

THE BULLETIN
OF THE
AUSTRALIAN ACOUSTICAL SOCIETY

Volume 4, Number 4, December 1976

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THE BULLETIN

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AUSTRALIAN ACOUSTICAL SOCIETY

VOLUME 4, NUMBER 4
DECEMBER 1976

EDITORIAL

ACOUSTIC STANDARDS

Editorial comment in the last two issues of the Bulletin has stressed the importance of acoustic standards, and a report from SAA on acoustics work has become a regular feature. Nevertheless, there is one aspect which still seems in need of discussion – that of our liaison with the International Organisation for Standards (ISO).

The author was fortunate recently to work in a number of research institutes in Europe, and to meet some of the people responsible for the ISO acoustic standards. The amount of information in their files (and highly pertinent to current work in Australia) was impressive. This information lies virtually buried. It is, of course, from such working group papers and notes that the ultimate ISO Draft Standards emerge. But the published drafts rarely indicate the detailed reasons behind the decisions which are made, and in any case are available only some time, often years, after the inception of the work.

Liaison between ISO and SAA is well established, of course, and there is a continuing flow of material between the two bodies. The Australian committees draw heavily on ISO drafts and standards as a basic for local work. What is lacking, though, is a knowledge of the progress of development work within the ISO groups at any one time, and prior to publication of draft documents.

One way of providing some immediate contact is by Australian representation on ISO working groups, and this is currently practised in some cases. But the most effective method still remains that of the personal visit.

The author has formally proposed an arrangement whereby regular visits to the appropriate overseas institutes could be made specifically for this purpose. Finance is naturally the greatest obstacle. Perhaps some kind of legally constituted non-profit body could be set up to carry out this work, hopefully funded by donations from the industries concerned. Meanwhile, it is urged that anyone on an overseas trip should try to spare time for the purpose. Prior reference to SAA would assist in choosing the appropriate subject and the most rewarding contacts to pursue.

JOHN IRVINE
Editorial Subcommittee

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OF THE AUSTRALIAN ACOUSTICAL SOCIETY

The Society values greatly the support given by the Sustaining Members listed below and invites enquiries regarding Sustaining Membership from other individuals or corporations who are interested in the welfare of the Society. Any person or corporation contributing \$160.00 or more annually may be elected a Sustaining Member of the Society. Enquiries regarding membership may be made to The Secretary, Australian Acoustical Society, Science House, 157 Gloucester Street, Sydney, NSW, 2000.

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FROM THE PRESIDENT

I think that we can all reflect with satisfaction on the beginnings of the Society, and look forward with confidence to its growth. However, in order that we look forward not only with confidence but also with clear purpose, we should occasionally remind ourselves of our given goal.

The Memorandum of Association states that the Society is "to promote and advance the science and practice of acoustics in all its branches and to facilitate the exchange of information and ideas in relation thereto." A little reflection will indicate the range of the responsibilities that result from this admirable goal. The branches of acoustical science are numerous and more are emerging. We already have members working in a number of these, and will have members working in more in due course. Again, the branches of practice are several at least, and we have members working in each. Furthermore, the work is carried out within a variety of public agencies, semi-public institutions and private firms. Consequently, we can assume a considerable range of interests and attitudes, all of which must be encompassed, if the Society is to fulfil its role.

It is to the credit of the foundation members that they were not daunted by the range of responsibilities implied by their concept of a proper goal. And it will be to our discredit if we fail to ensure that the Society avoids the under and over actions that would reduce its effectiveness in moving towards that goal. To assist in this matter, the Society should, before its business expands much further, give serious consideration to a comprehensive system of national committees that, in conjunction with state committees, could advise the Council on all of the interest areas. I look forward to your consideration of this development.



(Carolyn Mather)
PRESIDENT

NEWS & NOTES

INAUGURAL MEETING – SA DIVISION

R. F. Tonin

The South Australia Division of the Australian Acoustical Society is pleased to announce its successful inaugural meeting on the 20th of September 1976 following a very promising trial period during the first half of the year. The venue, held at the Australian Broadcasting Commission theatre in Collinswood, Adelaide, was initially chaired by Mr. R. W. Boyce who welcomed the A.A.S. President Dr. Carolyn Mather and the General Secretary Mr. W. A. Davern.

First on the agenda was the election of a committee of ten and the appointment of officers by the committee. The following nominated persons were elected unopposed:

R. B. King	Chairman
R. W. Boyce	Vice Chairman
D. H. Woolford	Secretary
K. J. Martin	Treasurer & Registrar
J. D. Kendrick	Member
Prof. R. E. Luxton	Member
M.A.G. Price	Member
R. G. Stafford	Member
R. Tonin	Student
R. P. Williamson	Member

Mr Bruce King announced the result of the appointments and then introduced the Adelaide String Quartet which presented three fine movements from Eine Kleine Nacht Musik (Mozart), Gemachoich (Webern), Theme and Variations and Finale from "Death and the Maiden" (Schubert). Mr King complimented the Quartette on a magnificent performance and choice of programme. He remarked that this kind of entertainment was most appropriate for a gathering of acousticians, many of whom are involved in the creation of suitable venues for making listening to and recording music.

Mr King subsequently introduced Dr. Carolyn Mather who addressed the meeting on the legislation for community noise both in Australia and overseas in the light of her recent experience in the United States of America, England and Europe.

ERRATUM – VOL. 4, NO. 3, SEPT. 76

Please note that the word 'employer' (page 3, para 3, 3rd line) in the Guest Editorial in the September issue of The Bulletin should read 'employee'. The sentence then reads as follows:

'If granted an exemption, as part of the alternative hearing protection programme, the employer will be required to supply hearing protective devices suitable for the particular circumstances and the employee will be required to use that device.'

The success of the meeting may be gauged by a most responsive attendance (51 persons) which showed its appreciation to the retiring Ad Hoc Committee whose excellent foundation work made the evening a success and in particular instilled life into the South Australian Division of the Australian Acoustical Society; Messrs. R. W. Boyce, J. D. Kendrick, R. B. King, Prof. R. E. Luxton, M.A.G. Price, Dr. R. N. Reilly, R. G. Stafford, S. D. Swanson, R. P. Williamson and D. H. Woolford (Secretary & Treasurer).

IREE AUDIO GROUP

One of the success stories of the Institution of Radio and Electronics Engineers, NSW Division, was the creation of the special interest audio group in late 1972. Since then it has organised a continuing and well supported lecture program, approximately one per month, covering a range of subjects of interest to audio engineers and enthusiasts.

The Group was formed to promote and serve the special interests of both IREE members and others in the areas of audio-frequency engineering and technology. Membership is open to any person with a particular interest in audio, and at a special rate to members of the IREE and students.

The principal activity of the Audio Group is its lecture/meeting program. Generally the Group meets 10-12 times a year, on week day evenings from February to November. Both the day of the week (usually Tuesday or Wednesday) and the location, (usually Macquarie, N.S.W. or Sydney University) are rotated for the convenience of members.

Regular meetings include not only lectures and/or demonstrations on traditional audio topics (amplifiers, loudspeakers, tapes, etc.) but also technical tours and visits. A special effort is made to arrange lectures from visiting overseas experts. Meetings are frequently held in co-operation with other groups and organizations having a common interest, e.g., IREE Sydney Division, Australian Acoustical Society, Music Broadcasting Society.

The Audio Group supports professional activities in the audio field and is represented on subcommittees of the Standards Association of Australia which are currently active in establishing measurement standards and minimum performance standards for high fidelity reproducing systems.

The Audio Group is administered (under a set of Rules approved by IREE Council) by a voluntary committee which is elected annually.

Annual subscriptions to the Audio Group (paid directly to IREE) are currently \$10 per year. Financial members of IREE (any grade) and bona fide students, may join at a special rate of \$3 per year.

