exposure without any penalty.
This research study had two main aims:
1. to investigate various technical issues that arise as a result of moving from producing summer average L_{Aeq} contours to producing annual average L_{den} contours; and
2. to produce L_{den} and L_{night} contours for Heathrow Airport for the year 2001.
The current production of contours makes certain assumptions. These include the following:

- ❑ the receiver height is 1.2m above ground; and
- ❑ the topography around the airport is flat and at runway level;

The study has examined re-standardising on a 4m receiver height, and the effect of incorporating a limited representation of actual topography (modifying the slant distance, but not reflection or ground attenuation effects).
In addition, the contours currently tend to be based on the results for 100m by 100m grids. Other noise sources that may be mapped might be based on 10m by 10m grids, the higher resolution being necessary because of the much greater importance of surface-level shielding and reflection effects. The need to integrate air noise with road and rail noise for agglomeration mapping requires a common grid density. The study, therefore, also investigated what error might occur if 10m by 10m results were interpolated from the 100m by 100m results rather than calculating the 10m by 10m results directly.
It was recognised that the presence of Concorde in the fleet mix had a significant effect on the size and shape of the contours. The year 2001 was unusual in so far as Concorde only flew a restricted schedule towards the end of the year following its re-entry into service after modifications in the wake of the accident in 2000. Thus, in order to understand fully the influence of Concorde, several assumptions were tested. These were:

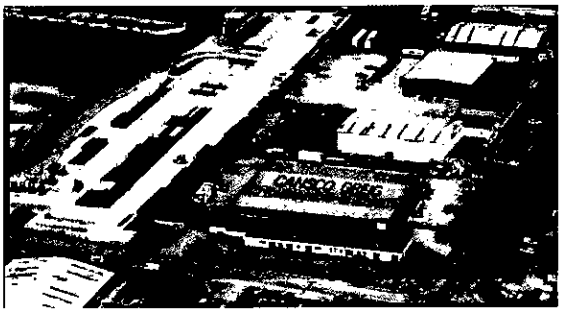
- ❑ 2001 contours assuming Concorde operated at its 1999 level of activity;
- ❑ 2001 contours assuming that Concorde flew as it did in that year; and
- ❑ 2001 contours excluding any Concorde movements.

As Concorde has since been retired from service, these comparisons are now largely of academic interest only.
The other variable that was examined was the modal split, *ie* the amount of time the airport operated with aircraft taking off and landing towards the west (westerlies) and *vice versa* (easterlies).
In addition to producing results for the L_{den} and L_{night}, results have also been produced for the other constituent elements of L_{den}, namely L_{day} (the equivalent continuous level for the daytime period of 0700-1900) and $L_{evening}$ (the equivalent continuous level for the evening period of 1900-2300). Values for the area enclosed within various contour bands, together with the population and the number of households, have been produced.
When evaluating the results it must be remembered that the annual average L_{den} indicator is different from the summer average 16 hour L_{Aeq} indicator that has traditionally been used to describe the noise exposure from the airport. Thus the two sets of results must not be compared. Instead they should simply be seen as two methods of describing average noise exposure at the airport.

The full report can be downloaded from http://www.defra.gov.uk/environment/noise/aviation-mapping/pdf/aircraft-noise.pdf (it is an 8MB pdf file containing 98 pages).

2. Industrial noise sources

Can a national method for predicting noise from industry be determined?



To assist in the implementation of the Environmental Noise Directive (2002/49/EC) (END) and the development of the National Ambient Noise Strategy (NANS), this report was prepared by Bureau Veritas Acoustic Technology (BV-AT).
There is no formal national method for predicting noise from industry. In general, information regarding the sound power output for the various items of plant and machinery on an industrial site is combined with methodologies that determine the propagation of sound from such sources to determine the sound level at a particular location.
The END makes reference to ISO 9613-2 as a means of calculating the propagation of noise from industrial sources and mentions three other standards that could be used to determine the sound power information for the sources.
This study was designed to explore whether a method for characterising the source noise levels of an industrial complex could be derived that was simple, reproducible and robust. It took account of the advice in the END and explored the sensitivity of some of the variables to be found in ISO 9613. A possible methodology was identified.
Work is now underway refining the method and preparing a formal procedural document. It is then intended to carry out some trials of the approach as well as seeking peer group review of the proposed methodology

The full report can be downloaded from http://www.defra.gov.uk/environment/noise/industry-mapping/pdf/industry-noise.pdf (it is a 9.5MB pdf file).

Noise from the A34

European Parliament to consider if it breaches residents' human rights

The European parliament is to investigate claims that residents living near one of Britain's busiest trunk roads have had their human rights breached because the government has failed to resurface the route, which is unreasonably noisy.

