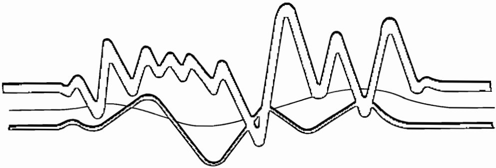
The Bulletin

OF THE AUSTRALIAN ACOUSTICAL SOCIETY

Volume 9, Number 1, April 1981



Addresses for Correspondence

Correspondence to the Society on National matters should be addressed to:

The General Secretary, Australian Acoustical Society, Science Centre, 35 Clarence Street, Sydney, N.S.W., 2000.

Correspondence to the Society on regional matters should be addressed to the appropriate Division Secretary as set out below:

N.S.W. Division (includes Queensland & A.C.T.): Mr. G. Patterson, C/ Science Centre, 35-43 Clarence Street, Sydney, 2000.
S.A. Division (includes N.T.): Mr. R.W. Boyce, P.O. Box 87, Hindmarsh, S.A., 5007
Vic. Division (includes Tasmania): Mr. W.J. Kirkhope, P.O. Box 130, Kew, 3101.
W.A. Division: Dr. V. Alder, 10 Parkway, Nedlands, 6009

Address for Correspondence to The Bulletin

Mr. R.J. Law, c/o 240 Victoria Parade, East Melbourne, Victoria, 3002.

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- The Bulletin is published by the Australian Acoustical Society, 35-43 Clarence St., Sydney, NSW, 2000.

EDITORIAL

MOONDAH

I would like to share with members some of my experiences from attending a recent Management Development Program at the Australian Administrative Staff College.

The college has been housed since 1957 in a 19th century mansion (Moondah) set in 9 hectares of sumptuous gardens at Mt. Eliza, on Port Phillip Bay. The college was founded on a recommendation of the Rotary Club of Sydney and is now recognised world wide as an important management training institution. The Council of the college comprises the most senior executives of Australia's largest corporations and government bodies.

Two types of courses are offered at Moondah: the Management Development Programs (MDP's) and the Advanced Management Programs (AMP's). Both are fully residential, intense courses lasting 5 to 6 weeks respectively (only one weekend is free and there is normally scheduled work until 9.30 p.m.). The MDP's are usually attended by managers in their mid 30's and the AMP's by senior managers in their mid 40's or older. Only 60 students attend a given course and the fees are $3,400 for the MDP course and $4,800 for the AMP course. Scholarships are available to managers from small businesses.

The courses are based on a mixture of syndicate work, formal lectures and talks from invited speakers, with syndicate work being the main component. Some of the invited speakers on the course I attended were Mr. Bob Ansett of Budget Rent-a-Car, Mr. Ken Stone, Secretary of the Victorian Trades Hall Council, and Mr. Paul Everingham, Chief Minister of the Northern Territory.

The membership of each syndicate is chosen very carefully by the college to ensure the broadest make-up possible. My syndicate included a trade union leader, a television executive producer, two production engineers, the owner of a chain of supermarkets, a senior banker, an accountant and an executive officer of the YMCA. There are five syndicates comprised of twelve members each.

The course content varies from formal lecture series on such topics as The Australian Economy, Accounting and Financial Control and Quantitative Methods, to syndicate work on subjects such as Motivation, National Policy Issues, Industrial Relations and Integrative Management. In all, twenty subjects are studied. The lecture notes and study papers are excellent and the back-up facilities are superb (e.g. on-line computer facilities).

Syndicate members act in turn as Chairman and Secretary for the various subjects and case studies and are responsible for formally reporting the syndicate views or findings to plenary sessions.

The aim of the course is not so much to teach skills (although this is certainly done) but rather to promote self-questioning by the individual of his or her previously held beliefs. This is facilitated through the constant interaction with other managers from widely differing backgrounds. The atmosphere at Moondah is such that exchanges of opinion are open and frank and the desire to learn the other fellow's point of view is strong. It is a very enriching experience.

Rob Law, Editor.

NEWS & NOTES

HUGH VIVIAN TAYLOR

Born 19th December 1894. Died 15th March 1981.

The Society records with deep regret the passing of Hugh Vivian Taylor, and extends its deepest sympathy to his son Hugh, daughter Helen and daughter-in-law Ann.