Applications for membership in the Audio Group may be obtained at Audio Group meetings, or from the Honorary Secretary of the Audio Group. Completed application forms should be forwarded to the Honorary Secretary: P. Garde, Hon. Secretary, School of Electrical Engineering, The University of New South Wales, P.O. Box 1, Kensington, N.S.W. 2033. Telephone: 662 2829;

THERMAL INSULATION INSTITUTE OF AUSTRALIA

During the latter part of 1974 members of the thermal insulation industry and representatives of the Australian Department of Housing and Construction exchanged views on the merit of promoting the concept of thermal insulation to ensure that the community would benefit by the intelligent use of thermal insulation products. As a result, two informal exploratory meetings were held in Melbourne on 10 February and 3 March 1975 on the topic of thermal insulation. Participants at these meetings represented a wide section of the insulation industry, the Government sector and research institutions. The objectives of these meetings was to find a common ground, and to propagate the establishment of a representative body which could foster wider and better understanding of the use and application of thermal insulation. It was felt that in this way the whole of the thermal insulation industry as well as consumers should benefit, quite apart from the contribution to reducing energy usage for space heating and cooling and improving conditions within a building.

The Institute was established at an inaugural meeting in Melbourne on 10th April 1975. Since then the activities have been mainly confined to Melbourne with papers being presented and a journal published on a quarterly basis.

Several technical meetings have been held in Sydney and it is now proposed to organise activities in N.S.W. in a similar manner to that which has proved successful in Victoria.

The objectives of the Institute are summarised as follows:-

1. To promote the correct use of thermal insulation.
2. To initiate, co-ordinate or co-operate in research into all aspects of thermal insulation.
3. To examine thermal insulation as a means of improving comfort based on user characteristics, performance standards and advisory documents dealing with thermal insulation, design, materials and insulation.
5. To act as a focal point on matters of thermal insulation and foster the involvement of all sectors, groups and individuals with an interest in thermal insulation.
6. To encourage close working relationships within the insulation industry and between the industry, the government authorities and the community at large.

The Council of the Institute is widely representative of organisations and individuals who are concerned to achieve the above objectives including the C.S.I.R.O., Department of Environment, Housing and Community Development, Department of Architecture & Building, Melbourne University, both bulk and reflective insulation manufacturers, installation contractors and the glass manufacturing industry.

There are three classes of membership; Corporate, Associate and Ordinary, subscriptions being \$400, \$40 and \$8 respectively. In addition there is the facility to have the Journals sent post free on the payment of an annual fee of \$6.

A lecture entitled 'The Installation of Bulk Insulation in Dwellings' will be presented at 6.00 pm on 22nd March, 1977, at the Auburn Businessmen's Club, Auburn, N.S.W. The lecture will be presented by an installation contractor, with slide illustrations, and we anticipate should provide useful information on present practices which should be particularly helpful to architects and specifiers of insulation. Further information and booking details are available from Mr. Richard Stimming, (02) 517359.

RECENT PUBLICATIONS

ARCHIVES of ACOUSTICS published by the Polish Academy of Science is the English version of the quarterly ARCHIWUM AKUSTYKI which has been published in Polish since 1966. Volume 1, Number 1, 1976 has been received by the Australian Acoustical Society and will be kept in our library for the reference of the members.

This first English version contains a note from the EDITOR which includes the following comments:-

"The new English edition of the Acoustical periodical follows from the universal tendency towards the development of acoustics which is a wide and complex discipline, comprising different branches of knowledge. Both the increase of acoustical societies and organizations in the world and the increasing number of general or specialized conferences, as well as the increasing number of their participants confirm this intensive development. As a result, the amount of material for print is growing; it is hoped that the publication of the papers of foreign authors in ARCHIVES of ACOUSTICS will help to meet the growing demand for print."

"In presenting the first issue of ARCHIVES of ACOUSTICS the Editor hopes that this issue and future ones will evoke the readers' interest and will stimulate the co-operation of Polish and foreign acousticians. Contributions both from Poland and abroad are welcome."

The contents for Vol. 1, No. 1 are as follows:-

C. Cempel, U. Kosiel, Noise source identification in machines and mechanical devices.

R. Makarewicz, The equation of acoustic rays in an inhomogeneous moving medium.

A. Opilski, On the possibility of an investigation of semi-conductor surface properties using ultrasonic surface waves.

Z. Cerowski, A. Opilski, T. Pustelny, M. Urbanczyk, On an approximate method for calculating filters based on acoustic surface waves.

Z. Kleszczewski, Thermal relaxation processes in some organic liquids.

R. C. Chivers, Ultrasonic holography in ophthalmology - physical considerations.

B. Zaplor, A. Juszkiewicz, A. Grzegorzczak, Measurements of ultrasonic velocity in the molten salt mixture $CdCl_2 - NaCl$.

Technical Reports

A. Jarozewski, A. Rakowski, Analogue modulator for psychoacoustical pulse measurements.

NSW DIVISION TECHNICAL MEETINGS

SIMPLE METHODS FOR SELECTING HEARING PROTECTORS

The speaker will be Mr. Richard Waugh, who is employed at the National Acoustics Laboratory. His presentation will be based on extensive investigations into the development of a single number rating system for hearing protectors.

The technical meeting commences at 8.00 pm on Tuesday, 22nd March 1977, and will be preceded by dinner at 6.30 pm. The venue for the dinner and meeting is The Crows Nest Club, Hayberry Street, Crows Nest. Further details are available from Phil Williams on (02) 239 4066 (messages 239 4054)

SEA NOISE AND UNDERWATER ACOUSTICS

Mr. Doug Cato will present a talk and demonstrations on the above subject on Tuesday, 19th April, 1977. The technical session will be held at the Senior Common Room Club, Electrical Engineering Building, University of NSW, and will commence at 8.00 pm. The talk will be preceded by dinner at 6.30 pm. Mr. Cato is well remembered for his interesting session at the 1974 Seminar "Current Acoustics", where he discussed a theoretical model for the noise emission from high speed trains.

At the coming meeting in April, Mr Cato will present edited tapes of recorded sea noise and discuss some of his recent work at the Royal Australian Naval Research Laboratories. Further details are available from Phil Williams on (02) 239 4066 (messages 239 4054).

ACOUSTIC EMISSION

R. W. Nichols

Acoustic emission is a new technology which is beginning to be seen as more reliable and economic than testing methods presently used for inspecting pressure vessels. This small book collects six papers given at an International Institute of Welding Colloquium in 1975. The authors discuss their experiences with the technique both in testing welded structures, and in monitoring structures known to be flawed. The information in this book will not give you sufficient details to set up appropriate equipment, nevertheless it does provide a good introduction to the topic.

Applied Science Pubs. (22 Rippled Commercial Estate, Barking, Essex), 1976 121pp. £8.00

Reprinted from Engineers Australia, March 11, 1977.

CHANGE OF ADDRESS FOR AAS

The official mailing address for the Australian Acoustical Society has recently been changed to the following:

**Australian Acoustical Society
The Science Centre
35 Clarence Street
SYDNEY, NSW, 2000**

The previous address was Science House, 157 Gloucester Street, Sydney, NSW, 2000

CONFERENCE & SYMPOSIUM ANNOUNCEMENTS

1977 AAS CONFERENCE

The Australian Acoustical Society, in co-operation with the Mechanical Branch of the Western Australian Division of the Institute of Engineers, Australia, will hold a two-day conference in Perth, W.A., on August 29 and 30, 1977. A general call for papers will not be made, but it is intended to arrange poster displays of case studies of specific noise or vibration problems. It is hoped that these poster displays will originate primarily in industry and consist simply of a statement of the problem together with initial measurements defining the problem, the solution tried and a statement of the result together with final measurements. Unsuccessful attempts at solutions will be just as welcome as successful attempts. The Conference publication in the form of pre-prints will contain only a brief summary of these poster contributions. Anyone inter-

ested in contributing to this poster display of case studies should contact the W.A. Divisional Secretary, Graeme Yates, Department of Physiology, University of W.A., Nedlands, W.A., 6009.

FIRST AUTUMN SCHOOL IN AUDIOLOGY

JANET CLARKE HALL, MELBOURNE 23-27 MAY 1977

The initial circular outlining a proposal for a five day School was distributed during November 1975. The response to this circular from audiologists and otologists encouraged the organisers to proceed with the planning for the School. Professor Ole Bentzen, Head of the State Hearing Centre, Aarhus, Denmark and Professor James Jerger, Head of the Division of Audiology and Speech Pathology at Baylor College of Medicine Houston, Texas, have both confirmed

that they would be pleased to contribute to the School. Their major contributions to the School will be complemented by presentations by members of the Department of Otolaryngology and the National Acoustics Laboratories.