An inquiry was begun after villagers in Oxfordshire complained about the roar of traffic on a five-mile section of the A34. Sir Richard Branson, one of those affected, described the noise as 'like an express train'. The noise is so loud that Branson, whose country estate near Kidlington is about 500 yards from the road, has planted a wood in an attempt to block out the sound of passing vehicles. In summer, residents have to sleep with their windows closed or turn up the television or radio to drown out the traffic. Garden parties and barbecues are almost impossible.

If MEPs find the government at fault and persuade it to take action, many lawyers believe that any residents afflicted by excessive noise levels from British roads could make similar challenges. The A34 between Peartree and Weston-on-the-Green has a grooved concrete surface, and was due to be resurfaced last year with a thin layer of porous asphalt. Unfortunately, the Highways Agency now says the work will not be carried out for at least two years due to lack of funds.

Residents have therefore been prompted to write to the petitions committee of the European parliament, claiming that their right to privacy and family life under the European convention on human rights has been breached. They also claim that the government is failing in its duty to protect the environment.

The petition was signed by more than 500 people and was filed by the clerk of Gosford and Water Eaton parish council, the area where residents are most affected by traffic on the A34. Branson has written separately to the petitions committee, claiming that the road is 'polluting' their lives and causing them to suffer every day and night from the excessive traffic noise generated by the tyres of vehicles travelling on the over-brushed concrete surface. He has planted 7,500 trees to try to reduce the effects of the noise, but the effect is negligible in winter when their leaves have fallen.

Local resident Sir Richard Branson has likened the traffic roar to an express train

When the A34 was first proposed, planners told a public inquiry that passing traffic would generate no more than 60dB but apparently failed to mention the concrete surface. Concrete roads now make up only 250 miles (5%) of the motorway and trunk road network, but tend to be noisy because of tiny grooves scored into the surface. These are designed to prevent skidding, but generate a loud hum as tyres pass over them. When the road opened, residents commissioned an independent investigation by the Transport Research Laboratory (TRL). The actual levels proved to be as high as 78dB, which was equivalent to a quadrupling of the traffic volume. Private cars travelling at 70mph were generating the same amount of noise as would be expected from a lorry.

Residents living within about 300m of a new road producing levels of more than 68dB have a statutory entitlement to sound insulation measures such as double-glazing. The right was denied to residents near the A34 because the government did not acknowledge the TRL figures until 2000, and insulation entitlement cannot be given retrospectively.

The government plans to phase out all concrete motorways and A-roads by 2011 and has set a target of resurfacing 60% of the entire Highways Agency network with quieter surfaces by then. The noisiest concrete roads, including the A34, have been given priority and could be resurfaced by 2007, accounting for some 120 miles and mitigating the effects at some 11,500 residential properties. A favourable decision by the EU petitions committee could speed up the process, and result in further actions by tens of thousands of other British residents whose lives are also blighted by excessive road noise.

Merseyside Noise Study

Seminar to reveal findings of wide-ranging survey into noise and its impact on people

In April 2003, the five Merseyside local authorities and Merseytravel commissioned one of the most wide-ranging and intensive investigations into environmental noise in any region of the UK. The main purpose of the *Merseyside Noise Study* was to address the lack of good quality information about environmental noise and its effects on people's quality of life.

The study included a major survey of public perceptions of noise, with nearly 1200 interviews carried out across all 117 wards in Merseyside. Alongside the perception survey, noise levels over 24 hours were monitored at 90 locations representative of different situations such as near busy roads, in city centres and residential suburbs.

The *Merseyside Noise Study* will tell us whether environmental noise is a problem for people in the area, how significant or widespread are the problems, what sorts of noise cause problems and the effects they have on people. The study pays particular attention to transport-related noise.

The findings of the *Merseyside Noise Study* are being presented at a seminar on 22 June 2004 at the Merseyside Maritime Museum. Invited speakers from DEFRA and NSCA will also take part. The conference will be opened by Lord Whitty, Parliamentary Under-secretary of State, DEFRA, and the discussion session will be chaired by Geoff Kerry, the IOA's Immediate Past President.

The seminar is provided free as part of the Local Transport Plan programme for dissemination of best practice in transport policy and planning. All attendees will receive an information pack and a CD containing a full set of the Noise Study Reports. To request a registration form please contact:

Mrs Michelle Langshaw, tel: 0151 934 4224, e-mail michelle.langshaw@technical.sefton.gov.uk