Educated at Scotch College, East Melbourne and later at the Working Men's College, Melbourne (now R.M.I.T.) and at Swinburne Technical College (1907-1915).

He served in the A.I.F. from 8th October, 1915 to 9th July, 1916, then in the R.A.E. from 10th July, 1916 to 20th September, 1919. During his Service life, the major areas of deployment were in submarine minefield work at Port Phillip Bay Entrance and in communication networks.

After the 1st World War he was employed as assistant to Carleton and Carleton Architects of Melbourne, from 22nd September, 1919 to 10th August, 1923.

Vivian was admitted as an Associate to the Royal Victorian Institute of Architects in 1921 and registered as an Architect in Victoria during 1923.

Private practice was commenced late 1923, concentrating at first on commercial and domestic architecture.

Interest in acoustics began in 1923, publications available for study were the collected papers of W.C. Sabine, and later the then contemporary works of F.R. Watson, P.E. Sabine, V. Knudsen and H. Bagenall. Vivian Taylor commenced working professionally in acoustics in 1928. The initial projects being churches, public halls and some industrial work.

In 1929, the sound film (then called the "Talkies") was introduced; in 1929 alone some 300 theatres were equipped with sound reproduction systems. The resultant acoustic conditions were of course not suitable by any means. From 1930 to 1941 at least 434 theatres and public halls were handled by his office. Some were acoustically treated, but many were new developments for which he was engaged as both architect and acoustic consultant. Jobs involving architectural and acoustic services included:- Windsor Theatre; Regal Theatre; Hartwell; Hoyt's; Albury; Padua; Brunswick; Ozone; Mildura and Rivoli, Camberwell.

Perhaps one of the projects of which he was most proud was the South Australian Parliament House, for which he was consulting architect and acoustic consultant, 1935-40. When a pin is dropped on the speakers table it is clearly audible in all parts of the Chamber and in Hansard, Press and Public Galleries.

Membership of the Acoustical Society of America was gained in 1931.

The period of 1940-1956 was one of intense committment to the Australian Broadcasting Commission. As Architect and Acoustic Consultant, he designed and documented A.B.C. facilities throughout all States and in Port Moresby.

From 1964, H. Vivian Taylor attended the meetings leading to the formation of the Victorian Acoustical Society, which was eventually fused with Societies from other States to form the Australian Acoustical Society in 1971. Vivian was elected founding President.

He was created a Member of the Most Excellent Order of the British Empire by her Majesty, Queen Elizabeth II, in June, 1968, for Services to Acoustics.

Life Fellowship of the Royal Australian Institute of Architects was granted in February, 1971.

Elected as first and sole Fellow to the Australian Acoustical Society in September, 1972.

Throughout Vivian Taylor's life, his drive, enthusiasm and capacity for thought enabled him to become an unparalleled success in his Professional fields of Architecture and Acoustics.

He will be greatly missed by his friends and associates.

ACOUSTICS ENGINEERS

We are looking for young enthusiastic mechanical persons, whose interests are in the noise control area. Applicants preferably will have had some experience in building services however, a recent graduate sales engineer or other technically inclined person should not be deterred from applying.

Work would involve all aspects related to sound control engineering and will enable the successful applicants to gain first class experience with an expanding acoustics manufacturer.

An attractive salary related to qualifications and experience will be negotiated.

All applications treated in the strictest confidence are to be addressed to:

General Manager
Advanced Acoustic Products Australia Pty Ltd
P.O. Box 82
Brunswick Vic., 3056

FUNDS FOR BIONIC EAR

Medical researchers who have developed a bionic ear to give aid to nerve-deaf people have received a $495,000 grant from the Federal Government for its commercial development. The ear, developed after more than nine years research by a team led by Professor Graeme Clark, of the University of Melbourne's Department of Otolaryngology, consists of an electronic device which converts normal sounds into electric impulses in the ear. Threee nerve-deaf patients have so far had prototypes implanted in their ears and can now hear and converse. The three, two men and a woman, are now testing the system as they go about their normal daily lives.

The next stage of the project is to further develop the wearable processor units which transit sounds to the receiver-stimulator implanted in the ear.