The Programme for the School now provisionally includes half day sessions on:

IMPEDANCE AUDIOMETRY
PREVENTION OF DEAFNESS
INDUSTRIAL DEAFNESS
CENTRAL AUDITORY DISORDERS
AUDIOLOGICAL SERVICES
HEARING AIDS

Additional half day sessions have been set aside for demonstration sessions at the Royal Victorian Eye and Ear Hospital and other venues.

The fee for the School is expected to be \$300.00 exclusive of accommodation but this cannot be confirmed until the final brochure containing full details of the programme is published.

Prospective participants would assist the organisers by contacting the Office for Continuing Education, University of Melbourne, Parkville, Victoria 3052 (telephone 341 7081, 341 6827).

NEW ZEALAND CONFERENCE

The Fourth Acoustical Conference in New Zealand will be held under the auspices of the New Zealand Acoustical Society on March 25 and 26, 1977, at the Central Institute of Technology, Heretaunga, Upper Hutt, New Zealand.

The theme for the conference is 'Acoustic Research for Industry', and twelve papers will be presented over a two day period.

Further information may be obtained from:

R. Satary
P.O. Box 44006
Lower Hutt
New Zealand

F.A.S.E. SYMPOSIUM ON "EUROPEAN NOISE LEGISLATION"

The Institute of Acoustics is to host the 2nd Symposium of the Federation of Acoustical Societies of Europe in London from 14th - 17th November 1977. The Symposium is organised in conjunction with the British Society of Audiology and the U.K. Department of the Environment.

Twelve eminent invited speakers from Europe are being approached to speak on Criteria, Standards and Laws.

Enquiries for attendance, submission of papers and exhibition space should be made in writing to the Conference Secretary, Owles Hall, Buntingford, Herts, UK.

F.A.S.E. 78 CONGRESS, WARSZAWA, POLAND SEPTEMBER 18 - 22nd

The programme will cover:

1. Acoustic waves and the structure of matter.
2. Ultrasonic methods of location and recognition.
3. Objective and subjective evaluation of sound in a limited space.

If you wish to be kept informed about the F.A.S.E. 78 Congress send your name, Institute or Company, address and section(s) (1, 2 and 3 above) of the programme you are interested in to:
F.A.S.E. 78 Organizing Committee
IPPT-PAN, C/- Swietokrzyska 21
00-049 WARSZAWA, POLAND

INTERNATIONAL ACOUSTICS EVENTS

The following information on conferences and symposia have been supplied by:

International Commission on Acoustics (ICA)
Information Service
c/o Acoustical Commission of the Czechoslovak
Academy of Sciences
Provaznicka 8, 110 00 Prague 1

1977

Austria:

July 18-23, 1977, Ossiach

"Second Workshop on Physical and Neuropsychological Foundations of Music"

organized as part of the Carinthian Summer Festival 1977 in co-operation with Austrian Broadcasting Org. and University of Denver, Colorado, USA.

Subjects:

1. Acoustical Features of Musical Instruments relevant to Musical Tone Quality
2. Psychomotor control of Music Performance
3. Neuropsychological Aspects of Musicality

Write to:

Prof. Juan G. Roederer,
Dept. of Physics and Astronomy,
University of Denver,
Denver, Colorado, 80210

France:

a) July 11-13, 1977, Paris, Centre Georges Pompidou
"Symposium International sur la psychoacoustique musicale"

organise par l'Institut de Recherche et Coordination Acoustique-Musique (IRCAM) en association avec le Groupement des Acousticiens de Langue Francaise (GALF)

Details from:

IRCAM (Relations Exterieures)
31 rue Saint-Merri, 75004 Paris (France)

b) September 5-10, 1977, Paris

"International Conference on Lattice Dynamics" – various aspects of phonons and lattice dynamics.

Information from:

Prof. R. M. Pick,
Dept. de Recherches Physiques
Escalier 22, 4 Place Jussieu
75230 Paris, Cedex 05

Czechoslovakia:

October 1977, High Tatra Mountains

"16th Acoustical Conference on Noise and Environment" held by the Acoustical Commission of the Czechoslovak Academy of Sciences

Secretariat:

House of Technique,
Kocelova 17, 88130 Bratislava

Denmark

August 15-18, 1977, Bella Center Copenhagen

"17th International Congress of Logopedics Phoniatrics"

Contact:

IALP Congress, Copenhagen Congress Center,
Belle Center A/S
Center Blvd. DK-2300 Copenhagen S

Great Britain

a) June 29-July 1, 1977, Imperial College

"Ultrasonics International 1977" – conference and exhibition –

Details from:

Dr. Z. Novak
Ultrasonics, IPC House
32 High Street
Builford Surrey GU1 3EW

b) September 12-23, 1977, Southampton

"Diagnostics and Data Analysis Symposium"
Institute of Sound and Vibration Research University of Southampton, Southampton SO9 5NH
Organiser: Dr. A. Hughes

c) November 14-17, 1977, London

"2nd Symposium of FASE on European Noise Legislation"

Main headings of the programme:

Criteria (derivation, surveys, L1, etc.)

Instrumentation (performance, accuracy, simplicity, costs, etc.)

Standards (review of national and intern. legislation, Social cost benefit, etc.)

Laws (types of laws, EEC, UK, inspectorates, codes of practice, policing, enforcement, implementation, psychology.)

Organised by the Institute of Acoustics in collaboration with the British Soc. of Audiology and the Dept. of Environment.

Details from: Institute of Acoustics

Secretary: P.G.C. Mylne
47 Belgrave Square
London SW1X 8QX

Japan:

October (date fixed later) 1977, University of Shizuoka

"Meeting of the Acoustical Society of Japan"

– all branches of acoustics –

On both, details from:

Acoustical Society of Japan
Ikeda Building,
7 Yoyogi 2-chome,
Shibuya-ku, Tokyo

Switzerland:

June 14-18, 1977, Basel

"7 Internationale Fachmesse für Umweltschutz Pro Aqua – Pro Vita 77"

–Wasser, Abwasser, Abfall, Luft, Lärm –

Sekretariat Pro Aqua – Pro Vita 77

c/o Schweizer Mustermesse

Postfach
Ch-4021 Basel

U.S.A.:

a) May 9-11, 1977, Sheraton Hotel Hartford, Conn.

"IEEE – International Conference on Acoustics, Speech and Signal Processing"

– also underwater acoustics, electro-acoustics and noise measurement –

General Chairman:

Harvey Silverman
IBM-T, J. Watson Research Center
POB 218
Yorktown Heights, N.Y. 10598

b) June 7-10, 1977, State College Pennsylv.

"Meeting of the Acoustical Society of America"

–all branches of acoustics–

Chairman: John C. Johnson

Pennsylvania State University
PA 16802

c) December 13-16, 1977, Miami Beach, Flor.

"Meeting of the Acoustical Society of America"

–all branches of acoustics–

Chairman: John G. Clark

Institute of Acoustical Res.
615 SW Second Avenue
Miami, FL 33130

Yugoslavia:

June 6-9, 1977, Banja Luka

"XXI ETAN Conference"

–all branches of Acoustics–

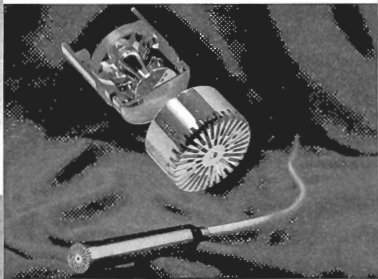
Information from:

Acoustical Society of Yugoslavia
Secretary Dr. P. Pravica
c/o Elektrotechnical Faculty
Bul. revolucije 73
11000 Beograd

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LETTERS

MYTHS IN ACOUSTICS

Dear Sirs,

Occasionally we hear, read about or see an unusual method of controlling a noise problem. Many, if not most of these methods fail to do the job desired of them and sometimes, for vague or obscure reasons, success is claimed.

I am interested in obtaining information relating to the unusual, unscientific and erroneous methods, materials and ideas used in the reduction and or control of noise.

It is proposed to offer such acoustical remedies and antidotes to the Editor of the A.A.S. Bulletin for subsequent publication in a section perhaps called Smith's Myths. Due acknowledgement will be given to those accepted for publication.

For a start; we have been advised by 'those who know' that, fan and blower noise emanates from the discharge end considerably louder than (if not totally) from the inlet end. "After all, the air is going in that way so how can the noise come out?" The specification will be written to indicate that, silencing may only be required on the discharge side of fans and need not be considered for the inlet side.

