THE BULLETIN

OF THE AUSTRALIAN ACOUSTICAL SOCIETY

Volume 4, Number 1, March 1976

REGISTERED FOR POSTING AS A PERIODICAL – CATEGORY C

Membership – *Persons interested in the activities and objectives of the Australian Acoustical Society are invited to apply for membership to the Society. Application forms and details regarding the Society's requirements for admission to the various grades of membership are available from THE AUSTRALIAN ACOUSTICAL SOCIETY, SCIENCE HOUSE, 157 GLOUCESTER STREET, SYDNEY, NSW, 2000.*

Bulletin Subscriptions – *Yearly subscriptions to non-members of the Society – $15.00, Australia – $20.00, foreign postage (airmail).*

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THE BULLETIN

OF THE
AUSTRALIAN ACOUSTICAL SOCIETY

VOLUME 4, NUMBER 1
MARCH 1976

EDITORIAL

THE TURNING POINT

The Society has grown rapidly since its inception with membership now totalling about 350. There are growing pressures on the Society for commitments and decisions on how it will direct the tremendous resources of its membership in the interests of the community.

Many decisions are presently under consideration by various sub-committees and groups throughout the Society. What educational services should the Society provide? Should it sponsor seminars, technical courses, provide lectures or library services, produce films, video tapes and other educational aids? Should it be a regulating authority? Should it establish or advise on standards and criteria for testing authorities, consultants, acoustical products and services? What should be the Society's role in international acoustics?

With such decisions under consideration the Society is poised on a new era of community involvement and service.

Publication of The Bulletin is also at a turning point. Over the past year production costs have risen to such an extent that publication of four issues would cost the Society over $2500 per annum. This cost represents about $8 per member, a significant portion of each member's yearly subscription.

The Bulletin's charter calls for a quarterly journal which reflects the views, interests, activities and work of members by presenting news items, technical notes, research briefs and technical papers.

There is a strong feeling among members that The Bulletin should continue to be published along these guidelines. Such a journal provides a national forum and medium for communication between State Divisions and members, and is essential if the Society is to function efficiently and cohesively at the national level.

The Editorial Sub-committee has investigated several avenues for reducing costs. Various changes in format and printing methods were adopted but the only long-term and practical solutions seemed to involve an increase in revenue. It was on this basis that Council at its recent Fifteenth Meeting agreed to permit advertising in The Bulletin.

The next issue of The Bulletin will therefore carry advertising. Several potential advertisers have already indicated interest, and we are sure their advertisements will provide a valuable and informative service to readers. It is intended, however, that advertising will not become a dominant feature of The Bulletin's content. Only sufficient advertising will be accepted to offset publication costs.

The Editorial Sub-committee also wishes to expand subscriptions of The Bulletin to libraries and other organisations. If any members or readers know of likely sources for subscriptions, please make them known to the Editorial Sub-Committee or Divisional Activities Officer.

We hope the new style and format of The Bulletin is to your liking and look forward to the continued interest and support you have shown over the past year.

The Editors

THE BULLETIN
OF THE AUSTRALIAN ACOUSTICAL SOCIETY

Volume 4, Number 1, March 1976

2 **Editorial**

5 **From the President**

6 **News and Notes**

7 **Conference and Symposium Announcements**

9 **Bulletin Publication Deadlines**

10 **Standards Report**

11 **Letters**

13 **Membership Admissions and Transfers**

14 **The Authors**

23 **Technical Note**

25 **Book Reviews**

15 **ESTIMATING THE ENVIRONMENTAL NOISE OF THE NEW HIGH SPEED HOVERTRAINS** *D. H. Cato*

19 **REQUIREMENTS AND RECOMMENDATIONS FOR MOTOR VEHICLE NOISE EMISSION IN AUSTRALIA** *C. E. Mather*

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SUSTAINING MEMBERS

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

In the previous Bulletin, I stated that South Australia was shortly to form the Society's fourth Division. The formation of the South Australia Division was ratified at the fifteenth meeting of Council and it is with great pleasure that I welcome its members to the Society. The persons responsible for its formation are to be congratulated on their efforts and perseverance, and the Society looks foward to the new Division's support and assistance in all its activities.

In addition to the formation of the South Australia Division, two other very important matters were discussed at the fifteenth meeting of Council — the qualifications required for members to be elevated to the grade Fellow and the formation of a professional practice group within the Society. With regard to the former, the Society has to define the qualifications necessary for a member to be up-graded to Fellow as well as those for a person's election as an Honorary Member. This includes consideration of whether the grade Fellow should be limited to those who have made an outstanding contribution to acoustics or whether it should be broadened so that members will be eligible for election after a minimum number of years of service at the professional level. To assist Council in reaching a decision, the Divisions were requested to submit their views on this matter and these were discussed at the meeting of Council on February 29. Following this discussion, the Council agreed to ask its Membership Grading Sub-committee to review member's qualifications generally and to provide it with an overview of these at its next meeting.

With regard to the formation of a professional practice group within the Society, this matter was raised initially several years ago and has progressed only slightly since that time. One of the most important aspects to be resolved is whether such a group should be formed within or without the Society. To obtain some understanding of the many problems involved, Council has agreed to approach persons known to be interested in the formation of a professional practice group and also requests others interested in this matter to contact Duncan Gray or Bill Davern. The information obtained will form the basis of discussion regarding the formation of a professional practice group at the next Council meeting.

In the longer term, the Society hopes that it will be able to compile some form of 'register of consultants' which will include details of the types of service offered. Such a register should be of considerable benefit to both those supplying and those seeking a particular type of service.

Carolyn Mather

(Carolyn Mather)
PRESIDENT

NEWS & NOTES

SOUTH AUSTRALIA DIVISION FORMED

At the recent meeting of Federal Council, it was recognised that there existed a sufficient number of members to justify the formation of a South Australia Division.

All members of the Society welcome this new Division and extend to it best wishes for the future. Special thanks must go to the many people involved in organising its formation and who also campaigned so vigorously and successfully for new members during the period of formation.

The SA Division was formally constituted on 1st March 1976, with 23 Members, 3 Affiliates, 23 Subscribers and 3 Students.

The following is a list of the foundation members of this new Division:

Members

Adamson, B M	Pryce, M A
Bies, D A	Rennison, D C
Bogner, R E	Reilly, R N
Boyce, R W	Rice, J C
Bull, M K	Sawley, R J
Chessell, C I	Serrudura, A
d'Assumpcao, H A	Shearer, J C
King, R B	Stafford, R G
Lim, K B	Swanson, S D
Luxton, R E	Williamson, R P
Martin, K J	Woolford, D H
Pickles, J M	

Affiliates

Brandford J B	Rogers, F M
Neave, V J M	

Subscribers

Ballad K F	Mayman, G D
Beardsley, J W	McKay, B V
Boord, H	Moule, C E
Brogan, F R	Muscat, P
Brown, G L	Pope, G R
Dean, H S	Ratcliff, A L
Dungey, P J	Saunders, A C
Flavel, R W	Seabrook, T D
Gloyne, W P	Soetratma, D
Gough, P L	Starr, J A
Kitchen, B	Whiting, K B
Patterson, D J	

Students

Swift, P B	Worrall, D R
Tonin, R	

NSW DIVISION AGM

The NSW Division will hold its Annual General Meeting at 8.00 pm on 25th May, 1976, and all members are invited to attend.

The venue for the AGM will be The Graduates Club, 243 Commonwealth Street, Sydney (near Central Railway).

The Meeting will be preceeded by dinner at 6.00 pm, and bookings may be made through Phil Williams (02 259 4066).

ACOUSTIC MODEL TECHNOLOGY

The NSW Division will hold a Technical Meeting on Wednesday 21st April, 1976, entitled 'Acoustic Model Technology — What it is — Where to apply it! The speaker will be Mr. Peter R. Knowland.

Towards the end of 1975, Peter Knowland attended a course of several weeks at Massachusetts Institute of Technology looking at recent developments in model technology. This meeting will give members and others an opportunity to benefit from his experience.

The Technical Meeting will be held at the Crows Nest Club, 33 Hayberry Street, Crows Nest. A buffet meal will be served at 6.30 pm, and Mr Knowland's presentation will commence at 8.00 pm. Further information and booking details are available from Phil Williams (02) 259 4066.

CONFERENCE & SYMPOSIUM ANNOUNCEMENTS

9th INTERNATIONAL CONGRESS ON ACOUSTICS

Madrid, Monday 4th-Saturday 9th, July 1977

The International Congresses on Acoustics, open to those of all nations interested in the subject, are held every three years and constitute the most important world event in this field: the last Congress took place in London, July 1974, and was attended by over 1,400 participants.

The 9th International Congress will be held in Madrid in the Palacio de Congresos y Exposiciones, an integrated building with appropriate Congress facilities. All the sessions and the equipment exhibition will take place in this building located in the main Avenue of modern Madrid which has good communications with those areas where there are hotel establishments of different types and reasonable prices. Special accommodation in student residences will also be available.

AUSTRALIAN PARTICIPATION

In view of the very likely possibility that the 10th ICA will be held in Sydney in 1980, The Australian Acoustical Society is particularly interested in encouraging Australian participation and attendance at the 9th ICA in Madrid. Anyone considering contributing or attending are requested to contact Mr Jack Rose as soon as possible at the National Acoustics Laboratories, 5 Hickson Road, Sydney, 2000 (02-2 0537)

INVITED LECTURES

The sessions include a series of invited lectures — duration 45 minutes — summing up the advances in different fields of Acoustics. Special emphasis will be given in this 9th Congress to the subject of:

Acoustics and Habitat; planning the acoustic environment.