The receiver-stimulator consists of a small gold-plated electronic device which is implanted in the mastoid and connected by electrodes to the inner ear. This device then takes over much of the function of the inner ear which is to convey messages received as sound signals, to the brain.

The speech-processor consists of a tiny microphone which feeds sounds into a mini-processor-transmitter measuring 150 X 150 X 63 mm and weighing 1.7 kg which the patient carries in a shoulder bag. It is in fact a mini-computer. The mini-computer processes the speech into coded radio signals which flow to a coil attached to the person's ear - 5 mm from the implant inside the ear.

The signals flow from the coil through the skin to the implant which converts them to electric impulses which are fed to a multi-electrode array in the inner ear. The array consists of a bundle of ultra-miniature wires which make contact with the auditory nerve endings.

Until recently people with nerve deafness -also known as sensory neural deafness or deafness of the senses and nerves - had no hope of ever hearing.

Members of Professor Clark's team said that while the commercial side of the bionic ear was being studied the research project would continue in two directions. One was to ascertain how the device at its current stage - which worked well in laboratory conditions - worked with patients in their normal lives. The second was to continue the laboratory work to further reduce the size of the parts.

Professor Clark said it was not possible to estimate how long it would be before the bionic ear became commercially available. This would depend on commercial considerations.

NEW WIND TUNNEL TO INVESTIGATE AIRFLOW WITHOUT SOUND

An open jet wind tunnel has been constructed at the CSIRO, Division of Mechanical Engineering to carry out further basic research into the aerodynamics of bluff bodies.

There are three basic factors to be understood in investigating air flows around bluff bodies in a duct. These are the random velocity and pressure changes in the flow, the uniformly oscillating waves that can produce sound, and the vibration of the structure itself. All three factors can combine and interact to produce the industrial problems of noise and structural vibration (see EngEvents 3 and 10).

One way of understanding these industrial problems is to isolate and investigate each factor. Initially some work was done by the Division on flows with resonant sound and without mechanical vibration. Now, a project led by Martin Welsh will investigate flows around bluff bodies without resonant sound.

To do this, an existing wind tunnel has been modified by having the walls of the working section and the bellmouth removed and an extra fan added. The tunnel now has two fans, one pushing and one pulling air through the completely open working section of the tunnel. With this arrangement, the flow of air around a bluff body can be studied with the surroundings at atmospheric pressure and without any sound waves being reflected from the tunnel walls back to the flow.

COPIES OF I.C.A. PAPERS

The Society has arranged to continue to supply copies of papers presented at the 10th International Congress on Acoustics. Each copy will cost $3.00.

Requests should be forwarded to the Australian Acoustical Society.

Science Centre,
35 Clarence Street,
Sydney, N.S.W., 2000

JOINT MEETING

The New South Wales Division of the Acoustical Society will join with the Institution of Engineers, Australia in a joint meeting when an address will be delivered by Dr. D.A. Bies on "STATISTICAL ENERGY ANALYSIS - A TOOL FOR ACOUSTIC AND VIBRATION ENGINEERS."

The meeting will be held at the I.E. Aust Sydney Division Auditorium, 118 Alfred St., Milsons Point at 6.00 p.m., Wednesday 19th August, 1981. Supper will be served in the ante-room at 5.30 p.m.

ACOUSTICS AND SOCIETY

Cowes 18-19th September 1981

Australian Acoustical Society Conference and Annual General Meeting

THEME: Papers have been invited in the following areas:-

. Acoustics & Noise in Domestic Appliances

. Musical Acoustics

. Recreational Noise

. Occupational Noise

ATTRACTIONS:

. Phillip Island

. The Penguins

. Squash, Sauna, Golf, Tennis, Heated Pool

. Billiards, Table Tennis

Delegates will be encouraged to register on Thursday evening 17th September, 1981. A full programme for ladies will be arranged, so that they may see the renowned beauty of Phillip Island. Comfortable accommodation will be available at the Continental on a share basis.

Registration forms may be obtained from your Divisional Secretary, or, The Conference Convenor, D.A. Gray, Australian Acoustical Society, 117 Lonsdale St., Melbourne, 3000. TELEX AA35366.

Noise Rating Numbers

by

Graeme E. Harding
Knowland Harding Fitzell Pty. Ltd.