I will be grateful to those readers who respond to the request for this information via the Editors of The Bulletin or the address below.

Yours faithfully
Caleb Smith

34 Northcott Street,
Wentworthville, NSW 2145

PROPERTIES OF GRANULAR MATERIALS

Dear Sirs:

In the September '76 edition of the Society's Bulletin there appeared an article on the investigation of acoustic properties of granular materials.

The authors of this article said that the main objective of the study was to allow the effective use of these materials. They said "the property data of such materials would enable the designer and architect to suggest suitable applications".

In describing the test method, the authors stated:—"The standing wave tube was tilted to hold the samples in the tube as no bonding or adhesive was used".

If these materials are to be used as sound absorbers in an unbonded state they could only be placed on floors or on the ground. To be used on walls and ceilings they would have to be mixed with some bonding agent, such as cement or plaster, in which case the information presented in the article would be of no use. When materials such as those

tested are laid on floors or on the ground they would not be used in 'high traffic areas and could only be used in relatively small areas or in "land-scaping patches"'. In view of this, there does not appear to be much point in the study other than academic enquiry.

The information presented in figures 2 and 4 gives the impedance and the absorption coefficient respectively. However no indication of the thickness of the material yielding these results is indicated.

It would be interesting to know what motivated the study and why it did not include the performance of such granular materials in a "bonded" state. I would also ask the author to provide the material thicknesses that correlate with the results shown in figures 2 and 4.

Yours faithfully

John B. Lyon
(22nd December, 1976)

GRANULAR MATERIALS — AUTHOR'S REPLY

Dear Sir,

In the absence of Raj Singh, the major author of the paper referred to by John Lyon, I would like to make a short reply.

Firstly I would like to say how gratified I am that someone has read the paper in sufficient detail to make the critical comments that John has made. It often worries me that academics keep churning out papers and get little comment on them, which they usually interpret as acceptance. To me a critical examination of other people's work is usually as important and often far more important (see for example "Are Researchers Trustworthy" New Scientist 2nd September 1976 pp 481-483) than the original work.

The work presented in the paper, "Experimental Investigation of the Acoustic Properties of Granular Materials" was exploratory. (Originally it was thought that the absorption of granular materials would be easier to treat theoretically than fibre materials. Subsequently the theory turned out to be too difficult for us to handle, in the time available, and so our objectives had to be changed a bit.) As such the convenience of using unbonded materials in a tilted impedance tube far outweighed the more practical consideration of how to use such a material unless it was bonded, or faced with a retaining material of some sort.

I think the results show that granular materials have some merit insoundcontrol. If John Lyon would like to use his influence and get us some research funds I would be happy to have a go at turning our "academic" results into a viable product.

Finally, two important pieces of information were omitted from Figs 2 and 4, as John has pointed out. The thickness of the samples in Fig 2 was 1". The thickness of the samples in Fig 4 was 2.5".

Yours faithfully
Fergus Fricke
14th January, 1977

TECHNICAL NOTES

MEASUREMENT OF FAN SOUND POWER IN A DUCT

John A. Moffatt and Jim Watson

The following technical note is a resume of an address to members of the Victorian Division by Professor Malcolm Crocker of Purdue University on 18th June, 1976.

The sound power output of a fan is a quantity that is of interest to designers of systems which include fans. Unfortunately we cannot measure sound power directly, but we can measure sound pressure, and from that and a knowledge of the acoustic environment of the fan we can deduce the sound power. There are, however, several problems which confront us. Fans move air, usually with considerable turbulence, but we want to measure only the pressure fluctuations which constitute the noise, not the pressure fluctuations associated with the turbulence the noise generated by air flow over the measuring microphone. Other problems are due to the fact that above a certain critical frequency of sound, related to the duct size, there are a number of modes of sound propagation down the duct, including cross modes, and these give rise to a non-uniform distribution of sound pressure across the duct. Furthermore, at the end of the duct, if it is of finite length, reflections may occur and the reflected sound will affect the net sound pressure in the duct.

The problem of end reflection is usually overcome by the use of an anechoic termination, of a type which allows the passage of air. Prof. Crocker described a form used at Purdue, wherein a conical shaped plug of sound absorbing material acts as an anechoic wedge and is also used to apply air loading to the fan.

Flow noise generation at the microphone can be significantly reduced by the use of a suitable streamlined windscreen and the Bruel and Kjaer "Nose-cone" is quite effective for this. However nose-cones or wind-screens are not very effective in reducing the pressure fluctuations due to air turbulence. In regions of high turbulence, such as immediately following a fan discharge, these pressure fluctuations may be larger than the sound pressure fluctuations, and may lead to an over-estimation of the fan sound power.

Like most workers in this field Prof. Crocker and his associates investigated the concept of a sampling tube in front of the microphone. Unlike most workers in this field they successfully developed this concept, and the Bruel and Kjaer "Turbulence Screen" resulted from their work and that of another team in Germany. Essentially the microphone is fitted with a long tube which has, on one side, a long slit or series of holes covered with an acoustically resistive material. Its principal disadvantage (perhaps its only one) is its long length. Its claimed "turbulence rejection" is quite impressive.

The problem of cross-modes was tackled at Purdue by a composite programme of experimentation and calculation in the process of which the proportion of energy contained in each mode was determined. The end result was a relative-

ly simple set of measuring points whose average sound pressure enables the 'true' sound power of the fan to be determined fairly accurately. It was noted that these points differed from those proposed by B. S. 848.

Prof. Crocker explained that the method of in-duct power determination developed at Purdue forms the basis for a new ASHRAE standard (now in draft) which differs in many respects from existing standards such as the AMCA standard and the British Standard.

Unfortunately time did not allow the development of the subject in more detail under the questioning of our local experts on aerodynamic noise.

ADAPTATION TO NOISE

Ron Yuen & Fergus Fricke
University of Sydney

We recently undertook a literature search on adaptation to noise and were unable to find any information on how long people take to adapt to a changed acoustical environment in a domestic situation, e.g. a change of place of residence or the introduction of a new noise source to a neighbourhood. Such information is important in a number of situations, one of which is the investigation of noise complaints and another being the peace of mind of residents.

In an attempt to provide some information on adaptation to a changed acoustical environment (information which everyone knows and no-one has quantified) a social survey was undertaken. The survey was limited to people living in rented accommodation in Johnson Street, Annandale. Amongst the questions asked were:-

- (i) "How much are you annoyed by noise during the day (7 a.m. - 5 p.m.)?"
A choice of answer on a 10 point scale from "Not at all" to "Extremely" was required.
- (ii) "How much are you annoyed by noise during the evening (5 p.m. - 10 p.m.)?"
Also a 10 point scale.
- (iii) "How often are you awoken, at night, by noise?"
A choice of answer on a five point scale from, "Not at all", to "Always" was required.
- (iv) "Is your present or previous dwelling noisier?"

The response of each interview was classified according to the period of residence; less than one month, 1 to 3 months, 3 to 6 months, 6 to 12 months and more than one year. It was assumed that the response of residents who had lived in an apartment for longer than one year was the "standard" response. The responses of residents, in other occupational periods, were compared with this standard response.

A modified Chi-squared test was used because of the unequal sample sized. It was possible to do Chi-squared analysis on the "evening annoyance" and "sleep" answers but it was not possible for "day annoyance" because of the

small number of residents at home during the day.

People who had lived less than one month in an apartment had a markedly different response to those who had lived in an apartment for more than one year [$\Pr(\chi^2 > 22.9 | \nu = 7) < .005$]. Residents who had lived in the same apartment from 1 to 3 months, 3 to 6 months and 6 to 12 months showed no significant difference, in their reaction to noise, from those living in the same apartment for more than one year [$\Pr(\chi^2 > 7.2 | \nu = 7) \approx 0.4$, $\Pr(\chi^2 > 9.2 | \nu = 7) \approx 0.25$, and $\Pr(\chi^2 > 3.24 | \nu = 7) \approx 0.85$, respectively].

Disturbance to sleep was not significantly different in any of the populations though the group that had lived in an apartment for less than one month showed the greatest difference.