CONTRIBUTED PAPERS

Current research activities and technical advances in all branches of Acoustics will be presented as contributed papers. Periods of 20 minutes, including discussion, will be allowed for its oral presentation in full (English, French, German) in the scientific sessions.

The following classification has been initially considered for grouping the papers.

I. **Environmental acoustics.**
   1. Acoustic criteria
   2. Design and planning
   3. Building acoustics
   4. Acoustic materials

II. **Noise and vibration**
   1. Noise sources
   2. Noise Control
   3. Shock and vibration.

III. **Psycho and physiological acoustics**
   1. Hearing
   2. Speech and communication
   3. Bioacoustics

IV **Physical acoustics**
   1. Untrasound
   2. Underwater acoustics
   3. Molecular acoustics

V **Electroacoustics**
   1. Sound systems
   2. Musical acoustics
   3. Instrumentation

PUBLICATIONS

A complete abstract of the contributed paper, one page in length typed in official format, must be received at the Secretariat before the 1st December 1976 to allow its publication and dispatch to the participants before the Congress.

With the author's permission, it will be possible for those interested, to have photocopies of the full versions of the papers, at cost price, during the Congress. The authors are kindly requested to bring their papers (four to eight pages, including figures) ready for this purpose.

ADVANCE PROGRAMME

Sunday 3rd and Monday 4th July:
Reception of participants and distribution of information.
Monday 4th (morning):
Opening session.
Monday 4th to Friday 8th:
Invited lectures, and scientific sessions.
Friday 8th (afternoon):
Closing session
Friday 8th (evening):
Official banquet and Folklore festival.
Saturday 9th (morning):
Meetings of International Organizations and Societies.

SPECIAL SESSIONS

Apart from the regular sessions, at appropriate hours, special meetings and round table sessions will be arranged on request.

EQUIPMENT EXHIBITION

A technical exhibition of equipment and materials of specialized firms in the field, including demonstrations, will be arranged in the Congress buildings. Firms interested, please write to the Secretariat for direct information.

COMPLEMENTARY ACTIVITIES

The following complementary activities will take place during the week of the Congress.

Technical visits

To research and applied acoustics establishments.

Official events

Receptions and Concerts, for participants and accompanying members, during free hours.

Ladies programme:

Conducted visits to the town, Prada Museum and Royal Palace. Opportunities will be given to attend typical Spanish handicraft, fashion and cooking demonstrations.

Excursions

One day visits to typical Castillian towns near Madrid, will be available. Special arrangements will be made for the weekend.

SATELLITE SYMPOSIA

Barcelona, Friday 1st and Saturday 2nd (morning) July: Sound Recording and reproduction.
Sevilla, Monday 11th and Tuesday 12th July: Hearing and industrial noise environments, including a special meeting on Impulsive noise hazards.

As in previous ICA Congresses, specialized Symposia have been planned for the days just before and after the Congress. On this occasion Barcelona and Sevilla, two interesting cities with appropriate backgrounds for their respective subjects, will be the sites of these Symposia.

The sessions will consist of specialized lectures — 30 minutes long — followed by round table meetings.

Both Symposia will include complementary activities and equipment exhibition.

1976 NOISE CONTROL CONFERENCE

The Committee of Acoustics of the Polish Acoustical Society has announced a conference to be held in Warsaw 13-15 October, 1976.

The Programme for the Conference will be:

Industrial Noise
Transportation Noise
Building Acoustics
Community Noise
Effects of Noise and Vibration on Man
Methodology and Instrumentation of Noise and Noise and Vibration Measurements
Standards, Legislation.

Presentations at the Conference will be in English and take the form of Invited Papers, Contributed Papers, Poster Sessions. Further information is available from the Australian Acoustical Society or by writing to:

EWA Glinska M.Sc.
SWIETOKRZYFKA
21 p. 82 IPPT PAN,
00-049 WARSZAWA, POLAND.

INTER-NOISE 77

INTER-NOISE 77 will be held in Zurich, Switzerland, in the buildings of the Swiss Federal Institute of Technology, on March 1-3, 1977. The main theme is *"Noise Control: The Engineer's Responsibility"* and the topics to be discussed will be:—

- Units, Modern Measurement and Data Acquisition Methods
- Noise Prediction for Land Use Planning and Industrial Environments
- Optimum Noise Control in view of Technical, Economical and Legal Constraints.

Contributedl papers are requested and abstracts of about 500 words should be submitted before 1 September 1976. Authors will be notified by 15 October 1976 of the acceptance of their abstract and special masters will be forwarded for the typing of manuscripts.

Further information can be obtained by writing to:

INTER-NOISE 77
ETH 8006 ZURICH
SWITZERLAND

OR

SECRETARY (NSW Division)
AUSTRALIAN ACOUSTICAL SOCIETY
C/- Science House
157 Gloucester Street
SYDNEY. NSW 2000

INTERNATIONAL EVENTS — 1976 & 1977

Federal Republic of Germany: (change of date)
20-23 September, 1976, Heidelberg
"D A G A '76 Meeting"
Contributions (to 1 April 76):
—D A G A '76—
z.Hd. Herrn Prof. Dr. F. Mechel
Grunzweig + Hartmann und Glasfaser AG
D-6802 Ladenburg, Am Hagen 2

Great Britain:

a) 12-14 April, 1976, Liverpool, Polytechnic Engineering & Science Building,
"Spring Conference 1976"
(parallel sessions: Noise in buildings, Loudness evaluation, Industrial noise, Non Linear behaviour in solids, Acoustic imaging)
held by the Institute of Acoustics
Secretary:
Dr. R. Lawrence,
Acoustics Group, Physics Department,
Liverpool Polytechnic
Byrom Street
Liverpool L3 3AF

b) 17-18 September 1976, Glasgow
"Thermal, Acoustical & Viscoelastic Properties of Polymers"

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

Japan

a) 25-29 May 1976, Tokyo
"Meeting of the Acoustical Society of Japan"

b — all branches of acoustics —

b) 7-9 October 1976, Hiroshima University
"Meeting of the Acoustical Society of Japan"
—all branches of acoustics—

On both venues details from:
Acoustical Society of Japan
Ikeda Building,
7 Yoyogi 2-chome
Shibuya-ku, Tokyo

Norway

24-27 August 1976, Sanderjord
"The Acoustical Society of Scandinavia Conference"
Details from:
NAS
ELAB
N-7034 Trondheim-NTH

Poland

13-15 October 1976, Warszawa
"76 Noise Control Conference"
(Industrial Transportation, Buildings, Community Noise, Effects of Noise and Vibration on Man, Methodology and instrumentation for noise and vibration measurements, standards, legisl.)
held by Polish Academy of Sciences, Committee of Acoustics and Polish Acoustical Society.
Secretary of Conference:
Ewa Glinska M.Sc.
Swietokrzyska 21 p.82 IPPT PAN
00-049 Warszawa

Great Britain

14-17 November 1977, London
"FASE Symposium — 1977
European Noise Legislation"
(The technical programme will include consideration of criteria, instrumentation, standards, laws and regulations, their nature, enforcement and effectiveness — invited speakers, discussions)
held by the Institute of Acoustics
Secretary P.G.C. Mylne
47 Belgrave Square
London SW1X 8QX

U.S.A.

a) 1-10 June 1977, State College PA
"Meeting of the Acoustical Society of America" —
all branches of acoustics
Chairman:
John C. Johnson
Pennsylvania State University
PA 16802

b) 13-16 December 1977, Miami Beach Florida.
"Meeting of the Acousticsl Society of America" —
all branches of acoustics
Chairman:
John G. Clark
Institute of Acoustical Res.
615 SW Second Avenue
Miani, FL 33130

BULLETIN PUBLICATION DEADLINES

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, Science House, 157 Gloucester Street, Sydney, 2000".

Acceptance deadlines for publication are as follows:

Volume 4, Number 2, June 1976	
Full Technical Papers	7th May
Other Shorter Items	28th May
Volume 4, Number 3, September 1976	
Full Technical Papers	6th August
Other Shorter Items	27th August
Volume 4, Number 4, December 1976	
Full Technical Papers	5th November
Other Shorter Items	26th November

STANDARDS REPORT

STANDARDS ASSOCIATION OF AUSTRALIA

R. Nagarajan,
Engineer-Secretary,
Standards Association of Australia.

The Association's work on acoustics standards continued to develop during the first quarter of 1976.

The Association's Committee on Instrumentation (AK/2) met in Sydney to consider a Draft Guide for the Use of Sound Level Meters, which will be issued shortly for public comment. This draft is intended to provide the basic information and procedures which will enable meaningful sound measurements to be made.

The Association's Committee on Architectural Acoustics (AK/4) also met in Sydney and finalised the Draft Code for Building Siting and Insulation Against Aircraft Noise Intrusion (earlier issued for public comment as DR 74163) and finalised the Draft Method for Measurement of Normal Incidence Sound Absorption Coefficient and Specific Normal Acoustic Impedance of Acoustic Materials by the Tube Method (earlier issued for public comment as DR 75060).

The Association's Community Noise Committee (AK/5) met in Sydney to consider a Draft Revision of AS 1055, Noise Assessment in Residential Areas, which was intended to simplify certain procedures and amplify the scope to include guidance for planning purposes. This draft, duly revised as suggested at this meeting, will go for postal ballot with a view to early finalisation and printing.