This paper reviews the origin and development of noise rating numbers; and shows by examples how noise rating numbers retain some advantages over other rating systems. A set of definitions and terminology applicable to noise rating numbers is proposed, and a table allowing direct conversion from octave band sound pressure levels to octave band noise rating numbers is introduced.

INTRODUCTION

A noise rating number is a single number measure of noise devised to correlate with subjective reactions to noise such as annoyance, sleep disturbance etc; as well as for assessing speech interference, hearing damage risk and similar.

In this regard a noise rating number is similar to the other single number measures such as dB, dB(A), dB(B), dB(C), dB(D), SC, NC, NCA, PNC, Noy, Sone, Phon, Level Rank, NNI, etc., etc. Many of these measures have fallen into disuse, some have always had and were intended to have a restricted, use, whilst a few such as dB(A), NC (now being superseded by PNC) and noise rating numbers remain as broadly applicable widely used measures.

Noise rating numbers were first introduced in 1961 at a conference held at the National Physical Laboratory in a paper presented by Kosten and Van Os (1); the paper included an extensive analysis of field data justifying the concept and use of noise rating numbers.

The noise rating numbers were first included in an Australian Standard in 1966 in AS B210 ref (2) and are currently published in AS 1469-1973 ref (3) and ISO R1996-1971 ref (4).

Although never stated in the literature it would seem that noise rating numbers must be a development from the NC and similar curves; refs (5) to (9).

WHAT IS A NOISE RATING

Broadly speaking a noise may be assessed by comparing the octave band sound pressure levels of the measured noise with a set of octave band criteria in the form of noise rating curves such as is also done when assessing measured noise against NC curves.

The advantage of noise rating curves compared to SC, NC, NCA, PNC, and similar curves is that the noise rating or NR curves have a mathematical basis that permits infinitesimal interpolation between the normal NR curves at 5NR increments. This mathematical basis also permits the inverse process of converting any arbitrary octave band sound pressure level to an octave band noise rating number.

A table of octave sound pressure levels corresponding to noise rating numbers at 5NR intervals (and corresponding noise rating curves) is shown in Fig. 1.

NR	Octave band sound pressure levels (dB)								
	Centre frequencies (Hz)								
	31.5	63	125	250	500	1000	2000	4000	8000
0	55.4	35.5	22.0	12.0	4.8	0	-3.5	-6.1	-8.0
5	58.8	39.4	26.3	16.6	9.7	5	1.6	-1.0	-2.8
10	62.2	43.4	30.7	21.3	14.5	10	6.6	4.2	2.3
15	65.6	47.3	35.0	25.9	19.4	15	11.7	9.3	7.4
20	69.0	51.3	39.4	30.6	24.3	20	16.8	14.4	12.6
25	72.4	55.2	43.7	35.2	29.2	25	21.9	19.5	17.7
30	75.8	59.2	48.1	39.9	34.0	30	26.9	24.7	22.9
35	79.2	63.1	52.4	44.5	38.9	35	32.0	29.8	28.0
40	82.6	67.1	56.8	49.2	43.8	40	37.1	34.9	33.2
45	86.0	71.0	61.1	53.6	48.6	45	42.2	40.0	38.3
50	89.4	75.0	65.5	58.5	53.5	50	47.2	45.2	43.5
55	92.9	78.9	69.8	63.1	58.4	55	52.3	50.3	48.6
60	96.3	82.9	74.2	67.8	63.2	60	57.4	55.4	53.8
65	99.7	86.8	78.5	72.4	68.1	65	62.5	60.5	58.9
70	103.1	90.8	82.9	77.1	73.0	70	67.5	65.7	64.1
75	106.5	94.7	87.2	81.7	77.9	75	72.6	70.8	69.2
80	109.9	98.7	91.6	86.4	82.7	80	77.7	75.9	74.4
85	113.3	102.6	95.9	91.0	87.6	85	82.8	81.0	79.5
90	116.7	106.6	100.3	95.7	92.5	90	87.8	86.2	84.7
95	120.1	110.5	104.6	100.3	97.3	95	92.9	91.3	89.8
100	123.5	114.5	109.0	105.0	102.2	100	98.0	96.4	95.0
105	126.9	118.4	113.3	109.6	107.1	105	103.1	101.5	100.1
110	130.3	122.4	117.7	114.3	111.9	110	108.1	106.7	105.3
115	133.7	126.3	122.0	118.9	116.8	115	113.2	111.8	110.4
120	137.1	130.3	126.4	123.6	121.7	120	118.3	116.9	115.6
125	140.5	134.2	130.7	128.2	126.6	125	123.4	122.0	120.7
130	143.9	138.2	135.1	132.9	131.4	130	128.4	127.2	125.9