The probabilities were as follows:—

Up to one months residence	$\Pr(\chi^2 > 5.6 \nu = 3) \approx 0.15$
1 to 3 months residence	$\Pr(\chi^2 > 1.8 \nu = 3) \approx 0.6$
3 to 6 months residence	$\Pr(\chi^2 > 3.6 \nu = 3) \approx 0.35$
6 to 12 months residence	$\Pr(\chi^2 > 1.8 \nu = 3) \approx 0.6$

This analysis of disturbance to sleep does not mean there is not adaptation to noise, although this is one possible explanation. Another possible explanation is that the conditions in Johnson Street are sufficiently quiet at night, not to disturb most inhabitants, whatever their length of residence.

Very little can be said about the answers to the question, "Is your present or previous dwelling noisier", other than to give the answers:—

	Previous Noisier	Present Noisier
Up to one months residence	4	7
1 to 3 months residence	3	6
3 to 6 months residence	6	2
6 to 12 months residence	5	4
More than one year's residence	15	8

These figures would support a thesis that people either tend to adapt to noise or move out of a noisy area. When asked whether noise was a criterion used on the selection of an apartment only 10% of interviewees said it was, which suggests that few people move out of an area because of noise.

The total sample was small (60 people) and the population biased. From the results however we can reasonably say that adaptation to noise by residents living in rented accommodation in Annandale is highly likely to occur in the first month of occupancy. (You may generalize to other areas at your own risk). Any person still concerned about noise, after three months, would be well advised to move. On the other hand, any organization investigating noise complaints would be well advised not to act too hastily.

STANDARDS REPORT

STANDARDS ASSOCIATION OF AUSTRALIA

R. Nagarajan
Engineer Secretary
Standards Association of Australia

The Association's work on acoustic standards met during October under the chairmanship of Dr. R. G. Barden. Note was taken of the increased activities of ISO Technical Committee 43 and IEC Technical Committee 29 and of the need for more effective participation in their work. Note was also taken of the needs for standards by the various environmental control organisations in different states for their regulations in the area of acoustics.

The following new standards on acoustics were published during the last quarter:

AS

1191—1976 Method for laboratory measurement of airborne sound transmission loss of building partitions \$2.40

Covers the measurement of the airborne sound transmission loss of building partitions such as walls, floor/ceiling assemblies, doors, windows and other space-dividing elements. It provides a means of evaluation of the sound-insulating performance of an isolated partition element in a laboratory. The sound transmission loss is defined in terms of a diffusely incident sound field; such a field is intrinsic to the test procedure. (ISBN 0 7262 0919 8)

This standard was issued for public review as Doc. 979 and was to have been AS Z32.

1269—1976 Code of practice for hearing conservation
(Known as the SAA Hearing Conservation Code) \$3.60

Sets out a recommended practice for establishing a hearing conservation program to protect persons who are occupationally exposed to noise. It does not specify limits for exposure. Is in five parts, covering responsibility for implementation of the program, noise measurements, evaluation of noise, engineering techniques of noise control, and hearing protection program, and includes appendices on incidence of hearing impairment in workers exposed to noise, and on methods of calculating the noise reduction provided by hearing protection devices.

(ISBN 0 7262 1075 7)

This standard was issued for public review as DR 72084.

1935—1976 Method for measurement of normal incidence sound absorption coefficient and specific normal acoustic impedance of acoustic materials by the tube method \$2.40

Provides an economical method for rapid and absolute measurement of the normal incidence sound absorption coefficient and the specific normal acoustic impedance of a sound absorbing system, e.g. a material with a rigid backing or with air space and rigid plate backing.

(ISBN 0 7262 1026 9)

This standard was issued for public review as DR 75060.

1948—1976 Method for measurement of airborne noise on board vessels \$1.60

Specifies simplified engineering methods and conditions for obtaining objective measurements of noise level and noise spectrum on board a vessel where the source of the noise is on or in the vessel. It does not deal with vibration or with criteria of acceptability but includes measurement of vibration-induced noise (ISBN 0 7262 1065 X) *This standard was issued for public review as DR 74073*

1949—1976 Method for measurement of airborne noise emitted by vessels on waterways and in ports and harbours \$1.60

Specifies simplified engineering methods and conditions for obtaining measurements of the noise levels and noise spectrum emitted by vessels of all kinds on waterways and in ports and harbours. It does not deal with vibration or with criteria of acceptability, but includes measurement of vibration-induced noise. (ISBN 0 7268 1066 8) *This standard was issued for public review as DR 74074.*

A public review document DR 76115, Draft Miscellaneous Publication, The Use of Sound Level Meters, Part 1 — Basic Information, has been issued for public comment. The latest date for receipt of comments was 15 February 1977.

The following two new standards are in course of printing:

- AS , Code of Practice for Building Siting and Construction Against Aircraft Noise Intrusion.
- AS , Method of Measurement of Airborne Noise From Agricultural Tractors and Earthmoving Machinery.

Consideration is being given to review AS 1633—1974, Glossary of Acoustic Terms. Members of the Acoustical Society who have suggestions for additions of terms or amendments to terms in AS1633—1974 are invited to

write to the Headquarters of the Association, P.O. Box 458, North Sydney, NSW 2060, so that these suggestions could be borne in mind in this work. This project is being handled through Committee AK/1 — Glossary of Terms, for which Mr. A. K. Connor is the Chairman.

Work has been initiated in preparation of a new standard on personal dosimeters, taking into account the work of the IEC committee. Consideration is also being given to prepare a document on the use of sound level meters (as a supplement to DR 76115, mentioned earlier) to take into account the use of more advanced techniques in establishing noise levels. In particular, this document is to cover the use of digital readout clinics, statistical noise analysers, graphic level recorders, multi-channel tape recorders and the space averaging of measurements. These prospects are being handled by Committee AK/2 — Instrumentation and Techniques for Measurement, for which Mr. R. A. Pesse is the Chairman.

Work has also commenced on the preparation of Australian Standard methods of airborne noise from compressors and pneumatic tools, which will be brought out as different parts of one standard. Part 1 is to deal with the method of measurement of the mean sound level and mean band pressure levels of airborne noise emitted by compressors for outdoor use, generally in accordance with ISO 2151, which is followed in principle in Europe and with minor variations in the U.S.A. Part 2 will bring out a similar method of measurement for pneumatic tools and machines, generally in accordance with the CAGA—PNEUROP Test Code for the measurement of sound from pneumatic equipment, published by the Compressor Air and Gas Institute, New York. The drafts of Parts 1 and 2 above will be issued for public review later this year. This project is being handled by a new Committee AK/9 — Noise from Pneumatic Tools and Machines, for which Mr. R. Bruce King, is the Chairman.

BULLETIN PUBLICATION DEADLINES

The December 1976 issue of The Bulletin has been delayed several months. With the change over to a new style and format for the journal, an attempt was also made to streamline the administration, production and distribution methods and procedures. Difficulties were experienced during the initial period, but we hope that the problems have now been overcome.

There will be no issue of The Bulletin for the March 1977 quarter. All technical material received to date will be carried forward to the June 1977 issue. Acceptance deadlines for the 1977 issues of The Bulletin are as follows:

Volume 5, Number 1 & 2, June 1977

Full Technical Papers 15th April
Other Shorter Items 6th May

Volume 5, Number 3, September 1977.

Full Technical Papers 15 July
Other Shorter Items 5th August

Volume 5, Number 4, December 1977.

Full Technical Papers 14th October
Other Shorter Items 4th November

Members and persons interested in the Society and Acoustics are invited to submit items for publication in forthcoming Bulletins: technical articles, shorter technical notes, brief reports on current research, news of members' and Divisions' activities, letters, or any items of general interest to members.

All submissions for publication should be clearly legible, and preferably typed with 1½ spacing. Apart from Technical Papers there are no special requirements for the format or presentation of items submitted for publication.

Technical papers (articles on technical topics exceeding about 2000 words) should be typed with 1½ spacing, and include a summary of approximately 150 words. Relevant information about the author should also be provided (approximately 100 words).

Contributions should be forwarded to 'The Bulletin of the Australian Acoustical Society, The Science Centre, 35 Clarence Street, Sydney, 2000'

GR 1982

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The 1982 Precision Sound Level Meter and Analyzer combines measurement versatility with simplicity of operation to give you a practical, economical solution to a variety of noise measurements.

Now you can use a single instrument, without plug-in filters or other add-on accessories, to make A, B-, or C-weighted sound level measurements from 30 to 140 dB, octave-band analyses from 31.5 Hz to 16 kHz, and peak or impulse noise measurements.