Campbell Associates
Award Winner 2004

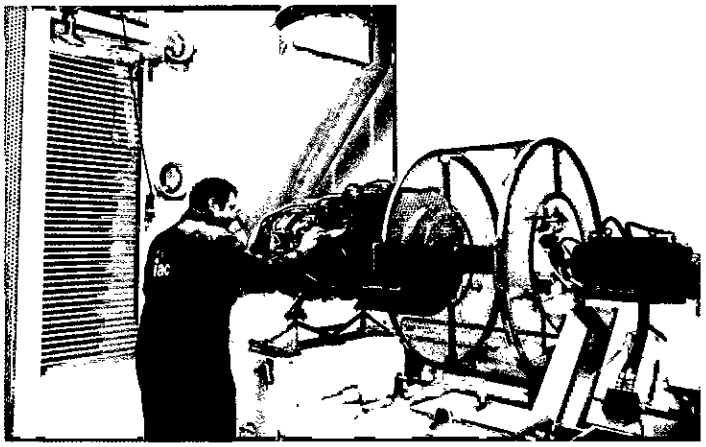
Campbell Associates are delighted to announce that their 2004 Award Winner is Thomas Hill pictured (left) receiving his accolade from Dr John Pritchard at Derby University. Thomas made a study into methods for the validation of noise maps relating to quarrying operations and developed techniques that would allow quarry managements to make better use of the theoretical data produced by these programs. The company wishes Thomas well in his promising career in acoustics.

IAC is national environmental champion

For its 'outstanding environmental performance', Industrial Acoustics Company (IAC) has scooped the title of National Champions in the DTI's *Green Apple Environment Awards* for Commerce and Industry.

The winning noise control solution, which caught the imagination of the DTI's judging panel, was the multi aero-engine, test facility designed and built for defence establishment DARA in Fareham, Hampshire. As the turnkey project was to occupy a brown field site adjoining an Area of Special Scientific Interest the onus was on IAC to minimise and monitor environmental impact during every stage of construction.

Below: the environmental team celebrates its Green Apple Award as national champions



This multi aero-engine test facility for DARA proved to be the winning noise control solution

The end result was a facility able to do the job of two conventional test cells, with reduced engine test time, fuel and water consumption and emissions. (This project also won the Bond Pearce Innovation Award in the Hampshire Business Awards 2003.)

Companies from across the UK competed in the awards, regarded as among the most prestigious in the UK and, as national champions, IAC is also eligible to enter for this year's *European Environment Awards*.

Collecting his award at the House of Commons, on behalf of his team of acoustical engineers and manufacturing specialists, managing director Brian Quarendon said: "I am delighted that IAC has been recognised in this way, particularly in view of the high standard of all the entries. The award is a coup for us and we'll be putting it to work for our commercial advantage.

"Noise," he added, "is an increasing environmental concern at every level but that's good news for us - ours is among the few manufacturing sectors that is growing. Innovation is key and that's what we're good at - this award adds to the great achievements of all our staff both here and overseas."

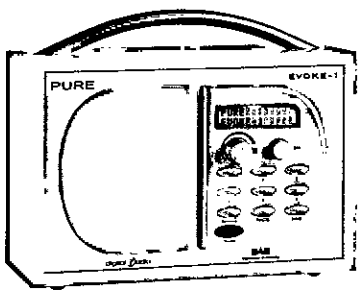
IAC employs around 200 people at its manufacturing facility in Winchester, in addition to other plants in Essex and Derbyshire. The IAC Group operates world-wide and is a market leader in the USA and Europe in noise control solutions across a wide variety of industries.

Monitoring noise on the Medway valley line

Residents living close to the rural Medway Valley railway line are reaping the benefit of the latest noise measurement technology. In an ongoing quest to protect local residents and its own workforce from the effects of noise created by its major operations, one of Europe's largest railway contractors has purchased the latest state-of-the-art noise measuring equipment.

The Specialist Services Group of AMEC SPIE Rail has taken delivery of a Casella 480 hand-held noise monitor, which is used on all the sites where the contractors are undertaking majors works, the most recent being the noise-sensitive Medway Valley line.

Teams from the group health and safety unit conduct extensive noise monitoring at the start of a new contract and take daily readings thereafter at all AMEC SPIE projects to assess the environmental impact of the specialist heavy equipment being operated. The results are also used to determine the types of ear defenders and other safety equipment to be worm by the operatives on site. Although the company has always had an environmental department, now that it has its own equipment it can respond to environmental and health-related queries on site that much more quickly.



Half a million DAB radios drive car manufacturers

Figures released by the Digital Radio Development Bureau (DRDB) reveal that a dynamic 229% year-on-year growth in DAB digital radio sales over the past 12 months has pushed the UK market over the half million mark. Driven by consumer enthusiasm for new, digital radio stations, the level of sales has motivated several key car manufacturers to offer DAB as an option in 2004 models.

Vauxhall's New Astra, GM Daewoo's Lacetti and many MG and Rover cars, along with the Lotus Elise 111R and several TVR models all offer DAB as an option to new car buyers. Says DRDB chief executive, Ian Dickens: "With 500,000 DAB radios in UK homes, it is inevitable consumers will want to take that digital listening choice into their cars". This, he predicts, is a first step towards car manufacturers fitting DAB as standard.