The Association's Sub-committee on Noise in Ships (AK/7/1) met in Sydney to finalise the following two draft standards for printing:

1. Draft Method for Measurement of Noise on Board Vessels (earlier issued for public comment as DR 74073).
2. Draft Method for Measurement of Noise Emitted by Vessels on Waterways in Ports and Harbours (earlier issued for public comment as DR 74074).

This sub-committee will consider setting down maximum permissible noise levels on board vessels and emitted by vessels in ports and harbours in its meetings later this year.

Announcements of standards as and when they are published and draft standards as and when they are issued for public comment will be made through the pages of the Standards Association of Australia Monthly Information Sheet, as usual.

AMERICAN NATIONAL STANDARDS INSTITUTE

Noise Designation Standard Approved

On January 23, the American National Standards Institute (ANSI) approved a new method for designating product noise. The *Noise Power Emission Level* has been standardized as the quantity to be used when specifying the sound power output of a stationary noise source.

The newly-approved American National Standard, S1.23-1976, is entitled: "Method for the Designation of Sound Power Emitted by Machinery and Equipment." This new standard fulfills a need for information on the noise emissions of machinery and equipment and avoids confusion between sound power levels and sound pressure levels which are both expressed in decibels.

Using the new standard, a product might be labelled, "9.0 bels (noise power emission level)." One bel is a logarithmic unit equal to 10^{-11} watt of emitted sound power with A-weighting in the measurement system to simulate the response of the human ear.

Prepared by ANSI's Working Group S1-64 on Noise Measurement Systems, this new standard will be published in February by the Acoustical Society of America (the sponsor of ANSI Standards Committee S1) and will be available from the Back Numbers Department (Department STD), American Institute of Physics, 335 East 45th Street, New York, NY 10017.

PROFESSIONAL ANNOUNCEMENT

By mutual agreement, Ron Carr and Roger Wilkinson have dissolved the Partnership of Carr and Wilkinson, on the basis that as from the 1st March 1976 the former business of the Partnership will be carried on by

- Roger Wilkinson Consulting Pty Ltd from Chatswood NSW

and

- Ron Carr & Co Pty Ltd from Hawthorn Victoria, and Canberra

Both consultants look forward to continuing, in their separate business entities, the traditions, service and friendships built up in the past 12 years.

LETTERS

IMPACT STATEMENT — CONCORDE OPERATIONS

Dear Sirs,

I have recently read the 'Draft Environmental Impact Statement on Concorde Operations in Australia' (obtainable from the Civil Aviation Adviser to the British High Commissioner in Melbourne, free of charge).

The statement is not meant to be a document putting the case for or against Concorde, though as "The Proponents" are Her Majesty's Government in the United Kingdom in collaboration with the British Aircraft Corporation and British Airways, there is doubtless a slight bias in Concorde's favour.

I tried hard to be objective about the subject too, but it was not easy. Maybe Concorde is before its time, as its proponents suggest, and maybe it is after its time. The odds that it will be a roaring failure seem better than the odds that it will be a roaring success in the cynical 70s. Certainly one of the greatest noises associated with the aircraft will be the wails of the British taxpayer, who has to support it, and the environmentalists, who oppose it.

Before reading this Draft Statement I was inclined to think that, despite its being a masterly piece of engineering, Concorde should never have gone into production but now it has, it should be allowed to fly. Having read the statement I am now inclined to have second thoughts on the matter. The reason for this is because of what the statement does not say, what it says very vaguely or to deliberately mislead. Perhaps this is because the statement has been prepared for public consumption but I suspect that there are figures which must be hidden behind the PR whitewash that this statement appears to have been given.

An example of what I think is a deliberately misleading piece of information is given on page 19 on the section on sonic booms, " . . . a 30 m.p.h. wind gust would produce pressure on a building of 115 pascals, comparable to the sonic boom overpressure directly beneath Concorde track". Ignoring the inconsistent units, the overpressure is not the only factor which determines the structural behaviour of buildings; the rise-time and spatial correlation of the pressure are just as important. The rise-time for a wind gust is comparatively long and is therefore unimportant, whereas the rise-time for a sonic boom is so short that no pressure equalization occurs in the building due to the impulse loading of the boom. The spatial correlation of the pressure on a building, due to a wind gust is also negligible compared to a sonic boom.

Another example of a misleading statement occurs on page 33, " . . . a change of less than 5 dB for aircraft noise is barely perceptible . . .". Yet, on the previous page a table is given comparing Concorde's Noise levels in EPNdB (for Lateral, Flyover and Approach) with a 707-320B, a DC8-60/61 and a 747-100. Concorde's levels are quoted to the nearest 0.5 dB, while the others are quoted to the nearest whole dB. Also, Concorde's flyover level (119½ EPNdB) is for a take-off with thrust cut back whereas the 747-100 (115 EPNdB) is for full thrust. The approach and take-off levels are then added arithmetically and compared (Concorde 236, 707-32012 234, DC8-61 234, 747-100 229).

The vagueness of the report may be judged by two quotations. The first quotation is from page 3. "The time saving offered by Concorde will markedly increase their (executives in Australian business and public affairs) contributions with benefits spreading through the whole community, ultimately taking in such matters as family and medical emergencies, and aiding all essential travellers from every part of the Australian community, whatever their objective for travelling may be." Will someone living in Perth fly to Melbourne to catch Concorde to the U.K. or the U.S.A.? The second quotation is from page 27. "CIAP Manager has said that ½% reduction in total ozone is equivalent to 45 minutes extra sunbathing on the beach and the corresponding effect of the operations of the Concordes would be roughly equivalent to 90 seconds instead of 45 minutes . . .". Unfortunately it is not stated what would happen if there were more than nine Concordes.

An example of what the Statement does not say is the condition under which the measurement of the take-off EPNdB measurement is made. According to Webster ("Noise and Induced Vibration Levels from Concorde and Subsonic Aircraft", Sound and Vibration, Oct. 1975, 18-23) Concorde is operated to minimise the sound level at the take-off measuring point. However, at other positions under the flightpath, Concorde's levels, for a 4% climb, are 10 EPNdB greater than the 707-320B's.

The issuing of this statement should be applauded even though it is a thinly disguised public relations exercise which becomes transparent in places e.g. page 9. "If Concorde could not operate on the Australian route, it would affect the viability of the aircraft project, including the British Airways purchase of five aircraft, with consequent adverse effects on the whole programme and on British and French employment in particular".

It should never have been built in the first place, but now that it has been, I am inclined to think it should be allowed to fly. Ultimately the millions of dollars spent on Concorde for noise research will benefit the environment, even if Concorde will have the opposite effect.

Let's face it, if Concorde is not a viable proposition it won't be flying in a few year's time and if it is a success it will take some of the traffic away from Sydney. Speaking as a resident who lives near a flight path in Sydney, I wish Concorde every success and offer my condolences to Melbournians.

Yours faithfully,

Fergus Fricke
University of Sydney

JOHN IRVINE WRITES AGAIN

Dear Sirs:

The following are comments on observations I made while at the T.N.O., Delft, Holland from December 1975 – January 1976, which may be of interest to your readers:

1. Sound Leaks

Two reports dealing with the effect of small apertures on the overall sound insulation between spaces have been studied. These publications, both by M. C. Gomperts, T.N.O., Delft, have the titles:

(a) Sound Leaks — Report 33, July 1968
(b) Sound Nuisance from Slits at Windows — Report R40, April 1972

The treatment in both cases is largely theoretical, but is backed by experimental evidence.

Report 33 gives detailed mathematical formulae, and a scheme whereby calculations can be made to show the effect of circular and slit-shaped apertures in a sound barrier. Provision is made for a practical range of aperture sizes, in various positions (central, edge, corner), and of barrier sound transmission loss. In the present form, the calculations are easy but extremely tedious. It seems quite possible to create a computer programme to handle them (indeed Max Gomperts states that he could readily do this, if time were available), and it may also be worthwhile for someone to design nomograms to reduce the work. Full details have been lodged with Committee AK/4, Standards Association of Australia.

Report R40 carries the work reported in Report 33 into the particular field of slits at the edges of windows. After theoretical discussion and provision of formulae, the experimental verification is described, and the relation between sound leakage due to these slits and the "A" weighted sound levels is discussed.

While the work described in these reports may not have day-to-day applications, it nevertheless could be of considerable use to those concerned with architectural acoustic design.

2. Noise Legislation

An English-language Summary of the draft Dutch Noise Control Act has been obtained, along with other (also English-language) documentation concerning the design of this legislation. A full copy of the present draft Act, in Dutch, has also been obtained.

The draft Act is being studied actively in Holland by people with a wide range of interests – technical, commercial, socio-economic. No doubt some changes will be made before it is finally accepted by parliament.

With a view to assist in these discussions, copies of the Australian legislation have been given to the relevant T.N.O. staff man, Mr. Jan van den Eijk. These copies were made available through the kind services of Dr. C. E. Mather, to whom copies of the Dutch documentation have been sent.

It is hoped that further useful exchanges of views on this complex and important subject will be possible.

3. Impact Noise Test

Since the last Notes there has been further, and quite detailed, correspondence with Dr. T. J. Schultz, U.S.A., regarding his newly proposed test methods. This work is being carried out for A.S.T.M., and being still at the committee draft stage is confidential. However, it is publicly known that experimental work is currently in progress at the Chalmers University of Technology, Goteborg, Sweden (Professor Kihlman) on one of the proposed methods. It is planned to visit that laboratory during May to obtain, first hand, an account of progress. Details of the two test methods (with approval of Dr. Schultz) have been sent to the Chairman, Committee AK/4, Standards Association of Australia, as background information for our own work in this field.