FIG.1 OCTAVE BAND PRESSURE LEVELS CORRESPONDING TO NOISE RATING NUMBER

An inverse table of octave band noise ratings corresponding to octave band noise levels at 1 dB increments in the range 41 to 90 dB re 20μPa is shown in Fig. 2. Values for extending the table to higher or lower sound pressure levels are easily calculated from the equations and constants given in the formal definitions.

DEFINITIONS

Noise Rating Number:

The Noise Rating number NR is equal to the highest Octave Band Noise Rating NR_f calculated for the octave bands with centre frequencies from 31.5Hz to 8kHz.

L_{pf}	31.5	63	125	250	500	1000	2000	4000	8000
90.	50.8	69.0	78.2	83.9	87.5	90.0	92.1	93.8	95.1
89.	49.3	67.7	77.0	82.8	86.4	89.0	91.1	92.6	94.2
88.	47.9	66.5	75.9	81.7	85.4	88.0	90.1	91.8	93.2
87.	46.4	65.2	74.7	80.6	84.4	87.0	89.2	90.8	92.2
86.	44.9	63.9	73.6	79.6	83.4	86.0	88.2	89.9	91.3
85.	43.5	62.7	72.4	78.5	82.3	85.0	87.2	88.9	90.3
84.	42.0	61.4	71.3	77.4	81.3	84.0	86.2	87.9	89.3
83.	40.5	60.1	70.1	76.3	80.3	83.0	85.2	86.9	88.3
82.	39.1	58.9	69.0	75.3	79.3	82.0	84.2	86.0	67.4
81.	37.6	57.6	67.8	74.2	78.2	81.0	83.3	85.0	86.4
80.	36.1	56.3	66.7	73.1	77.2	80.0	82.3	84.0	85.4
79.	34.7	55.1	65.5	72.0	76.2	79.0	81.3	83.0	84.5
78.	33.2	53.8	64.4	71.0	75.2	78.0	80.3	82.0	83.5
77.	31.7	52.5	63.2	69.9	74.1	77.0	79.3	81.1	82.5
76.	30.2	51.3	62.1	68.8	73.1	76.0	78.3	80.1	81.6
75.	28.8	50.0	60.9	67.7	72.1	75.0	77.3	79.1	80.6
74.	27.3	48.7	59.8	66.7	71.0	74.0	76.4	78.1	79.6
73.	25.8	47.5	58.6	65.6	70.0	73.0	75.4	77.2	78.6
72.	24.4	46.2	57.5	64.5	69.0	72.0	74.4	76.2	77.7
71.	22.9	44.9	56.3	63.4	68.0	71.0	73.4	75.2	76.7
70.	21.4	43.7	55.2	62.4	66.9	70.0	72.4	74.2	75.7
69.	20.0	42.4	54.0	61.3	65.9	69.0	71.4	73.3	74.8
68.	18.5	41.1	52.9	60.2	64.9	68.0	70.4	72.3	73.0
67.	17.0	39.9	51.7	59.1	63.9	67.0	69.5	71.3	72.8
66.	15.6	38.6	50.6	58.1	62.8	66.0	68.5	70.3	71.8
65.	14.1	37.3	49.4	57.0	61.8	65.0	67.5	69.4	70.9
64.	12.6	36.1	48.3	55.9	60.8	64.0	66.5	68.4	69.9
63.	11.2	34.8	47.1	54.8	59.8	63.0	65.5	67.4	68.9
62.	9.7	33.5	46.0	53.8	58.7	62.0	64.5	66.4	68.0
61.	8.2	32.3	44.8	52.7	57.7	61.0	63.5	65.5	67.0
60.	6.8	31.0	43.7	51.6	56.7	60.0	62.6	64.5	66.0
59.	5.3	29.7	42.5	50.5	55.6	59.0	61.6	63.5	65.0
58.	3.8	28.5	41.4	49.5	54.6	58.0	60.6	62.5	64.1
57.	2.3	27.2	40.2	48.4	53.6	57.0	59.6	61.6	63.1
56.	0.9	25.9	39.1	47.3	52.6	56.0	58.6	60.6	62.1
55.		24.7	37.9	46.2	51.5	55.0	57.6	59.6	61.2
54.		23.4	36.8	45.2	50.5	54.0	56.7	58.6	60.2
53.		22.2	35.6	44.1	49.5	53.0	55.7	57.7	59.2
52.		20.9	34.5	43.0	48.5	52.0	54.7	56.7	58.3
51.		19.6	33.3	41.9	47.4	51.0	53.7	55.7	57.3
50.		18.4	32.2	40.9	46.4	50.0	52.7	54.7	56.3
49.		17.1	31.0	39.8	45.4	49.0	51.7	53.8	55.3
48.		15.8	29.9	38.7	44.4	48.0	50.7	52.8	54.4
47.		14.6	28.7	37.6	43.3	47.0	49.8	51.8	53.4
46.		13.3	27.6	36.6	42.3	46.0	48.8	50.8	52.4
45.		12.0	26.4	35.5	41.3	45.0	47.8	49.9	51.5
44.		10.8	25.3	34.4	40.2	44.0	46.8	48.9	50.5
43.		9.5	24.1	33.3	39.2	43.0	45.8	47.9	49.5
42.		8.2	23.0	32.3	38.2	42.0	44.8	46.9	48.5
41.		7.0	21.8	31.2	37.2	41.0	43.8	46.0	47.6