After several years of high prices and form factors limited to hi-fi tuners and kitchen radios, DAB is now available across the entire audio range, including boomboxes, pocket radios, clock radios, micro systems, home cinema, and in-car units.

With entry prices starting at around £60 for a radio, Sony and Sharp are two more familiar brand names due to launch DAB products this year, joining the likes of Philips, Samsung, TEAC, Grundig and Hitachi who are already in the market.

Using Claritas in-box questionnaires, the DRDB has gathered information from more than 12,000 owners. Satisfaction levels with sound quality, new station choice, and ease of use have consistently been in the 90th percentile over the past year. Says Ian Dickens: "Consumers like this technology - the wider station choice and ease of use. For manufacturers and retailers it has revitalised the audio market and they are making good margins on radio for the first time in years. Broadcasters like this technology, which enables them to extend their existing radio brands and bring new formats to market." The DAB digital radio, he added, was continuing to move ever closer to mass market.

Royal Festival Hall £90m transformation now underway

The £90 million refurbishment of the Royal Festival Hall and its surroundings has commenced, boosted by a £5 million donation from the Duffield Foundation.
South Bank Board Chairman Lord Hollick marked the start of the renovation work on 20 April 2004 by removing the first piece of the 53-year-old auditorium's boilers. Some £73 million has now been raised towards the £90 million target.
The total cost is made up of £71 million to be spent on refurbishment of the Royal Festival Hall, and £19 million on the new RFH extension building, landscaping and lighting of the surrounding area. With initial work now underway, the extension and a new river frontage will be completed before major refurbishment of the RFH foyers and auditorium begins in July 2005. The hall will re-open to the public in late 2006, and the official reopening of the auditorium will take place in January 2007.
In addition to enhanced public amenities and audience comfort, the £71 million investment programme aims to re-establish the Royal Festival Hall as one of the world's best concert venues, by enhancing its acoustics to meet classical music requirements. Plans also include the creation of a new education centre for school and community groups and upgrading of the stage and technical facilities for performers on the stage and backstage.
During its closure the South Bank Centre - the Queen Elizabeth Hall, Purcell Room and Hayward Gallery - will continue to present a full programme.
Securing the funding reflects the complex negotiations which are an inevitable feature in realising such an ambitious scheme. The project is receiving £25 million from Arts Council England, and £20 million from the Heritage Lottery Fund with an application for a further £5 million under consideration. So far £9 million has been raised from trusts and private donors and from 12,000 members of the audience who together have given more than £1 million. A further £19 million has been raised from the London Development Agency, the Waterloo Project Board, the Cross River Partnership and commercial sources.

Architect's impression of the refurbished RFH

Call for papers

The 11th international meeting on low frequency noise and vibration and its control, organised in association with INCE/Europe and the Journal of Low Frequency Noise, Vibration and Active Control, takes place in Maastricht, Netherlands, between 30 August and 1 September 2004.

The conference topics include:

- ❑ Sources of infrasound, low frequency noise and vibration, detection, measurement and analysis;
- ❑ Propagation of infrasound and low frequency noise in the atmosphere and in buildings;
- ❑ Propagation of vibration in the ground and in structures;
- ❑ Effects on man and animals, hand-arm vibration, whole body vibration, vibroacoustic disease;
- ❑ Perception of low frequency noise and vibration by man and animals;
- ❑ Interaction of low frequency noise and vibration, vibration caused by noise, radiation of noise from vibrating surfaces;
- ❑ Problems and solutions;
- ❑ Control of low frequency noise and vibration by passive and active methods;
- ❑ Technical applications of low frequency noise and vibration by passive and active methods.

The organising committee welcomes contributions on any of the above subjects. Abstracts of about 200 words, with the title of the proposed paper, should be submitted to:
Dr W Tempest, Multiscience Publishing Co Ltd, 5 Wates Way, Brentwood CM15 9TB or via the website at www.lowfrequency2004.org.uk.

Earshot No.5 - the Journal of the UK & Ireland Soundscape

Noise: debates, strategies and methodologies

Within the current milieu of the European Commission's noise mapping directive and the Greater London Authority's Ambient Noise Strategy, contributions are welcomed from practitioners who have been or are currently engaged in soundscape and/or noise studies within the UK and Ireland. Of interest are your objectives, methodologies and findings.
Also of interest is the prevailing culture and health debate surrounding noise abatement, and the addition of noise issues to, for example, the estate agent's and tourist industry's agenda.
As the built environment often defines and/or modulates our sonic environment, how are issues of sound and noise design being addressed in architectural/urban planning practitioner's education?
Not only would the publication like to hear about environmental and urban studies - contributions which have explored alternative approaches, such as community arts, direct action or culture jamming, are also invited. The deadline for submissions is 30 July 2004. Submission guidelines, proposals and correspondence should be e-mailed to j.drever@gold.ac.uk

Oops!