4. Noise Control Specification for Building Codes

Discussions by correspondence with Dr. T. J. Schultz, U.S.A., on this subject have been very interesting. The matter is one which is also of importance in Australia, and no doubt will be handled by Committee AK/4, Standards Association of Australia. Details (not yet publicly available) have been sent to the Chairman of that Committee as background information, with approval from Dr. Schultz.

An interesting reference to this subject appeared in Noise Control Engineering, Autumn 1973, p. 90 et seq., where Dr. Schultz discussed the problem as he then saw it. The use of dB(A) level differences was a prominent feature.

5. Hearing Conservation

The measurement of noise exposure, using a personal dosemeter and conventional methods, has been studied recently by T.N.O. A comparison of these two methods was carried out in the bottling plant of a Dutch Brewery under normal conditions of operation. A copy of the preliminary report has been sent to National Acoustical Laboratories, Sydney.

It seemed that the measures by personal dosemeter were generally very similar to those obtained by 'conventional' means (sound level meter, time periods, etc.), with a tendency for the dosemeter estimates to be slightly lower – perhaps 1-2 dB.

6 International Standards Organisation

Through the good offices of Standards Association of Australia, arrangements are being made to attend meetings of ISO/TC43/SC2 being held in Paris in June. Sub-committee 2 is concerned with Building Acoustics, and the meetings should thus be of interest so far as Australian standards in this field are concerned.

7. Nederlands Akoestich Genootschap

Some information has been obtained regarding the activities of the Netherlands Acoustical Society. Details have been sent to the President, Australian Acoustical Society.

The Dutch Society consists entirely of professionally qualified people, numbering in excess of 200. It holds at least one major technical meeting each year, the papers presented at that meeting being published in book form.

Since 1962, some 29 such publications have been issued. A very high standard is evident in the contributed papers, which are (unfortunately) always in Dutch language, though with an English summary. The Society also organises International Conferences, one held in Madrid, 1975, "Anglo Spanish Netherlands Symposium" being regarded as highly successful. All papers at this conference were published in book form, and in English.

It is perhaps interesting to note that the Netherlands Society has a relatively large number of Sustaining Members (38 were listed in January 1975).

As mentioned in my previous letter (The Bulletin, Vol 3 Nos. 3 & 4), I would welcome correspondence with members, and promise to answer any requests to the best of my ability. Address, from March 31st to July 31st, 1976 is:

J. A. Irvine
c/o Mr. J. van den Eijk
Institut TNO de Recherches de L'environment
Postbus 214
DELFT, HOLLAND

MEMBERSHIP

ADMISSIONS AND TRANSFERS

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 the the Divisional Secretary say on April 1. On recept 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.

NEW MEMBERS AND TRANSFERS

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

MEMBERS

NSW

MOTT, Kenneth John

SA

ADAMSON, Ben Macfarlane
BIES, David Alan
BOGNOR, Robert Eugene
BULL, Maxwell Kenneth
d'ASSUMPCAO, Henrique A
LIM, Kim Boon
PICKLES, John Martin
RENNISON, David Charles
RICE, John Cracroft
WOOLFORD, Donald Henry

VIC

FEARNSIDE, Peter Richard
GARDNER, Peter Robert

WA

CUMPSTON, Alan George

AFFILIATES

NSW

SHELLEY-JONES, Graham Bruce

SUBSCRIBERS

NSW

AUBREY, Owen Leslie
GOTTHARD, Detre
HANSSON, Lars Tommy Ingvar

SA

BOORD, Howard
DEAN, Harry Stephen
DUNGEY, Peter John
GOUGH, Paul Lancelot
KITCHEN, Barrie
PATTERSON, Dean James
SAUNDERS, Andrew Crawford

VIC

DAY, Christopher William
MODRA, John Desmond

STUDENTS

SA

SWIFT, Peter Bevan
WORRALL, David Robert

THE AUTHORS

D. H. CATO

Doug Cato is a graduate of Sydney University and has been engaged in underwater acoustics research at the R.A.N. Research Laboratory, Sydney, for several years.

His interest in train noise stems from his work at the Building Research Station, U.K. while on leave from R.A.N.R.L. in 1972/73.

C. E. MATHER

Dr. Carolyn Mather is the President of the Australian Acoustical Society, and is a distinguished figure in Australian acoustics. Her formal qualifications, B.Arch., M.Bldg.Sc., and Ph.D., were obtained at Sydney University. Her present position is Investigating Architect with the Public Works Department of Western Australia. She is also considerably involved in other activities in acoustics which include: Chairperson of the Standards Association of Australia AK/4 Committee on Architectural Acoustics, Member of AK/5 Committee on Community Noise, Member of the W.A. Noise Abatement Advisory Committee. Carolyn is also a recipient of a Churchill Fellowship and past Chairperson of the W.A. Division of the Australian Acoustical Society.

ESTIMATING THE ENVIRONMENTAL NOISE OF THE NEW HIGH SPEED HOVERTRAINS

D. H. CATO

SUMMARY

The development of hovertrains, which are supported on the guideway by air-cushions or magnetic levitation, has reached the stage where systems could be introduced into service in the next few years. This paper considers the possible sources of noise from hovertrains and provides estimates of the radiated noise levels.

Hovertrains powered by aircraft engines are likely to be at least as noisy as much longer conventional trains, because of the high engine noise. Linear Induction Motors (LIMs) have been proven to be viable alternatives to aircraft engines, and are likely to be generally used in hovertrains because they are much quieter and are electrically powered. LIM powered hovertrains are 10 to 20 dBA quieter than conventional trains at 160 km/h. At least above 200 km/h, and probably above 100 km/h the main source of noise from a LIM powered vehicle is aerodynamic, resulting from airflow over the vehicle surface.

Introduction

Hovertrains — vehicles which move without contact with the tracks by virtue of magnetic levitation or air cushion suspension and are capable of speeds far in excess of those of conventional trains — have been operational in Europe as prototypes for about 10 years. One of the more advanced prototypes, the French 1-80 Aerotrain (ref. 1), with seating capacity of 80, has logged many hours at speeds around 400 km/h on its air cushion suspension and propelled by an aircraft turbofan engine. Other prototypes are successfully operating at similar speeds using linear induca-tion motors (LIMs) which provide the motive power electrically without the high noise levels of aircraft engines. The first hovertrains are expected to be introduced into the service in the next few years, and some urban system guide-ways are already under construction in France.

Hovertrains can provide safe, comfortable transporta-tion at speeds twice that of the fastest conventional trains. Travel time between city centres will compare favourably with travel by air for distances up to several hundred kilometers. Other versions would be suitable for small scale inner city travel, and for suburban transport. An important application would be to provide the high speed link between the city centre and a remote airport, as an airport 40 miles from a city would be reached in about 10 minutes.

Hovertrains are likely to become important means of surface transport. Because of their high speeds of operation, there is likely to be considerable interest in the environ-mental effects, particularly from a noise point of view, however practically no information is available on their noise characteristics. This paper considers the possible sources of noise and provides an estimate of the radiated noise levels. The estimates are applied to an example of a 30 m long 3 m high and 3 m wide vehicle. This is likely to be typical (it would apply to the French Aerotrain) and is also in line with indications that, on the high speed applica-tions, vehicles would operate individually.

Sources of Noise

Because hovertrains are supported without actual physical contact with the track, the dominant source of noise usually associated with conventional high speed surface transport, i.e. train wheels (ref 2) or motor types, (ref 3) are absent. Hovertrains can therefore be expected to be significantly quieter than conventional surface transport for comparable speeds so long as propulsion noise can be kept down. Although electrically powered vehicles will require some sort of contact with the supply rail or wire, this is unlikely to have the significance of wheel noise because it would not be subject to the high loads and large driving forces experienced by the wheels, and would probably be shielded by the structure of the vehicles.

On some prototypes, like the French Aerotrain, aircraft engines provide the motive power and are likely to be the dominant sources of noise on these vehicles. The noise of the 1-80 Aerotrain at a distance of 60 m (presum-ably to the side of the vehicle) is reported to be 90 to 95 dBA at speeds (inferred from the context of the article) up to 250 km/h (ref 1). This is about the noise level to be expected from its aircraft engines (known from well estab-lished data on aircraft noise). The trend, however, appears to be towards the use of linear induction motors (LIMs) for propulsion, and these have been proven operationally on a number of prototypes at speeds up to 480 km/h (ref 1). LIMs could well be quieter than conventional electric motors because of the fewer moving parts, so may be one of the quietest forms of motive power available.

Another source of noise is the air cushion. The noise from the fans and air cushion efflux is subject to considerable attenuation by the shielding of the ducting and the skirts of the plenum chamber. On conventional hovercraft (as on the French Aerotrain) the air cushion noise appears to be insignificant by comparison with the noise from the propulsion system. However with the substantial reduction in propulsion noise achieved by using LIMs, air cushion noise may become significant.

Aerodynamic noise is usually not considered a significant component of the radiated noise of conventional surface transport. However, with the reduction in the noise from other sources and the unusually high speeds at which the hovertrains operate it may be an important part of the radiated noise.