FIG. 2 OCTAVE BAND NOISE RATING AS A FUNCTION OF OCTAVE BAND SOUND PRESSURE LEVEL L_{pf} dB RE 20μPa AND FREQUENCY Hz

Octave Band Noise Rating Number:

From the measured octave band sound pressure level L_{pf} in dB re 20μPa, the offset A_f, dB is subtracted, and this difference is divided by factor B_f dB/NR to give the Octave Band Noise Rating Number.

That is $NR_f = (L_{pf} - A_f)/B_f$

Where A_f and B_f are a function of the octave band centre frequency and have the values shown in Fig. 3.

Noise Rating Curve:

On a graph of sound pressure level versus Octave Band Centre Frequency a line or curve joining octave band sound pressure levels of equal octave band noise rating.

FIG. 3 CONSTANTS A_f AND B_f

Octave Band Centre Frequency Hz	A_f dB	B_f dB/NR
31.5	55.4	0.681
63	35.5	0.790
125	22.0	0.870
250	12.0	0.930
500	4.8	0.974
1k	0	1.000
2k	-3.5	1.015
4k	-6.1	1.025
8k	-8.0	1.030

PRACTICAL DETERMINATION OF NOISE RATING

The starting point in any determination of the noise rating of a noise is the measurement of the sound pressure level of the noise in octave bands with centre frequencies from 31.5Hz to 8kHz inclusive. For convenience these octave band sound pressure levels may be referred to by the acronym OBSPLs.

By way of example assume that the noise in the reception area and directors office has the OBSPLs tabled in Fig. 4.

The measured values may be plotted on a graph incorporating noise rating curves as in Fig. 5. The noise rating can then be visually estimated. For the examples plotted one may estimate both noises as about NR44.

Care must be taken when visually estimating plotted noise levels to allow for the non-linear spacing of noise rating curves. At 31.5 Hz there is only 3.4 dB between NR curves 5NR apart; increasing to 5.2 dB at 8kHz.

Note that an erroneous procedure for estimating the noise rating of a noise was given in AS B210 and in the current Australian Standard AS 1469-1973. In these standards an example is given in which the noise spectrum peaks relative to the noise rating curves at 500 Hz. At this frequency the OBSPL is 37 dB which is 3 dB above the NR30 curve and it is stated that this gives NR33 as the noise rating of the noise.

In effect these standards imply that:-

NR30 + 3 dB = NR30 + 3NR = NR33

At 500 Hz the error is small, but at low frequencies this procedure can give ridiculous results. For example an OBSPL of 90 dB at 31.5 Hz is 4 dB above NR45; by the above procedure 90 dB OBSPL at 31.5 Hz could be interpreted as NR45 + 4NR = NR49; however 90 dB OBSPL at 31.5 Hz is above NR50 by 0.6 dB!