Your acoustic howlers please

Our corresponding magazine, *New Zealand Acoustics* (Volume 17, no.1) includes a page devoted to blunders found in acoustic reports and related documents. With all due acknowledgement to our Antipodean colleagues, here are a few samples. No doubt readers will have come across similar 'foot-in-mouth situations' themselves, and contributions are invited for future publication in *Acoustics Bulletin*!
'Position 1: All activities (except barking)' This was in relation to a sawmill noise problem, but do they really need to repair logs that have been inadvertently debarked?
'Noise is often defined as unwanted sound and hence becomes annoying...' I am unable to improve on Stuart Camp's comment (Editor of NZA) that it is amazing what happens when you define something.
'Evaluation established that the noise had a decay rate of just over 3dB for every 10m of open ground.' No comment.
'Daylight hours are 06:00 to 21:00 Monday to Friday, and darkness hours are 21:00 to 06:00 Monday to Friday.' No wonder the days are so short in the UK: a local council in New Zealand has taken control of the sun!
Finally, a British howler from the GCSE website www.gcse.com/waves/frequency2.htm: *'Historical note: hertz is named after the German physicist, Heinrich Hertz (d. 1967)'* - at the grand old age of 110, apparently!

Simulating the dynamic behaviour of space systems

With LMS Virtual.Lab Motion

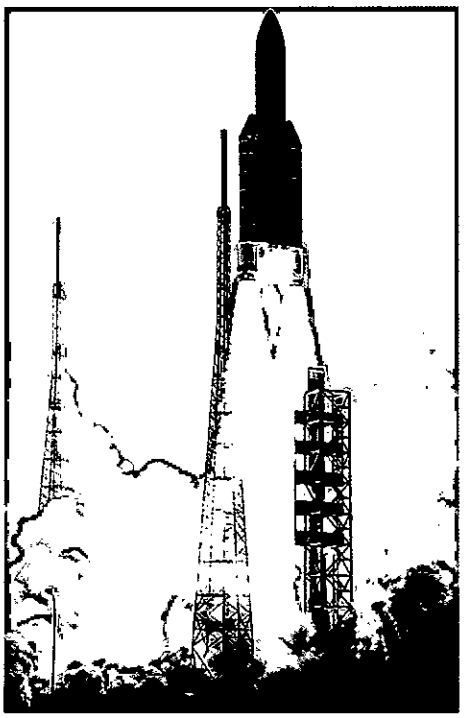
The European Space Agency's (ESA) technical centre ESTEC has selected LMS Virtual.Lab Motion as the preferred solution for dynamic multibody simulation. ESA engineers will use the software to generate virtual prototypes of launcher and satellite assemblies, and to simulate their dynamic performance under real-life loading conditions. The approach helps engineers recognise potential problems quickly, performing fast iterative simulations to assess the behaviour of many alternative design variants. By enabling systematic improvements in performance, safety and reliability, this significantly contributes to the overall quality of ESA space systems.

Wide-ranging space systems

Together with European subcontractors, the Mechanical Division of ESTEC in Noordwijk, Netherlands, participates in the design and development of a wide range of space systems, including launcher, satellite and lander assemblies. ESTEC is the largest entity of the ESA, and pools the scientific and engineering skills of 15 countries for carefully chosen ventures beyond this world.
The centre is also active in the fields of telecommunications, earth observation, global satellite navigation systems, and the development of manned space modules and launcher systems. LMS Virtual.Lab Motion will be used to predict the performance of critical in-orbit sequences, such as the separation of satellites, the deployment of solar arrays and safeguarding payload instrumentation. Other applications cover on-ground launcher and unmanned landing events. During the conceptual design stage, ESA engineers will evaluate various promising design concepts and try out a number of launch or separation scenarios without the need to build physical prototypes. The insights gained from these early simulations help identify candidate designs that are able to meet overall system targets.
LMS DADS, the predecessor of LMS Virtual.Lab Motion, was successfully used in many international space projects. At later stages, during development and qualification, the new product will enable engineers to simulate accurately the operation of different design variants.

Dynamic simulations

These detailed dynamic simulations allow efficient identification of those design aspects that may put the mission at risk, such as release springs with insufficient strength, excessive forces and stresses, residual spacecraft spin, colliding parts, insufficient damper characteristics, etc.



ESA's Ariane 5 launches into space

The resulting in-depth understanding of system performance and sensitivities leads to increased operation reliability and improved ability to withstand any possible combination of potentially disturbing factors.
Further details: Bruno Massa, tel +32 16 384 200 email: bruno.massa@lms.be

Robust Standard Details for acoustic insulation in dwellings

Independent company will approve and manage their use

The much-discussed Robust Details, by means of which house builders may secure compliance with the 2000 Building Regulations Part E in England and Wales, were officially launched on 20 May 2004.