The 1982 satisfies many noise-measurement requirements.

In a typical industrial facility, a company safety engineer, noise-control specialist or hired consultant may be required to make several types of noise measurements in a single day. Using the GR 1982, the following measurements can be made without the need for any accessories or additional instrumentation.

- 1 A-weighted sound-level measurements to locate noise-hazard areas.
- 2 Peak and impulse measurements of short-duration noises caused by punch presses, metal-stamping equipment, riveting machines, etc.
- 3 Octave-band analyses required for:
 - a. Ear-protector selection
 - b. Noise-barrier material selection
 - c. Noise-source identification for engineering-control programs
 - d. Audiometric booth-side surveys.

Beyond its many uses in industrial safety and hearing-conservation programs, the 1982 has broad application in:

- 1 General noise measurements made by acoustic consultants
- 2 Environmental noise programs at the federal, state, and community levels.

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MEMBERSHIP

ADMISSIONS AND TRANSFERS

NEW MEMBERS AND TRANSFERS

At the Sixteenth Meeting of Council on 29th September, 1976, the following persons were admitted or transferred to the membership grades indicated:

MEMBERS

NSW

DONALD, Graham Charlesworth
HEWETT, Anthony, R. G.
KATEIFIDES, Michael
MASON, Michael Gerald
SUTTON, Gerard Roger

SA

BROGAN, Francis Rae
DAVIS, Henry Horgan
DEAN, Harry Stephen
GOUGH, Paul Lancelot
KONTOPOULOS, Arthur

VICTORIA

DAVY, John Laurence
MODRA, John Desmond
SAMUELS, Stephen Edmund

WA

CARRUTHERS, Derek Dennison
COLES, Gerald Vivian

AFFILIATES

NSW

PATERSON, Terence Alan

SA

LANE, Maxwell Arthur Philip
POPE, Graham Robert
WALKER, William Spencer

WA

BELGER, Stanley William

SUBSCRIBER

NSW

HASSAN, Joe Walker
POWELL, Philip Richard
SLIMMING, Richard George

SA

BOARDMAN, John Earnest
TILLYER, Henry Charles

WA

GUNN, Pamela Ann

STUDENT

NSW

COLGAN, Peter John

HIELD, Peter Rogerson

MARTIN, Raymond William Lloyd

SHERMAN, Armand Marysya

SA

NORTON, Michael Peter

VICTORIA

YOUNG, Bruce Mackenzie

PROCEDURE FOR ADMISSION

Graeme Harding

Many of our members and prospective members do not know the full details of the admission procedure for new members and many applicants are concerned at the long delays they experience in the processing of their admission.

Perhaps a brief outline of the procedure may help members new and old to appreciate the time between the Society receiving an application and the final advice of admission of the member.

Let's consider a typical applicant who sends an application form to the Divisional Secretary say on April 1. On receipt of the application the Secretary of the Division enters the applicant's name on the mailing list of the Division so that the applicant may receive notices of meetings, copies of The Bulletin and similar.

The application is then passed to the Division's Membership Grading Sub-Committee. The Membership Grading Sub-Committee normally meets about 1 to 2 months before a council meeting. Council meetings are held only twice per year (one late in September and one late in February) so that applications are allowed to accumulate with the scantest of attention or consideration until the Council meeting approaches.

When the Division's Grading Sub-Committee considers applications they may well correspond with the applicant or telephone him with a view to learning more about his work, experience or similar; alternatively the Grading Sub-Committee may contact the proposers for other information. If all of the required information is at hand in time the Grading Sub-Committee makes recommendations to the Divisional Committee regarding admission and grades of admission of the various applicants.

The Committee in turn makes recommendation to Council for the admission of the applicants basing its recommendations on those of its own Membership Grading Sub-Committee.

The council has its own Membership Grading Committee formed with one councillor from each division. The function of the Membership Grading Committee is to provide a uniformity of admission, for all states, and a meeting place for members of the various Divisions' Grading Sub-Committees where a consensus of grading criteria can be applied.

The Council of the Society is the sole admission and grading authority and considers each applicant with the recommendations from its Grading Committee.

Assuming the Council admits the applicant, the General Secretary will write to the applicant, the Secretary of his Division, the Treasurer of his Division, the Registrar of his Division and the Registrar advising them of the applicant's admission and grade of admission.

This process can take as little as three weeks for an applicant who admits a well documented application form just before a Divisional Membership Grading Sub-Committee's meeting. Alternatively it may take over 6 months for an applicant who submits an application at the same time if correspondence is required between the Membership Grading Sub-Committee and the applicant.

AAS MEMBERSHIP LIST

At 31st December, 1976, The Australian Acoustical Society membership totalled 342. The Society also had thirteen Sustaining Members, whose names are listed towards the front of The Bulletin. The membership was distributed among the various grades and divisions as follows:

	NSW	SA	VIC	WA	TOTAL
Honorary Members	0	0	0	1	1
Fellows	0	0	1	0	1
Members	70	29	69	30	198
Affiliates	15	6	14	3	38
Subscribers	25	21	18	11	75
Students	14	4	4	7	29
Total	124	60	106	52	342

The following is a complete listing of names on the Federal Register of the Australian Acoustical Society at 31st December, 1976.

NSW DIVISION

NSW Member

ANDERSON, N.L.B.
 ANDREW, J. R.
 BENSON, J. E.
 BOURKE, W.L.J.
 BROWN, W. N.
 BURGESS, M. A.
 BURTON, J. H.
 BYRNE, K. P.
 CADDY, R. S.
 CARTER, A.W.L.
 CARTER, N. L.
 CATO, D. H.
 CHALLIS, L. A.
 CHAMBERS, R. J.
 DARLING, S.
 DAY, A.
 DONALD, G. C.
 DUCKER, B. B.
 DUNLOP, J. I.
 EDEN, D.
 EISNER, M.
 FLETCHER, N. H.
 FRICKE, F. R.
 GIBBINS, D.L.H.

GORE, G. B.
 GREEN, R. C.
 HAGAN, I. A.
 HALL, M.
 HARKNESS, E. L.
 HEGGIE, R. S.
 HEGVOLD, L. W.
 HEINKE, D. P.
 HEWETT, A. R.
 HUNTER, W. F.
 IRVINE, J. A.
 KATEIFIDES, M.
 KEEN, K. J.
 KENNA, L. C.
 KENWLAND, P. R.
 KOTULSKI, P. M.
 LAWRENCE, A. B.
 LONGSTAFF, B. G.
 MacRAE, J. H.
 MADDEN, J. A.
 MASON, M. G.
 MASON, V.
 MAZLIN, J. G.
 MEHAFFEY, W. J.

MOTT, K. J.
 MURPHY, R. G.
 MURRAY, B. J.
 NELMES, M. E.
 NYSEN, P. A.
 PASCOE, J. L.
 PATERSON, A. D.
 PHILLIPS, R. O.
 PICKFORD, G. C.
 PICKWELL, D. J.
 PIESSE, R. A.

NSW Affiliate

BRADLEY, J. A.
 COLLISS, J. W.
 CRANE, R. C.
 CRICHTON, W. D.
 KIMPTON, G. C.
 LYON, J. B.
 MANSELL, W. T.
 PATERSON, T. A.

NSW Subscriber

AUBREY, O. L.
 BOOTH, J. C.
 DONNAN, R. C.
 EDWARDS, D. A.
 FITZELL, R. J.
 FROST, M. A.
 GOTTHARD, D.
 HANDO, K. G.
 HANSSON, L.T.J.
 HASSALL, D.N.H.
 HASSAN, J. W.
 HAVEN, F. B.
 JOANNOU, J.

NSW Student

ANDERSON, A. R.
 BELL, M. J.
 BLACKALL, J. M.
 BRAY, V. E.
 CHEAH, B. K.
 COLGAN, P. J.
 DEMIRIS, G.

SA DIVISION

SA Member

ADAMSON, B.M.F.
 BIES, D. A.
 BOGNER, R. E.
 BOYCE, R. W.
 BROGAN, F. R.
 BULL, M. K.
 CHESSELL, C. I.
 D'ASSUMPCAO, H.
 DAVIES, J. M.
 DAVIS, H. H.
 DEAN, H. S.
 GOUGH, P. L.
 KENDRICK, J. D.
 KING, R. B.
 KONTOPOULIS, A.