Air Cushion Noise

It is difficult to estimate air cushion noise because in all available measurements of the noise of air cushioned vehicles, the noise of the engines predominates. Wheeler and Donno (ref. 4) give the noise of an idling Westland SRN 5 hovercraft at 71 dBA at 60 m. This presumably, is the condition in which propulsion noise would be a minimum, although it is still considered as the dominant source of noise. It does, however, provide the lowest level that is known to exceed the air cushion noise, and therefore it may be taken as an upper limit of air cushion noise. The area of the air cushion of the SRN 5 is approximately the same as expected for a 30 m long, 3 m wide vehicle.

The URBA 8 Urban transport System (Ref 5) consists of small, 8 passenger vehicles suspended from an overhead track by air suction and powered by linear induction motors. The radiated noise when stationary or at 36 km/h is reported to be 67½ dBA at a distance of 7.5 m, (ref 5) the main source being the lift fans with relatively little noise coming from the air entry to the cushion system. It seems reasonable to assume that to provide an air cushion for a vehicle of this size would require fans and air flow of similar dimensions to those of the air suction system. On this assumption we can use the measured noise level of URBA 8 as an estimate of air cushion noise of a vehicle of this size. This noise level can be scaled up to the equivalent noise of a vehicle the size of the 1-80 Aerotrain (30 m long and 3 m wide) by considering the relative dimensions. The ratio of weights and air suspension areas are approximately the same at 12:1. The increased weight of the Aerotrain would therefore be adequately supported by the increased air suspension area, so it seems reasonable to scale the noise in the same proportion (for distances greater than the vehicle length). This gives a level of 61 dBA for the radiated noise of the aircushion of a 30 m long vehicle at a distance of 60 m. This presumably would not vary significantly with speed.

Linear Induction Motor Noise

The only indication available of LIM noise is the measurements of URBA 8, discussed in the previous section. The linear motor is reported to be "silent" (ref 5) which presumably means that it was not significant compared with other noises (i.e. the air suspension noise). As the measured noise levels were the same while stationary or at 36 km/h, this would appear to be the case, indicating that the linear motor noise would be at least 10 dBA below the total noise level.

Thus a level of 57½ dBA at 7.5 m would be an estimate of the upper limit of linear motor noise on URBA 8 at 36 km/h. It seems reasonable to scale the motor noise levels in accordance with the weights of the vehicles, so that for a vehicle the size of the 1-80 Aerotrain, we would estimate the upper limit of linear motor noise to be 50½ dBA at a distance of 60 m and a speed of 36 km/h. The power dissipated by the propulsion system at constant speed would be proportional to FU where F is the force required to overcome frictional forces (mainly air resistance) and U is air speed (i.e. vehicle speed). As $F \alpha U^2$, we have power αU^3. If we assume that the acoustic power radiated is proportional to the motive power, then noise intensity would increase as U^3.

Aerodynamic Noise

The noise radiation from airflow over the surface of conventional road or rail vehicles is usually considered to be insignificant by comparison with the noise from other sources, so has received little attention. Until recently the same could be said for aircraft, however the success in developing quieter jet engines has resulted in a situation where further noise reduction could bring "airframe noise" (that due to air flow over wings and fuselage) into prominance (ref. 6). This has prompted some application of aerodynamic noise theory to the problem of airframe noise and a limited number of measurements. The difficulties in applying the theory to specific examples lies in the requirement for detailed characteristics of the air flow which are often difficult to obtain and do not appear to be available for the vehicles of interest.

Curle (ref. 7) originally considered theoretically the effect of a rigid body on the generation of noise by fluid flow. Based on his theory, we would expect that, in general, the noise generated by a turbulent boundary layer at the relatively low Mach numbers of interest should radiate as though due to a distribution of dipole sources over the surface of the body. Also the noise intensity should increase as the sixth power of the flow speed (in this case the vehicle speed). This compares with third to fourth power dependence on speed of conventional train noise, which (at speeds of 80 to at least 160 km/h) also has dipole directivity, although from an entirely different source (the wheels) (ref. 2).

In a recent paper, Tam (ref. 8), has developed theoretical expressions for the level and spectral characteristics of noise from the turbulent boundary layer over a flat plate, by using well established empirical data on wall pressure fluctuations and shear stress. It would seem to be a reasonable approximation to use this work to estimate the boundary layer noise radiation from a streamlined vehicle with surfaces having minimal irregularities due to window, door frames, etc. As Tam's paper contains no comparison with measurements, it is desirable to test his theory by comparing it with some available data on airframe noise. Some suitable measurements are those of a Blanik glider at a speed of 110 km/h (30.5 m/s) and a height of 30.5 m overhead (ref. 9), because the absence of engines ensures that the noise is entirely due to airflow over the body. To apply Tam's theory of this example requires the assumption that the empirical model of wall pressure fluctuations used in the theory applies down to this speed (Mach 0.09) whereas it was derived from data in the range Mach 0.3 to 0.8. Even so, the predicted noise level of 51 to 54 dB re 2×10^{-5} N m^{-2} is in remarkably good agreement with the measured value of 53 dB re 2×10^{-5} N m^{-2}. Such a close agreement must, of course, be partly fortuitous, considering the uncertainties of estimation. During the measurements the glider had flaps at zero angle and no spoilers out, so obstructions to the flow were minimal and thus conditions were closest to those required by the theory. When the spoilers were deployed, the noise level increased by 19 dB, presumably because of the considerable increase in disturbance to the flow.

Some airframe noise measurements are available for aircraft having engines cut back to flight idle where, it is claimed engine noise would be insignificant compared with airframe noise (refs. 6, 10). These measurements also show a large increase in noise when the disturbance to flow is increased. It is reported (ref. 10) that increasing the flap angle and lowering the landing gear on large aircraft cause increases in noise level of 9 to 13 PN dB. The airframe noise measurements reported by Blumenthal et al (ref. 6) are of a Boeing 727-200 at speeds around 300 km/h. The measurements exceed the levels predicted by Tam's theory by 6 to 17 PN dB, the excess increasing as the flap angle increased from 5° to 40°. There was also an A weighted result (for 25° flap angle) which exceeded the prediction by 9 dBA. Measurements of airframe noise on a Lockheed C5-Galaxy at 300 to 370 km/h, reported by Gibson (ref. 10) show levels 4 to 17 PN dB in excess of those predicted, and levels generally increasing as the flap angle increased and also when the landing gear was lowered (if some dubious results when the aircraft was very close to the microphone are neglected). It would seem that most of the excess in these measured noise levels over those predicted can be attributed to the disturbances caused by the flaps and the landing gear, with an excess of 4 to 6 PN dB unaccounted for. This remaining excess could be due to the angle of attack of the aircraft or to the surface roughness, and also the possibility of some small contribution from the engines to the lowest noise levels cannot be ruled out.

The surface of a hovertrain would probably be similar aerodynamically to that of an aircraft fuselage. The more advanced prototypes appear to be well streamlined and presumably it would be a design aim to minimise the

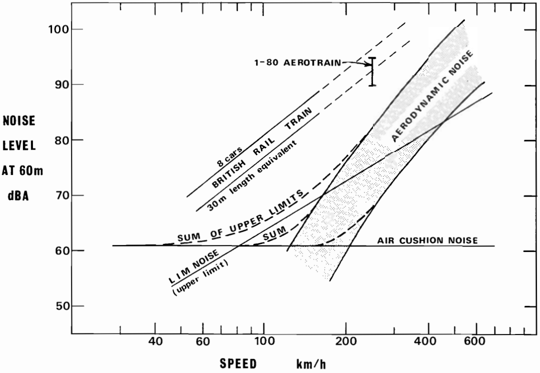

Fig. 1. Estimated noise levels as a function of speed for a 30 m long hovertrain vehicle powered by Linear Inducation Motors (LIMs), at a distance of 60 m. Also shown are the measured noise levels of the 30 m long French 1-80 Aerotrain (powered by aircraft engine) and of a conventional electric train on welded rails (British Rail). The British Rail measurement is extrapolated beyond 160 km/h.

disturbance to flow in future vehicles. The small clearance between the base of the vehicle and the guideway may be source of additional disturbance, increasing the noise somewhat on that expected theoretically. Based on these considerations, a reasonable estimate of aerodynamic noise radiated by a hovertrain vehicle would be that it should lie within the range from the level predicted by Tam's theory to a level about 15 dB higher. Well designed vehicles offering minimal disturbance to the air flow could be expected to produce noise levels in the lower half of this range while higher noise levels could be expected where there is significant departure from streamlined body shape with angular projections from body surfaces etc. analogous to aircraft flaps and landing gear.

It should be noted that such estimates would apply to a single vehicle moving in isolation to others. Where a number of vehicles are coupled together to form a train, all except the first would be moving in the turbulent wakes of the ones in front, with a substantial increase in the radiated noise unless the design of the coupling is such that the train appears aerodynamically as though it were one continuous body. Indications are, however, that vehicles on high speed routes would be operated individually.

The aerodynamic noise estimates for a 30 m long vehicle at a distance of 60 m are shown in fig 1 as a function of speed. The lower limit of the range of levels is the boundary layer noise determined using Tam's theory. The noise would be fairly broad band with a broad peak in the region of a few hundred Hertz (according to Tam's theory). The actual frequency of the peak varies with speed, and results in the A weighted level rising slightly more rapidly with speed than the linear level. The Perceived Noise Level (PN dB) can also be estimated from the spectra and would be approximately 11.5 dB above the A-weighted level for the speeds shown. The noise would presumably sound like a roar, somewhat like the interior noise of an aircraft at a point well away from the engines. The presence of protuberances or cavities in the surface of the vehicle would, however, introduce tonal components into the aerodynamic noise.