The House Builders' Federation has set up a new independent company, Robust Details Ltd (RDL), which will be the only organisation able to approve and manage the use of robust details as an alternative to pre-completion testing of separating (party) walls and floors.

RDL's role is to:

- Approve new robust details as a method of satisfying Building Regulations;
- Manage the use of robust details in the house building industry by permitting builders or their representatives to use them in new 'attached' homes;
- Monitor the performance of robust details and withdraw any that consistently fail to meet the required standards; and
- Promote the use of robust details and publish information to help the industry improve the sound insulation of separating walls and floors in new homes.

In order to be approved, each robust detail must be capable of consistently exceeding the performance standards laid down in Approved Document E of the Building Regulations. It must be practical to construct on site, and reasonably tolerant of workmanship.

The benefits of robust standards to the industry are clear. Using them avoids the need to carry out pre-completion testing, thus eliminating the risk and uncertainty of remedial action being required on completed floor or wall constructions, with the attendant delays in completion and handover of the property.

Part E robust details solutions are available in a handbook which may be purchased via the web site www.robustdetails.com Trade associations, product manufacturers and other interested parties may submit proposals for new robust details for inclusion in the handbook.

In order to use a robust detail, builders must obtain permission from RDL on payment of a fee (for each home to be built). Provided the solution is correctly implemented, building control bodies will accept a compliance certificate from the builder as evidence of exemption from pre-completion testing.

Further information: Robust Details Ltd, PO Box 7289, Milton Keynes MK14 6ZQ
tel: 0870 240 8210

PEOPLE

Colin Grimwood joins Casella Stanger

After 13 years with the acoustics team of the Building Research Establishment, Colin Grimwood has joined Casella Stanger as a Technical Director, working alongside Stephen Turner, Paul Freeborn and the rest of the 13-strong acoustics team which forms part of the group's multi-disciplinary environmental consultancy.

Colin said he had thoroughly enjoyed his time at BRE and particularly the opportunity to lead and get involved with major noise projects such as the National Noise Incidence Study, the National Noise Attitude Survey and the revision of Approved Document E. He was beginning to think about his future when this opportunity arose. He had a great deal of respect for the Casella team and was looking forward to working with them and helping to develop the business.

Stephen Turner said: "Of course, we are absolutely delighted that Colin is joining us. I have known him for many years and feel that our particular skills and experience compliment one another. Colin is a great addition to the team and will enhance the service we provide to both our public and private sector clients".

Colin, who is based in the company's St Albans office, can be contacted on
tel: 01727 816 715
email: colingrimwood@casellagroup.com

Nightingales can damage your hearing!

Because of the constant roar of city traffic, nightingales are being compelled to sing so loudly that their emissions technically exceed noise action levels and could thus be regarded as a hearing hazard.

The greater the background noise, the louder the male birds are forced to sing, according to a study of nightingales singing next to roads, railways and parkland in Berlin. At the noisiest location close to a dual carriageway road at Potsdamer Chaussee, the birds were producing 93dB in order to be heard above the morning rush hour. If anyone were able to hold an ear close to such a bird at full power, the Second Action Level in the current European workplace noise regulations would be breached.

Henrik Brumm, a behavioural biologist at the Berlin Free University, is reported to have claimed that a nightingale next to the ear for a prolonged length of time would cause severe damage. In Germany, as in many other EU countries, ear protection is obligatory when noise levels exceed 85dB for more than one hour, so working next to a nightingale could conceivably mean that ear protection was mandatory.

The loudest nightingale song was 14dB louder than those in the quieter parts of the city. Ornithologists are said to be quite surprised that the birds have the lung capacity to sing so loudly, although birds are perfectly adapted to singing, rather like opera singers, so it is unlikely that they would suffer sore throats or laryngitis. The nightingale's song is especially important in April and May, when they arrive in Western Europe having over-wintered in Africa, and proceed to seek mates.

The research appears in the May 2004 issue of *Journal of Animal Ecology.*

Disappearing soundmarks CD

Listeners in the UK and Ireland are invited to submit audio recordings of endangered sounds that are special to you, your community or your locality. For example, an endangered sound might be associated with a cultural event or a natural habitat that is declining or under threat.

The recordings should not exceed five minutes and should be submitted on an audio CD. Please ensure that you hold all rights to the material.

Please include your name, the location of the sound, the date and time of the recording and accompanying notes (250 words max.) describing the physical environment, why it is of value to you and what are the reasons for the sound becoming endangered. Please send submissions to: Earshot Submissions, c/o Dr John Levack Drever, Music Department, Goldsmiths College, University of London, New Cross , London, SE14 6NW, by the 30 July 2004 deadline.