POLLARD, H. F.
 ROSE, J. A.
 SATORY, R. J.
 SMITH, C.
 SUTTON, G. R.
 TAYLOR, K. J.
 THORNE, R. H.
 WESTON, E. T.
 WESTON, H. R.
 WILKINSON, R. C.
 WOOD, M. G.

SHELLEY-JONES, G. B.
 SIMPSON, G.
 SIMPSON, M.
 TRENNING, J. R.
 WEIR, R. G.
 WHITLOCK, J. A.
 WINTERS, C. W.

JOHNSON, J. D.
 KALMAR, J. M.
 LAWRENCE, G. R.
 O'BRIEN, M. S.
 PARTS, A. A.
 PATTERSON, G. W.
 POWELL, P. R.
 ROSCOE, N. E.
 SLIMMING, R. G.
 UNMACK, D.
 WILLIAMS, P. C.
 YATES, D. A.

DEMOS, C.
 HIELD, P. R.
 JAKUS, A.
 LIM, C.H.H.
 MARTIN, R. W. L.
 RANICAR, J. H.
 SHERMAN, A. M.

LIM, K. B.
 LUXTON, R. E.
 MARTIN, K. J.
 PRYCE, M. A.
 REILLY, R. N.
 RENNISON, D. C.
 RICE, J. C.
 SAWLEY, R. J.
 SERRADURA, A.
 SHEARER, J. C.
 STAFFORD, R. G.
 SWANSON, S. D.
 WILLIAMSON, R. P.
 WOOLFORD, D. H.

SA Affiliate

BRANFORD, J. B.
LANE, M.A.P.
NEAVE, V.J.M.

SA Subscriber

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BEARDSLEY, J. W.
BOARDMAN, J. E.
BOORD, H.
BROWN, G. L.
DUNGEY, P. J.
FLAVEL, R. W.
GLOYNE, W. P.
KITCHEN, B.
MAYMAN, G. C.
McKAY, B. V.
SA Student
NORTON, M. P.
SWIFT, P. B.

POPE, G. R.
ROGERS, F. M.
WALKER, W. S.

MOULE, C. E.
MUSCAT, P.
PATTERSON, D. J.
RATCLIFF, A. L.
SAUNDERS, A. C.
SEABROOK, T. D.
SOETRATMA, D.
STARR, J. A.
TILLYER, H. C.
WHITING, K. B.

TONIN, R.
WORRALL, D. R.

Victorian Affiliate

BARNES, G. A.
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PEOPLE AND PLACES

RAYLEIGH, JOHN WILLIAM STRUTT, 3rd Baron (1842-1919), English physicist, was born in Essex on Nov. 12, 1842, and educated at Trinity college, Cambridge. He succeeded to his father's title in 1873. From 1879 to 1884 he was Cavendish professor of experimental physics in the University of Cambridge, and from 1887 to 1905, professor of natural philosophy at the Royal Institution of Great Britain. In 1896 he became scientific adviser to Trinity House, and in 1901 chief gas examiner. His early papers were mainly mathematical, including two on electromagnetic phenomena considered in connection with dynamical theory, and one on the stationary thermal conditions of a sphere exposed to radiation from distant sources. His paper on resonance was the first of a series of memoirs which culminated in his standard work, *A Treatise on Sound*. Other papers on sound dealt with the vibrations of a gas contained in a rigid spherical envelope, disturbances produced in sound waves by a spherical obstacle, general theorems relating to vibrations, absolute pitch and the resultant of a large number of vibrations of the same pitch and of arbitrary phase. He carried out experiments on the amplitude of the sound wave near the limit of audibility and on the direction of sound. Rayleigh also carried out investigations in optics and experiments in colour vision. He wrote on polarization, the scattering of light by particles, and the colour of the sky. Great experimental skill was shown in his reproductions of gratings by photographic methods. A series of four papers entitled "Investigations in Optics, with special reference to the Spectroscope", were published in the *Philosophical Magazine* in 1879 and 1880. These dealt with the general question of the resolving power of optical instruments. Later he dealt more particularly with the microscope. His contributions to hydrodynamics were important; he dealt with problems connected with the

propagation of waves, showing how the wave velocity depends on the period. He applied this to the case of deep-sea water waves and showed the part played by waves in earthquakes.

Rayleigh's experiments on the instability of water jets led him to work on surface tension. While at the Cavendish laboratory he carried out his determination of the ohm. Rayleigh also worked out a formula for the distribution of energy in black-body radiation which holds for long wave lengths. His interest in Prout's hypothesis as to atomic weights led him to a series of experiments to determine the densities of gases. While working on nitrogen Rayleigh made observations which led to the discovery of argon. Sir William Ramsay co-operated with him in the latter stages of the work. Lord Rayleigh had an interest in abnormal psychological investigations, and became a member and vice-president of the Society for Psychical Research. He was one of the original members of the Order of Merit, instituted in connection with the coronation of King Edward VII. In 1904 he was awarded a Nobel prize, and at the end of 1905 he became president of the Royal Society, of which he had been elected a fellow in 1873, and had acted as secretary from 1885 to 1896. He remained president till 1908, in which year he succeeded the 8th duke of Devonshire as chancellor of Cambridge university. In 1909 the prime minister, Herbert Henry Asquith, set up a committee of aeronautics, of which Rayleigh was president. Rayleigh was the recipient of many academic and other honours. He died at Witham, Essex, on June 30, 1919.

Rayleigh's papers are collected in four volumes. An account of his life, by his son was published in 1924. See obituary notice by Sir A. Schuster in *Proceedings of the Royal Society*, vol. 98 (1921).

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Marion Burgess obtained a B.Sc. (Hons) from Sydney University and an M.Sc. (Acoust.) from the University of NSW. She has worked at the Experimental Building Station and is now a Senior Tutor in the School of Architecture at the University of NSW.

ROAD TRAFFIC NOISE THE OUTLOOK FOR THE FUTURE

ANITA LAWRENCE and MARION BURGESS

INTRODUCTION

The noise from road traffic affects urban, suburban and even rural areas. Although the sound produced by individual road vehicles is not as great as that produced by individual aircraft, the total number of road vehicles is increasing as is the proportion of the population living close to the source of noise. One example of this is the frequent replacement of single family homes by multi-family dwellings adjacent to main roads.

The relationship between objective measurements of road traffic noise and the subjective annoyance caused by the noise is very complex. The effects of noise on a particular activity, such as speech communication, can be measured under laboratory conditions but this does not give an indication of the overall annoyance. Social surveys where large numbers of people are interviewed have been used for the assessment of noise annoyance. The questionnaire must be carefully designed and it has been suggested that additional information such as personality tests and health questionnaires, are necessary to establish reliable causal sequences.¹

The most common unit used for the expression of noise from road traffic is L_{10} , the level exceeded for 10% of the time, in terms of $dB(A)^2$. Recent investigations indicate a good correlation with annoyance for Leq , the equivalent energy level, and this is gaining acceptance for the assessment of various types of community noises.² However, both of these indices have been found to be highly correlated⁴.

It is generally agreed that the noise levels emanating from major roads are excessive. Various methods for reducing these levels are available, and they fall into four main categories:—

1. Reduction of the noise emitted by individual vehicles.
2. Highway engineering and traffic management to smooth flow and reduce the need for low gear operation.
3. Planning; restricting the use of residential roads to local traffic and generally separating major roads from noise-sensitive land areas.
4. Construction of barriers between roads and people.

In order to make sensible decisions on the strategies to be employed it is necessary to quantify the benefits (in terms of reduced noise levels) that will ensue. The programme of work being carried out in the Acoustics Laboratory of the School of Architecture involves measuring the noise emitted by traffic streams having carefully defined parameters, such as number and classification of vehicle types, distance from the microphone, shielding etc in the hope that the information obtained will assist those involved in making cost/benefit decisions.

MEASUREMENT AND PREDICTION OF NOISE LEVELS

The measurement of the noise, in terms of L_{10} or Leq , for existing road systems is not complex but is time consuming. For future road systems, or increased flow on existing roads it is necessary to have a prediction formula which provides an accurate indication of the expected level.