FIG. 4 MEASURED NOISE LEVEL IN AN OFFICE BUILDING

Octave Band Centre Frequency Hz	63	125	250	500	1k	2k	4k	8k
Reception Area Noise Level dB re 20μPa	64	60	53	43	38	33	23	19
Directors Office Noise Level dB re 20μPa	56	52	44	42	44	42	34	27

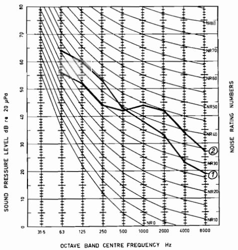

FIG. 5 (1) RECEPTION AREA NOISE LEVELS
(2) DIRECTORS OFFICE NOISE LEVELS

The definitive method of determining the noise rating is to calculate for each OBSPL the equivalent OBNR (octave band noise rating), with the noise rating being given by the highest OBNR. These calculations may be done very conveniently with a programmable calculator, or pre-calculated values from a table such as Fig. 2 may be used.

The same OBSPLs for the Reception Area and Directors Office are given again in the table in Fig. 6 with the equivalent OBNR under each OBSPL. The table clearly shows that there is NR44 in the Reception Area and NR45 in the Directors Office.

The OBNRs in Fig. 2 are shown with a resolution of 0.1NR as this allows accurate determination of NR differences. For example if the tabled values were rounded to integral OBNRs then at 8kHz the OBNRs for 77 and 78 dB OBSPL would both be NR83. At the other end of the spectrum at 31.5 Hz 1 dB changes in OBSPL would give 1 or 2 OBNR differences according to position in the table.

In use all noise rating differences or noise ratings should be rounded to integral noise ratings to reflect the measurement accuracy of noise levels.

Note that the convention has been adopted in this paper of using for example NR55 for a noise rating, and of using for example 5NR as a difference.

NOISE RATINGS AS A DESIGN CRITERIA

In some fields, particularly in the design of airconditioning and ventilating systems, calculations are made to predict the OBSPL of

FIG. 6 OCTAVE BAND NOISE LEVELS AND NOISE RATINGS

Octave Band Centre Frequency Hz	63	125	250	500	1k	2k	4k	8k
Reception Area Noise Level dB re 20μPa	64	60	53	43	38	33	23	19
Noise Rating	36.1	43.7	44.1	39.2	38.0	36.0	28.4	26.2
Directors Office Noise Level dB re 20μPa	56	52	44	42	44	42	34	27
Noise Rating	25.9	34.5	34.4	38.2	44.0	44.8	38.1	34.0

a proposed installation so that the octave band attenuation to meet a design goal can be calculated.

To calculate these octave band attenuation requirements it is necessary to have OBSPLs as a design goal. OBSPL design criteria to achieve a design NR are directly obtainable from the values tabled in Fig. 1.

By contrast there is no unique set of OBSPLs which will yield a given (A) weighted SPL; and hence there is no unique set of octave band attenuations which will yield a given (A) weighted SPL.

SUMMARY

Noise rating numbers are useful in the design of noise control measures allowing simple direct specification of acceptance octave band sound pressure levels, and hence the simple calculation of the octave band attenuation required to meet the design goal.

Determination of the noise rating from measured OBSPLs can be made without any subjective estimation either by directly calculating the equivalent OBNRs or looking up the conversion table introduced by this paper.

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GOSSIP

For the past two years The Bulletin has been published in Victoria. During this time we have all been fortunate to have an interesting, if sometimes slightly inaccurate gossip column written by GRAEME HARDING. This time however, Graeme's burden of work has prevented him from writing it.

Anyway it gives me the opportunity to thank Graeme for the considerable effort he has put in to keep us all informed of the activities of our friends and associates, especially those in other states.

JILL HULME, Senior Noise Control Officer, EPA, Vic., has had a most important few months. Last November Jill gave birth to a beautiful baby daughter, Letitia - Congratulations Jill and husband Chris.

During January the long awaited policy for the control of noise from industrial trade and business premises was declared and the enabling legislation proclaimed. Jill as leader of the Noise from Industry Group of the EPA played a major part in preparing this policy and legislation. I am sure that all in Victoria will welcome these as fair and accurate means of assessing noise from industry.