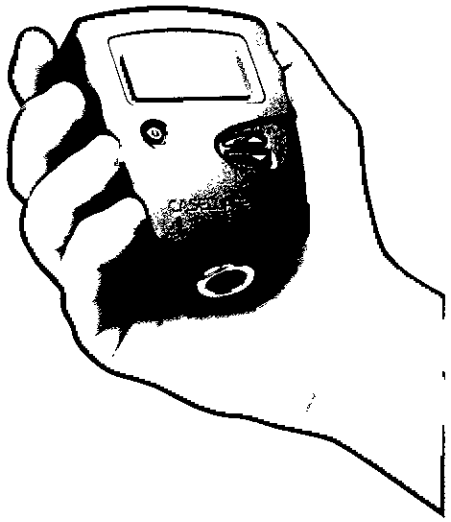
'Light thinks it travels faster than anything, but it is wrong. No matter how fast light travels, it finds the darkness has always got there first, and is waiting for it.'

Casella CEL

Competitively-priced real-time frequency analysis

The 400-series sound monitors are being replaced by **Casella CEL** with new models which the company says offers real time frequency analysis and a new software package at a very competitive price.
Primarily designed for workplace monitoring, the *CEL-450* gives rapid frequency analysis for the selection of the correct hearing protection, while the *490*, with its emphasis on environmental monitoring, measures all necessary statistical parameters, even in frequency analysis modes.
Range adjustments - a common cause of measurement errors - are eliminated as the instruments all have a single measurement range of 140dB.
Both of these logging instruments produce a time history of the noise levels at selectable time intervals (as short as 10ms if required), thus reducing analysis time and cost for environmental health officers, health and safety managers and acoustic consultants. Simple 'point and shoot' operation and an easy-to-use menu structure make learning to operate them straightforward.

CEL-110 calibrator



New model sound monitors

The new software will feature a full graphics package and reporting capabilities, while the robust case will be particularly welcomed by those working in more hostile environments.

Acoustic calibrator complies with latest IEC standard

The company has also launched the first UK-manufactured acoustic calibrator to comply with the new IEC 60942 2003 standard, for use by acoustic consultants, health and safety managers and environmental health officers. The *CEL-110* is the only instrument of its type to incorporate a screen that displays battery levels and warns of incorrect insertion of the microphone.
The compact calibrator, which fits neatly into the palm of the hand, gives a highly stable acoustic performance, easily managing variations in temperature, pressure, and humidity as specified by the new standard. Dual calibration levels of 94 and 114 dB are available on the Class 1 version in order to optimise calibration accuracy in all conditions.
The calibrator fits all industry standard inch and half-inch microphones, and the battery has a typical operating life of three years. PTB approval will also be available on the instrument (PTB is a recognised body whose endorsement is required by purchasers across much of Europe).

Further details contact: Rebecca Williams tel: 01234 844100 fax: 01234 841490
e-mail: rebeccawilliams@casellagroup.com

Autograph Sales

Aviom distribution secured

Professional audio distributor, **Autograph Sales**, has been appointed the exclusive UK distributor for *Aviom*, a range of American manufactured monitoring solutions for stage and studio, including new products the A-16 II personal mixer and AN-16/i-M mic input module.
The original Aviom system offers digital monitoring solutions by transmitting 16 discreet audio channels via a single cable. It is designed to operate with the inexpensive and readily available CAT5 cable. The A-16 II personal mixer can be found in broadcast and recording studios, as well as live venues, where it can be used for foldback monitoring using loudspeakers, headphones or in-ear monitors.
The range has now been complemented with the provision of a true 'digital snake' system. Currently using a 16-channel line input module and 16-channel line output module, the range is due to be extended in the next couple of months by the addition of a 16-channel mic/line input module. As well as providing a substitute for heavy multicore cables, the new system also provides a splitting facility in the digital domain, thus avoiding the need for huge racks of analogue splitters.
The popularity of Aviom was demonstrated when only a few days after taking on the range, the first sale was made to Merseyside Audio Consultants.
Several other systems are already on demonstration with some key customers.
Further details: www.autograph.co.uk

AcSoft

Power packed handheld sound and vibration meter and analyser

Svantek's latest handheld meter, which is now available from **AcSoft**, delivers value-for-money in the cost-effective and capable 94x range.
The new all-digital *947 Type 1* sound level and vibration meter and analyser should find a ready market in general acoustic measurements, environmental noise monitoring, and occupational health and safety monitoring. It enables three acoustic or vibration profiles to be measured in