Discussion

Figure 1 shows the estimated levels of the various noise components radiated from a 30 m long hovertrain vehicle at a distance of 60 m, as a function of speed. The least reliable estimate is that of the linear induction motor noise, which is an estimate of the upper limit only – the actual noise may be well below this.

It is evident from these estimates that aerodynamic noise would predominate, at least at high speeds, on LIM powered vehicles. Where aircraft engines are used, these are likely to be the predominant sources of noise, as on the French 1-80 Aerotrain (also shown in fig 1) producing considerably higher noise levels. Also shown in fig 1 is the noise of a British Rail electric train on continuous welded rails, scaled to the equivalent of a 30 m long vehicle (from ref 2). A train of 8 or so carriages would be 4 or 5 dBA higher. This could be considered typical of modern conventional steel wheel on steel rail trains. It is evident that LIM powered hovertrains would be 10 to 20 dBA quieter than conventional trains (at comparable speeds) except perhaps at the very low speeds where air cushion noise is prominant. Even so, at speeds around 400 km/h where some hovertrains would operate, average noise levels are likely to be comparable to those of conventional trains at 160 km/h (the present maximum on British Rail). This presents no less of a problem than a quiet, modern jet aircraft about 2 miles from touch down, and may necessitate reduced speeds in built up areas. There would thus appear to be a case for careful attention to vehicle design to ensure that the aerodynamic noise is kept to a minimum. The use of aircraft engines on hovertrains pose particular noise problems, and considering that Linear Induction Motors present a viable alternative it seems likely that most future designs will use LIMs.

Because the aerodynamic noise has dipole directivity, the rate of rise and fall of the noise level as a vehicle passes an observer would be considerably more rapid than for a simple line source. The noise would vary somewhat over the surface of the vehicle, however it could be considered, as an approximation, as due to a line of uniform dipole sources. The variation of noise with time as the vehicle passes an observer, or the variation with distance from the vehicle would then be according to the model in reference 2.

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REQUIREMENTS & RECOMMENDATIONS FOR MOTOR VEHICLE NOISE EMISSION IN AUSTRALIA

C. E. MATHER

SUMMARY

This paper reviews the current requirements and test procedures used to limit motor vehicle noise emissions in Australia and refers to some of the problems and deficiencies associated with them.

The motor vehicle is claimed to be the major source of noise at the majority of residential sites. The noise emitted by an individual vehicle varies in terms of many parameters, including its speed over the ground, engine speed, throttle position, type of tyre tread, condition of repair and adjustment, loading conditions and the smoothness of the road surface.

In Australia, present and proposed requirements and recommendations relating to motor vehicle noise generally fall into two categories — those for new vehicles and those for in-service vehicles. With regard to new vehicles, noise emission requirements exist at both the National and State levels.

The National requirements for motor vehicle noise emission have been laid down by the Australian Transport Advisory Council (A.T.A.C.) in Australian Design Rule 28 — Motor Vehicle Noise. This rule was prepared by the Advisory Committee on Safety in Vehicle Design — Augmented Committee on Motor Vehicle Noise and was endorsed by A.T.A.C. in July, 1972. Its requirements are applicable to passenger cars and their derivatives and multi-purpose passenger cars manufactured on and after January 1, 1973; petrol engined commercial vehicles manufactured on or after July 1, 1974 and all other vehicles manufactured on and after July 1975. (See Table 1).

The only State requirements are laid down in the Tasmanian Environment Protection (Noise) Regulations 1974, which state in regulation 3 (1) that "no person shall drive a motor vehicle (not being an earth moving machine) that emits a noise of a greater level than that specified in relation to that Vehicle in Schedule 1." (See Table 1).

Compliance with ADR 28, together with all other appropriate ADR's, is a pre-requisite for registration of new vehicles in all States and Territories. ADR 28 is based on the United Nation's Economic Commission for Europe (E.C.E.) Regulation 9 Uniform Provisions Concerning the Approval of Vehicles with Regard to Noise. At the time of its preparation, ADR 28 was regarded as an interim standard only and A.T.A.C. noted, when endorsing it, that a second stage rule, prescribing lower noise levels and appropriately longer lead times was desirable. Consequently, a further two stage proposal is being prepared for new vehicles.

The first stage, a short term proposal recommended to A.T.A.C. for endorsement at its next meeting by the Drafting committee, follows the principles of ADR 28 procedures. However, it is proposed to produce a separate rule for motor cycles as a matter of urgency, with a test procedure which produces noise levels more representative of those obtained under urban operation. The second stage will be for the longer term and probably involve a further reduction in permissible noise levels and a change in test procedure to more effectively simulate the noise potential of vehicles on the road.

The permissible noise levels in the short term proposal, known as ADR 28A, generally follow those put forward for adoption within the European Economic Community (E.E.C.), and are of the order of 3 to 5 dB (A) lower than the present ADR 28 levels except for motor cycles, the levels of which remain the same as those in ADR 28. The test procedure has been modified to clarity certain points and is slightly more rigorous than, but basically similar to, ADR 28.

The Tasmanian requirements are similar in many respects to ADR 28 but are divided into fewer categories and have some marginally different noise levels within categories.

The recently proclaimed New South Wales Noise Control Act includes provisions for the suspension of the registration "of any motor vehicle that does not comply with the regulations". However, these regulations have as yet to be promulgated.

In addition to these National and State requirements, the Standards Association of Australia has issued a draft Standard for public review entitled Measurement of the Determination of Motor Vehicle Noise Emission. This draft includes staged, recommended noise levels with Stage One intended for immediate application. These levels are very similar to the ADR 28 levels, but there is a reduction in the number of categories and a slight difference in noise levels. (See Table 1).

TEST PROCEDURES

Generally, maximum noise testing is used for describing noise emissions from new motor vehicles. This is useful mainly from describing low power-to-weight ratio vehicles which tend to operate at high performance levels. A more typical condition, such as part throttle acceleration, may better describe the majority of passenger vehicles which comprise most of the traffic mix. (For these vehicles, there is a considerable difference between normal operating conditions and maximum noise producing situations.)

CATEGORY OF VEHICLE	MAXIMUM NOISE LEVEL, dB(A)					
	ADR 28	SAA DR 75075			TAS. ENVR PROT. REG 1974	
		STAGE 1	STAGE 2	STAGE 3	MV PRE '75	OTHER MV
MOTOR CYCLES	JULY 1 1973					
WITH ENGINE CAPACITY -						
≮ 125 ML	82	80	75	70	82	80
OVER 125ML	-	85	80	70	-	-
OVER 125ML BUT ≮ 500ML	84	-	-	-	84	82
OVER 500ML	86	-	-	-	86	84
THREE-WHEELED MOTOR VEHICLES	85	85	80	70	-	-
MOTOR VEHICLES WITH FOUR OR MORE WHEELS						
PASSENGER CARS AND UTILITIES		-	-	-	84	80
PASSENGER CARS, PASSENGER CAR DERIVATIVES AND MULTI-PURPOSE PASSENGER CARS	JAN 1 1973 84	84	75	70	-	-
OMNIBUSES WITH A GROSS VEHICLE MASS -						
≮ 3·5T	JULY 1 1973	85	80	75	-	-
≮ 4·5MG	85	-	-	-	-	-
OVER 4·5MG WITH ENGINE OF ≮ 150NEP	89	-	-	-	-	-
< 3·5T	-	89	85	80	-	-
OVER 4·5MG WITH ENGINE OF < 150NEP	92	-	-	-	-	-
OTHER VEHICLES WITH GROSS VEHICLE MASS -						
≮ 3·5T	-	85	80	75	-	-
≮ 4·5MG	85	-	-	-	-	-
< 3·5T BUT ≮ 12T	89	89	85	80	-	-
OVER 12MG WITH ENGINE OF ≮ 150NEP	92	-	-	-	-	-
< 12T	-	92	85	80	-	-
< 12MG WITH ENGINE OF < 150NEP	92	-	-	-	-	-
< 3·5T WITH ENGINE OF ≮ 150NEP	-	-	-	-	89	85
< 3·5T WITH ENGINE OF < 150NEP	-	-	-	-	92	87

NOTE RE ADR 28 ONLY.
ALL PETROL ENGINED VEHICLES - JULY 1, 1974.
ALL MOTOR VEHICLES - JULY 1, 1975.

Table 1. Maximum Permissible Noise Levels.

CATEGORY OF VEHICLE	MAXIMUM NOISE LEVEL, dB(A)	
	7·5M	0·5M
MOTOR CYCLES WITH ENGINE CAPACITY -		
$\not>$ 125 ML	80	100
OVER 125 ML	85	105
THREE-WHEELED MOTOR VEHICLES	85	105
MOTOR VEHICLES WITH FOUR OR MORE WHEELS		
PASSENGER CARS, PASSENGER CAR DERIVATIVES AND MULTI-PURPOSE PASSENGER CARS	84	100
OMNIBUSES WITH A GROSS VEHICLE MASS -		
$\not>$ 3·5T	85	105
< 3·5T	89	110
OTHER VEHICLES WITH GROSS VEHICLE MASS -		
$\not>$ 3·5T	85	105
< 3·5T BUT $\not>$ 12T	89	109
< 12T	92	112

Table 2. Maximum Permissible Noise Levels.