Many prediction methods have been developed in U.K. and U.S.A. following measurements alongside freely flowing traffic^{5,6,7}. The formula developed by Delany⁵ has been shown to produce accurate prediction for freely flowing traffic not on motorways^{8,9}. This formula takes the form:—

$$L_{10} = K_1 + A \log Q + B \log V + C_p - D \log d$$

where $K_1 = 31$, $A_1 = 8.9$, $B_1 = 16.2$, $C_1 = 0.117$,
 $D_1 = 14.7$

Q is total vehicle flow per hour

V is the average speed of vehicles

P is the percentage of heavy vehicles

d is the distance from the centre of flow of the nearside lanes.

The type of operation of vehicles and the composition of the traffic flow are different on Australian urban roads to that on roads for which the prediction method was developed. However measurements of traffic noise in the Sydney metropolitan area have shown that a formula of this type is valid for traffic on level roadways and as freely flowing as is possible in the urban area¹⁰. A coefficient of multiple correlation of 0.93 and a standard error of estimate of 1.6 dBA was found using the following formula:—

$$L_{10} = K_2 + A_2 \log Q + C_2 p - D_2 \log d$$

where $K_2 = 56$, $A_2 = 10.7$, $C_2 = 0.3$, $D_2 = 18.5$

This formula has the term for V , which is difficult to determine in the urban area, omitted and the value for C twice that determined by Delany. However the values for K , A and D are similar to those found by Delany.

It should be noted that these formulae are applicable to traffic consisting of vehicles on the road in 1974-1976 (i.e. mostly pre ADR28 vehicles). They will hopefully require modification over the next few years when more

stringent vehicle noise emission limits take effect.

Further investigations for non-freely flowing traffic have shown that for traffic on grades the measured value can be up to 5 dBA greater depending on the steepness of the grade. For intersections the predicted value is very close to the measured value if the total traffic flow through the intersection is used for Q . Reflection for facades, which commonly occurs in commercial areas, increases the noise level further and more measurements are being made to determine the effect of facade reflections plus grade, intersections and shielding.

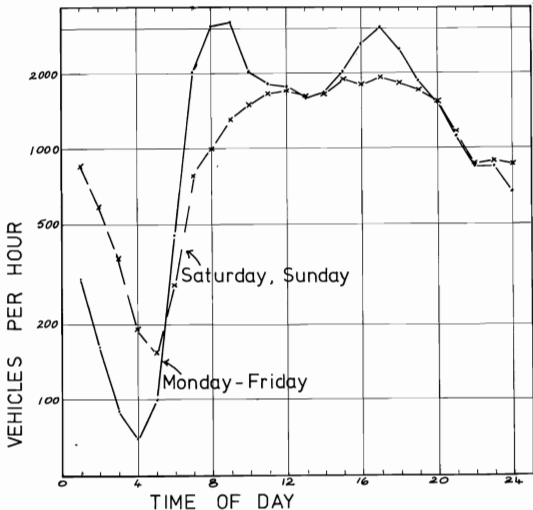


Fig 1. Typical variation in traffic flow during complete day for 6 lane road.

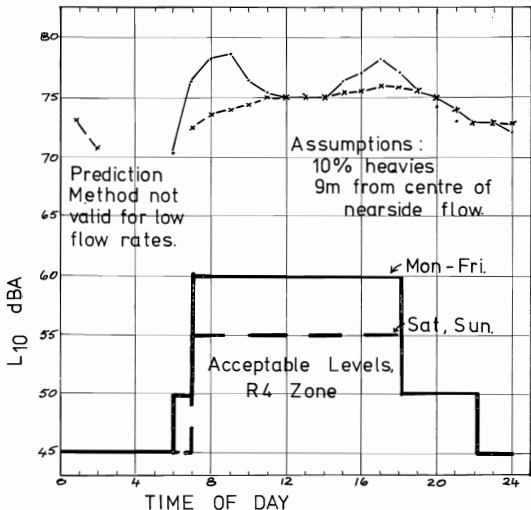


Fig 2. Predicted Values for L_{10} compared with acceptable levels determined using AS1055.

PRESENT NOISE LEVELS

From the data prepared by the Department of Main Roads¹¹ the average hourly traffic flow for a six lane road in the Sydney Metropolitan Area is shown on Figure 1. The Annual Average Daily Traffic Volume (AADT) for this road was 34,000 vehicles which is not atypical for Sydney roads. For 2,531 sites in the Sydney area the AADT for 1973 is available and the range of values is listed in Table 1.

Table 1

AADT	Range of Annual Average Daily Traffic Volumes (AADT 1973)					
	<1,000	1,000 10,000	10,000 20,000	20,000 30,000	30,000 40,000	>40,000
Percentage of sites within the range	4.4	41.6	30.4	12.6	5.8	5.2

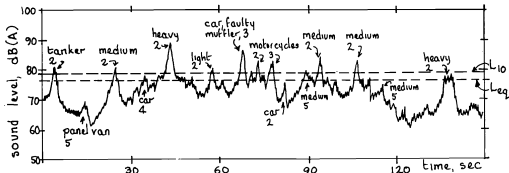


Fig 3. Typical Level Recorder Trace showing contribution of individual vehicles (2,500 vph and 10% medium and heavy vehicles).

The predicted values for L_{10} for the six lane road are shown on Figure 2 for a position 9m from the centre of flow of the nearside lane, which is commonly the boundary of residential properties, and for 10% heavy vehicles. (The prediction method has not been shown to be valid for traffic flows less than 500 vehicles per hour). As there are many roads with similar and even greater traffic flow it is easy to see why so many are disturbed by road traffic noise. However these values for L_{10} assume freely flowing traffic on a level roadway. If the traffic is accelerating up a grade or stopping and starting at control lights the levels would be approximately 5 dBA higher. In addition, if reflecting surfaces are nearby and the percentage of heavy vehicles is greater, the L_{10} could be even greater.

NOISE EMISSION OF INDIVIDUAL VEHICLES

By making a simultaneous voice commentary, assisted by still and motion photography, the actual vehicles present in the traffic mix at any time may be identified. With high flow rates, the vehicles actually identified are limited to 'other than passenger cars' - with the exception of exceptionally noisy cars.

If the L_{10} or L_{eq} level is superimposed on a level recorder trace of a traffic noise sample, any noise peaks above this level are from vehicles that are making the most significant contribution. (Fig. 3). It has been found that, on average, 85% of noise peaks in excess of ($L_{10} + 5$) db(A) were produced by medium and heavy commercial vehicles, although they contributed an average of only 10% of the vehicle mix in the samples studied.¹² The remaining noise peaks were emitted by motor cycles and by cars with modified or faulty silencing systems.

OUTLOOK FOR THE FUTURE

Acceptable noise levels for different areas and times of day have been specified in AS1055¹³. Although these levels were not designed to assess acceptability of road traffic noise they can be used to indicate the excess over normally acceptable levels. Assuming an R4 zone during the daytime the maximum acceptable level would be 60 dBA. This is more than 15 dBA below the very conservative levels shown on Figure 2. At night-time the acceptable levels would be at least 27 dBA below the traffic noise levels.

Even dramatic changes in the traffic flow would not reduce the levels by the desired amount. For example, a reduction of the total vehicle flow by 50% would only reduce the level by 3 dBA and a reduction of the % of heavy

vehicles from 10% to 0% would also reduce the level by 3 dBA. Increasing the distance from the roadway from 9m to 18m would lead to a reduction of from 4 to 6 dBA depending on the type of ground surface. The introduction of all these changes would still not reduce the levels by the 15 dBA necessary during the daytime.

The construction of barriers alongside major roads and the improvement of the attenuation provided by exposed building facades has been used in some cases to reduce the noise received by adjacent inhabitants. However, these are costly remedies and they have serious disbenefits, such as road safety problems and aesthetics, in the case of barriers, and in the need for alternative means of ventilation, in the case of facade attenuation.

Effective urban planning, traffic management and strict vehicle noise emission controls appear to be the most profitable long-term solutions to the traffic noise problem in both existing and new areas.

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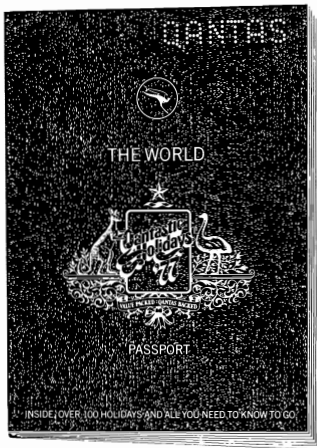
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