Svantek 947

parallel, with independently defined filters and *rms* detector. Weighting filters include the latest ISO 2631-1 standard.
The introduction of built-in VDV and MTVV calculations makes human vibration measurement simple and straightforward, and the facility is perfectly timed for introduction of the EC Physical Agents Directive.
As with other 94x series instruments, mix-and-match options include real-time octaves and third octaves, with statistical calculations, as well as FFT analysis and even tonality.
The 947 can be used as a stand-alone meter or as a PC front-end with another new development - USB 1.1 communications - to download stored data or transfer it in real time to a PC, via SvanPC software. Up to 32Mbytes of memory are available for storage of data over a full working day, supported by a built-in rechargeable battery.
Price of the 947 starts at £2400.
Completing the current Svantek line-up is the new *SV30A* sound level calibrator.
Further details: John Shelton, tel: 01296 682686 fax: 01296 682860

DETAILS OF NEW PRODUCT LAUNCHES AND APPLICATIONS SHOULD BE SENT TO THE EDITOR AT:

ian@acia-acoustics.co.uk

IAC

Industrial Acoustics company cuts £0.8m-worth of noise

With anti-noise legislation on the increase, the demand for effective noise control solutions is growing fast, reports **Industrial Acoustics Company (IAC).** So far this year, the company has secured new business worth over £800,000 from five noise management projects in the reciprocating power generation market. They are:

Prague - noise control for four CAT 2500kVA Gensets, which is being provided by IAC *Q-duct* silencers and the *Varitone* lining system;

Scotland - noise from four generator sets at a waste management site is being contained and controlled by acoustic cells constructed using the *Moduline* panel system;

Cambridge - where patients at Addenbrookes Hospital will now be protected from noise transmitted by two 1500kVA stand-by generators in a generator room below a ward through installation of IAC acoustic enclosures and a high-performance *Moduline* acoustic ceiling;

Heathrow vicinity - a data centre is benefiting from full enclosure of two Caterpillar 3516-powered diesel generator sets, each rated at 2000kVA. This was a 'turnkey' project which included the installation of the generator, cooling systems and exhaust pipe runs; and

London - resolution of noise generated by a standby generator being used by the Metropolitan Police in a heavily populated area of the capital, in response to very stringent noise criteria set by the local authority.

Looking ahead Gordon David, the company's business development manager, industrial division, predicts significant growth for the sector in both the UK and mainland Europe. For example, he points to another £3.5m-worth of quotations which IAC has already provided to existing and potential clients. Having expanded its product range over the past 18 months, the company was well placed to capitalise on what could be a burgeoning market, he added.

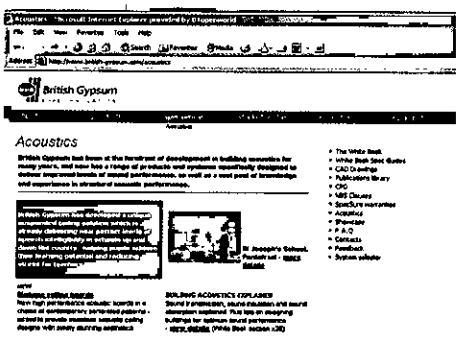
For more information about the range of noise control products visit http://www.iacl.co.uk

British Gypsum

Acoustics on-line

Building designers, acousticians and contractors faced with ever-increasing acoustic standards in today's buildings can now access a special section on the **British Gypsum** website dedicated to the company's acoustic products and systems. The URL www.british-gypsum.com/acoustics will be of interest to everyone, from the house builder looking to meet new acoustic standards in walls and ceilings, to acousticians and specialist contractors involved in specifying for cinemas, leisure centres *etc* where exceptionally high levels of acoustic performance are required.

Amongst key issues explored on the site are the new Part E acoustic standards which affect a range of residential buildings, and the increasingly important subject of speech intelligibility in schools, an area where British Gypsum is a market leader with its patented *IntelG* computer program and the unique *Casoprano* ceiling system. The web site brings together the company's full range of acoustic separating wall and ceiling systems. It includes details of



products such as *Gypframe AcouStud*, which can deliver sound insulation improvements of up to 6dB in wall systems, the new *Gyproc WallBoard TEN* and *SoundCoat* products for domestic separating walls. The company's growing range of specialist acoustic ceiling boards, planks and tiles is also featured.

Details of testing facilities and programmes at the company's acoustic test laboratories are included, along with a selection of projects where British Gypsum's systems and expertise have solved specific acoustic problems.

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There's a New *Breed in Town*

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Created for You

With over 60 years as pioneers within the world of sound and vibration, Brüel & Kjær presents its innovative 4th generation of hand-held instruments for sound and vibration measurement. Development of this latest generation – Type 2250 – was instigated and inspired entirely by the requirements of users participating in in-depth workshops around the world. The hardware has been designed to meet the specific ergonomic requirements of users, and the application software covers everything from environmental noise, troubleshooting, and occupational health, to quality control. The software packages can be licensed separately, so you can get what you need when you need it and won't get left behind if your requirements change. This way, the platform ensures the safety of your investment now and in the future.

For more information go to **www.type2250.com**

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