A. Approval Tests

The test procedures for moving vehicles in ADR 28 and the S.A.A. draft standard are similar (the former document has a moving vehicle test only), except that the S.A.A. draft differentiates between low and high speed tests[1] and ADR 28 uses only one speed (similar to the low speed of the S.A.A. draft).

The S.A.A. draft also includes provisions for an acceleration from standing start test as well as a stationary vehicle test to enable a comparison between approval and in-use test data.

The adequacy of the current ADR 28 test for evaluating the noise potential of vehicles in traffic situations is being studied. To assist this, a test programme, including a series of different procedures and a range of vehicle types, was conducted early last year[2]. So far, it appears that there is no presently available test superior to that used in ADR 28, and that there could be merit in adopting different test procedures for different vehicle types. In particular, motor cycles showed a lack of replication owing to their inherent performance – even with a skilled rider the test was difficult to repeat with a sufficient degree of accuracy.

B. In-Service Tests

With regard to in-service vehicles, ADR 28 does not cover these but the S.A.A. draft code prescribes maximum permissible noise levels which are arbitarily chosen as equivalent to the Stage 1 levels for new vehicles. (See Table 2).

A moving as well as stationary test procedure is prescribed, preferably to be as similar as possible to the tests detailed for approving vehicles. In addition, there is provision for a body noise test which employs a removable mound placed across the test site.

As well as these draft recommendations, the Victorian Environmental Protection Authority has recently conducted experiments aimed at limiting noise emissions from in-service vehicles. For passenger cars and passenger car derivatives, the noise levels are signifi-

1 ADR 28 approach speed: 50 km/hr with tolerances of + 5 km/hr and – 1 km/hr, or 75% of engine speed at which the engine develops its Net Engine Power (NEP), or 75% of maximum engine speed.
S.A.A. draft code approach speed: low speed test – 60 km/hr or 75% of maximum engine speed. High speed test – 80 km/hr or 75% of maximum engine speed.

2 Motor vehicle noise test programme conducted in Mangalore, Victoria, 1975.

cantly less than those contained in the draft Australian Standard, although the method of test used differs only slightly from that specified in the draft standard. A.T.A.C. is also looking at limiting noise from in-service vehicles through its Advisory Committee on Vehicle Performance.

What appears to be needed is an easily performed test, which can check on a noise emission level obtained at the time of the approval test.

CONCLUSIONS

Future motor vehicle noise emission requirements that are effective in terms of the cost the community is prepared to pay should be evaluated carefully. The limit for motor noise emissions appears to be around 70 dB(A), when body and tyre noise start to dominate. One European manufacturer, whose car has been tested in accordance with ADR 28, already achieves 73-74 dB(A) with its six cylinder model.

The Australian community has not yet had the opportunity to fully experience the effects of ADR 28 since only about 20% of passenger cars and derivatives and very few other vehicles currently in use have been subject to ADR 28 requirements. However, it is likely that these noise emissions will be regarded by many as too high.

It appears that the best strategy to reduce noise annoyance initially is to reduce the peak noise levels, then to reduce the average noise levels. However, if we are to pursue the motor vehicle transportation mode, an adequate strategy must include not only the limiting of vehicle noise emissions, but also highway design, planning standards and, most importantly, meaningful enforcement.

TECHNICAL NOTE

FREQUENCY MODULATION RADIO

John A. Moffatt

The following technical note is a resume of a talk given to members of the Victorian Division by Mr. Frank Brownless, Chief Engineer for the Australian Broadcasting Control Board. The talk was presented at the 24th Technical Meeting held at Monash University on 20th February, 1976.

During the last twenty years there has been a significant change in the relationship between society and technology. Previously, society wanted all that technology could produce, and technology was hard pressed to provide all that was wanted. Since then technology has advanced so far that it can provide alternative means of satisfying the needs, and society can choose between these alternatives.

In radio broadcasting the availability of channels follows this trend. There used to be a scarcity of channels, all in the medium frequency (MF) broadcasting band, because it was only possible to provide the required service using this band, and the band could only handle 100 channels for the whole of Australia. Licences were coveted and strict controls were imposed. There is now a relative abundance of channels for two reasons:

- (i) The development of very high frequency (VHF) and ultra-high frequency (UHF) technology to the point where it is capable of providing a broadcasting service.
- (ii) The usage of the MF band has changed. It is no longer regarded as a right to have interference-free reception at great distances from transmitters, in what was the secondary service area. Channels previously unused in order to keep this secondary service area free of interference are now being used. This doubles the number of channels.

There has been much discussion about the best way to utilize the extra channels, especially those in the VHF and UHF spectrum, and two committees have investigated the matter for the Australian Government.

The first committee, chaired by Professor Huxley, had to consider the introduction of more T.V. channels to meet unexpected demand, as well as future FM broadcasting. The recommendation was that the extra T.V. channels be in the VHF spectrum, as were the existing ones, and that some be in the band 88-108 MHz, which was used by some countries for FM sound broadcasts. It was also recommended that future FM sound be in the UHF spectrum, above 300 MHz. These recommendations were adopted by the Government in about 1960, and by now about a quarter of T.V. viewers watch channels in the band 88-108 MHz.

In 1972 the Australian Broadcasting Control Board recommended the introduction of the planned UHF/FM sound broadcasts. However the McLean committee, appointed by the Government, were given the task of reconsidering the matter, with wider scope to include the possibility of moving T.V. channels. This possibility was not open to the previous committee, nor to the A.B.C.B. The McLean committee recommended that the band 88-108 MHz be cleared of T.V. and used for FM sound broadcasts. This involved moving channel 3 T.V. down to below 88 MHz, into a region occupied by about 15,000 mobile radio telephone users, and moving channel 4 T.V. up to about 200 MHz, a region occupied by the distance measuring equipment (DME) of Australian aircraft. Channel 5 was to be deleted.

The A.B.C.B. supported these recommendations, as did the Australian Government. Civil aviation and telecommunications authorities were less enthusiastic.

The change of approach to MF/AM broadcasting, allowing use of extra channels, had by now taken some pressure off the FM broadcasting problem.

It was decided that international standard would be used for the new VHF/FM service, which would allow for stereo broadcasting. There are in fact two systems for stereo FM used overseas. The "Western" countries use the pilot-tone system, and the "others" use a system of polar modulation. The differences are not as great as the advocates of each system claim. The pilot-tone system has been adopted here.

The pilot-tone system of stereo broadcasting is an "add-on" method, originating overseas where there has been VHF/FM mono broadcasting for many years, because of earlier pressure for more channels. FM was first developed in the USA before the war, but was commercially developed in Germany because Germany lost its MF/AM channels when it lost the war. When interest in stereo reached the point where stereo broadcasting was considered desirable, a system was required which would allow stereo broadcasting to be received by mono receivers, in mono. The pilot-tone method gives this compatability. Even now in Germany, which has the most developed FM broadcasting system, there are more mono receivers than stereo.

The essence of the pilot-tone system of stereo broadcasts is as follows.

A mono signal, Left + Right, occupies 0 to 15 kHz.

A difference signal, Left-Right, occupying 0 to 15 kHz, is used to amplitude modulate a 38 kHz carrier, thus occupying 38 kHz ± 15 kHz = 23 to 53 kHz.

The 38 kHz carrier is suppressed, and a pilot-tone of 38 kHz ÷ 2 = 19 kHz is generated.

The total of these signals makes a composite signal occupying 0 to 15 kHz, 19 kHz, 23 kHz to 53 kHz.

The composite signal is used to frequency modulate a VHF carrier, which is broadcast.

If there is to be no detrimental effect on mono receivers the mono signal, Left + Right, must account for most of the radiated power. This allows little power for the difference and pilot-tone signals. The range is therefore good for mono but rather less for stereo. Outside the range where sufficient difference and pilot-tone signals are received a receiver can still pick up the mono signal.

The first-used method of decoding the stereo information in the receiver, a method which is widely used, is to separate the three signals 0 to 15 kHz, 19 kHz, and 23 to 53 kHz using bandpass filters, after the normal FM demodulator. The 19 kHz pilot-tone is doubled to re-create the 38 kHz sub-carrier, which is then used to operate an electronic switch at this rate, to produce $(L+R) - (L-R) = 2R$ and $(L+R) + (L-R) = 2L$. These are the required left and right stereo components. A mono receiver ignores the pilot-tone and L—R signal and responds only to the L+R signal. Alternative methods of decoding are now coming into use. These eliminate the need for bandpass filters.

It should be noted that the pilot-tone system need not be confined to FM broadcasting. It can be used whenever it is required to carry two sets of information on the one broadcast channel, provided that the channel is wide enough.

Most, but not all, of the parameters of the VHF/FM pilot-tone broadcasting system have been standardised throughout the countries using it. In Japan and Italy the frequency range 75 to 90 MHz is used. In much of Europe 88 to 100 MHz is used. In the USA, 88 to 108 MHz is used, and this has been adopted in Australia. The deviation, a measure of the channel width, is internationally 75 kHz, and we have adopted this. High frequency pre-emphasis and de-emphasis, on transmission and reception respectively, is used to improve the signal to noise ratio. The time constant of the resistance-capacitance network used to do this in Europe is 50 microseconds, whereas it is 75 microseconds in the USA. We have adopted 50 microseconds.

A very interesting parameter which had to be fixed is the signal polarization during propogation, governed by the orientation of the transmitting aerial.

The method of reception of FM signals is such that noise impulses and hiss, which are fluctuations in the amplitude, produce little audio output. However it was found in the early days of VHF/FM that radio noise emitted by motor vehicles had to be considered. Although the noise generated by ignition, rubbing metal, etc. is completely random in initial polarization, the car body, being a metal object insulated from and standing above the electrically conductive ground, is a more efficient radiator of vertically polarized waves. This led to the use of horizontal receiving aerials, which pick up less vertically polarized waves, and hence horizontally polarized transmitting aerials.

The increasing use of radio receivers in cars has forced manufacturers to take some steps to reduce radio noise emissions from cars, and furthermore VHF/FM radios can be made much more portable, and are being installed in cars. These factors have made it both possible and desirable to use vertical aerials, hence vertical polarization. In the USA there is a trend from horizontal to vertical. In the UK there is a trend from horizontal to slant. In Germany the feeling is that it doesn't matter much, because polarization rotation occurs during propogation. The ABCB has made a provisional recommendation that VHF/FM sound broadcasts use the same polarization as TV broadcasts in the same locality.

Locations, frequencies and powers of transmitters has been given detailed consideration. It has been found that in cities a signal strength of at least 3mV is required for mono reception, and 5mV for stereo. In the country, where there is less radio noise, much lower signal strengths are useable, particularly for mono. However, getting a signal is easy compared with keeping out unwanted signals. The closer another signal is in frequency, the lower must be its signal strength of prevent interference. Maximum interference to stereo FM signals occurs at a frequency separation of 38 kHz, the sub-carrier frequency, and the degree of interference does fall off a little at closer spacing, although it still is worse than for mono signals. When the transmitters are scattered throughout the area being served it is found that a frequency separation of 800 kHz is needed between adjacent channels.

Interference to and from other services is always important in any broadcast service, and the ABCB have considered this very carefully. Although there will be no other radio services in the 88 to 108 mHz band, harmonics of other radio and TV transmissions, and fundamental and harmonics of local oscillators in radio and TV receivers can fall in this band. Similarly, harmonics from VHF/FM radio transmitters and fundamental and harmonics of local oscillators in VHF/FM receivers can cause interference both inside and outside the 88 to 108 MHz band.

Intermodulation, an undesirable non-linearity in the front end of receivers in the presence of strong signals, can also result in interfering signals. There is a strong case for co-siting of all transmitters, to that it is not necessary to listen to a weak station in the presence of a strong interfering signal.

The ABCB has taken all these factors into consideration in planning frequency allocations for the VHF/FM stereo broadcast service.

At the moment the ABC operates a high power transmitter on Mt. Dandenong, at the same site as the TV transmitters. The Music Broadcasting Society of Victoria has a transmitter at Kew. The Royal Melbourne Institute of Technology has an experimental licence and will be transmitting soon. In Sydney there are also ABC and Music Broadcasting Society stations. In Brisbane the Queensland University Union has a station, and in Adelaide and Canberra there are ABC stations only. Present plans are for 14 ABC transmitters to be operating within the next three years, but the plans are subject to review by the present governmet.

After a number of questions from the audience Mr. Gerald Riley, who has known Mr. Brownless for many years, spoke of the efforts that Mr. Brownless had put into his work with the ABCB, and of the difficulties which he had encountered during the heated arguments leading up to the introduction of VHF/FM stereo broadcasting. Mr. Riley then proposed a vote of thanks, which was passed by acclamation.

BOOK REVIEWS

ROAD TRAFFIC NOISE

A. Alexandre, J. — P. R. Barde, C. Lamure and F. J. Langdon. Applied Science Publishers, London, 1975. vii + 219 pp; illus; index. Ptice 8 pounds sterling

In discussing the control of any form of pollution, it is becoming increasingly clear that only a truly inter-disciplinary approach can be expected to produce worth-while results. This book, which the authors believe to be "the first attempt at a general survey of the problem" of road traffic noise, gathers contributions from workers in a number of different fields, in an attempt to gain an overall view of what should and what can be done to alleviate the problem.

Langdon discusses what should be done — the physio-logical and psychological effects of present and possible future levels of noise on man. Lamure discusses technical aspects of noise production and ways in which it may be reduced, and Alexandre and Barde discuss legislative, administrative and economic tools which may facilitate its reduction.

The book appears to be aimed at a reader with some scientific background (one who understands the meaning of dB(A) and Gaussian distributions, for instance), but no knowledge of this particular problem. For such a reader, it could provide a good general understanding of both the difficulties facing workers at the present time and the results which may be expected in the future.

An interesting point to emerge from Lamure's analysis is that the most promising method for the reduction of noise is by suitable town planning and orientation of houses. This, he believes, could reduce current noise levels by 15dB(A). In comparison, noise barriers at the sides of major roads could reduce levels by only 8-10 dB(A), as well as being visually unattractive, and noise from vehicles themselves can be expected to be reduced by only about 5dB(A) in the near future. Unfortunately, it would appear from the chapters by Alexandre and Barde that legislators and administrators have investigated these solutions in the reverse order of priority, indicating the need for an inter-disciplinary approach.

In discussing technical details, the book contains a number of small but annoying defects, such as unlabelled or confusingly-labelled graphs. However, in a book designed to give an overview of the subject, these are not critical. Each chapter is adequately referenced, so that technical points may be followed up.

In general, the aim of the book — to give a complete picture of the problem of road traffic noise by bringing together ideas from a number of different fields — has been achieved as well as could be expected in a book of its (moderate) size. It should serve to give workers in all these fields, and anyone interested in road traffic noise, a better view of the problem as a whole.

Reviewed by Robert Bullen

ENVIRONMENTAL ACOUSTICS

Leslie L. Doelle. McGraw Hill 1972. X + 246 pp; illus; index; Price: $24.75

It is always a pleasure to hear or read a topic discus-sion by a master in the field, especially if he is one of those chosen few who not only recognises the fundamentals of the field, but also has that rare gift of the ability of presentation

Leslie L. Doelle is just such an author, and his book is a must for all who are in any way interested in those areas of environmental acoustics concerning room (or space) acoustics, rooms for speech or music, auditoria design, special purpose spaces, sound insulation, noise criteria, and all other forms of sound control in specific types of buildings.

The author has utilised his wide practical experience over twenty years as an architect, engineer, consultant and teacher in acoustics to compile a remarkable book of photographs, illustrated drawings and data sheets. Simple and practical recommendations, with ample references to actual installations, suggest possible design solutions which might be transferred straight to the drawing board.

This is not a heavy theoretical textbook, but a day-to-day practical reference manual that will become as useful as the Machinery Handbook to be found on every self-respecting engineer's bookshelf.

Reviewed by James A. Madden.

ACOUSTICS AND VIBRATION PROGRESS VOLUME 1.

Edited by R.W.B. Stephens and H. G. Leventhall. Chapman and Hall, London 1974, 243 pp., Price: UK 6.00 stg.

Many notable advances have been made in acoustics in recent years. Two of the most important have been decisions to review and consolidate knowledge in the rapidly diversifying areas of acoustics. The Journal of the Acoustical Society of America is regularly publishing "Tutorial" papers and now Chapman and Hall are publishing a series entitled, "Acoustics and Vibration Progress", edited by two eminent acousticians, Stephens and Leventhall of Chelsea College, University of London.

Volume One of "Acoustics and Vibration Progress" contains five sections:

(i) Traffic Noise by M. E. Delaney
(ii) Acoustic Emission by A. A. Pollock
(iii) Chemical Aspects of Ultrasonics by A. S. Sliwinski
(iv) Vibration and Noise Transmission in Building Structures by H. M. Nelson
(v) Underwater Ambient Noise by E. M. Arase and T. Arase

There will be few people with an interest and ability sufficient to follow in detail the five chapters. In this respect it is a pity that such diversified topics are presented in one volume. On the other hand it does encourage delving into topics that would otherwise be ignored or overlooked.

There are two possible criticisms of the text:

(i) Non-uniformity of presentation. There is a lack of uniformity in the depth of chapters and reference systems used, for instance. This criticism does not apply to the index which is uniformly excellent.
(ii) A lack of sufficient introduction in some cases. This is particularly marked in the chapter on Underwater Ambient Noise where it is nowhere stated why the work is being undertaken though presumably its main use is in the underwater detection of ships and submarines with other applications being in fisheries and geological and oceaneographic surveys.

Volume One is very relevant to the building industry. Besides the chapter on vibration transmission, by Professor Nelson, (University of Sydney) whose relevance is immediately apparent, there are two other chapters of interest. The prediction of traffic noise is of importance to designers because road traffic represents the most common source of noise disturbance in Western cities. Acoustic Emission, the study of ultrasonic noise emitted when structures are stressed, has obvious applications in buildings, both in testing, location of faults and determination of loads in members. It should be stressed though that this volume is not one for the practitioner looking for immediate applications; it is one for the R & D department.

Even though the theory is available it would appear from the chapter on Vibration and Noise Transmission in Building Structures, that the time when designers can estimate the vibration and noise levels in buildings is still a long way off. This is mainly because of the complexity, anisotropy and multi-resistant response of large structures in the audio frequency range. The world obviously needs another Wallace Sabine to work on structures.

Delany's chapter gets closest to being a design manual, but he and Nelson have depressing news for the designer. Even if traffic noise levels could be accurately predicted and hence compliance with existing environmental noise ordinances achieved, approximately 50 per cent of the public would still be dissatisfied. If existing building codes are followed, which set minimum standards of construction aimed at achieving an acceptable level of sound insulation, there is no guarantee that acceptably low levels of noise will result.

Reviewed by Fergus Fricke.