BOB FITZELL of Knowland, Harding and Fitzell has decided to branch out on his own. Bob has recently formed a new company, which we believe will be called Robert Fitzell Acoustics Pty. Ltd. On behalf of all who know Bob I wish him the very best. Knowland, Harding and Fitzell will, I have been informed, retain their current name.

CALEB SMITH CONSULTING has recently closed their office in Northcote Street and will continue trading as Caleb Smith Consulting Pty. Ltd. in their office at 19 Scott St., Newcastle.

NORM BRONER of Vipac recently contacted me to ask if members of the Society would advise him of any cases of low frequency noise annoyance that he can add to his data base. Norm carried out work on assessing low frequency noise in England. This work was reported by him at the 10th ICA. For those who missed Norm's paper it is hoped that it will be reproduced in The Bulletin shortly. Why aren't more ICA papers being offered?

MICHAEL NORTON of CSIRO's Division of Mechanical Engineering at Highett, Vic., will be taking up a lectureship in Mechanical Engineering at the University of Western Australian in early May. Michael did his PhD in Engineering Acoustics in the Mechanical Engineering Department at the University of Adelaide, on pipe flow noise. Since April 1979 he has been a Research Scientist with CSIRO, working with DON GIBSON'S Human Environment Engineering Team. In addition to pipe flow noise his research activities at CSIRO included industrial noise control and diver thermal support. Michael will be lecturing on Vibrations Analysis and Random Vibrations, and Engineering Acoustics in Perth and intends to set up a research program into random vibrations incorporating Statistical Energy Analysis Techniques.

After a successful and profitable Satellite Symposium the SA Registrar - Treasurer, KEN MARTIN, is off on a scheduled overseas trip encompassing Asia, Canada and Latin America.

The last bit of gossip for this edition concerns a resident in Victoria. Apparently her neighbour is learning the bagpipes and practices at night in the back yard. If this isn't bad enough, the resident contacted her neighbour's teacher and was told that the neighbour would never really master the bagpipes. Can you imagine being "lulled" to sleep each night by sick bagpipes.

As the next gossip column will be again written by Graeme, would you send any gossip to him at:

Knowland Harding and Fitzell,
22A Liddiard Street,
Hawthorn, Victoria, 3122

or telephone him on (03) 819 4522.

John Lambert.

TECHNICAL NOTES

A MOBILE ACOUSTIC LABORATORY FOR THE ACOUSTIC RESEARCH UNIT OF THE UNIVERSITY OF NEW SOUTH WALES

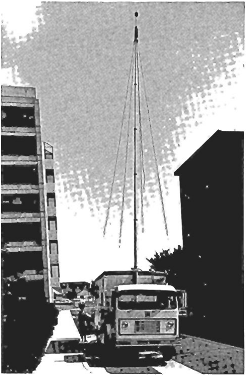
1. INTRODUCTION

An Acoustic Research Unit has been established in the Graduate School of the Built Environment, Faculty of Architecture, University of New South Wales. The staff associated with this Unit undertake extensive research projects into environmental noise and building acoustics in addition to fullfilling undergraduate and postgraduate teaching commitments. The Unit's resources are also available on a consulting basis through Unisearch Limited. Until recently the facilities available to the Unit were housed in a laboratory about the size of a small office. This laboratory was therefore used as a base and for analyses of measurements made elsewhere, and the Unit has tended to concentrate on in-situ field studies.

In 1979 the Faculty of Architecture was fortunate enough to obtain a Major Equipment Grant from the University for the purchase of a Mobile Acoustic Laboratory which could be used to facilitate acoustic research in the field. The Mobile Laboratory was delivered about the middle of 1980 and in a few months has proved to be a very versatile and most useful addition to the Unit. It greatly facilitates the measurements which form part of various research projects and it is a useful teaching aid in the acoustics subjects or courses within the Faculty.

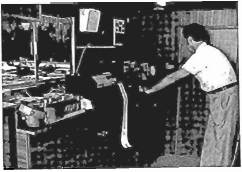
2. PRELIMINARY CONSIDERATIONS

The basic requirement was for a "vehicle fitted with laboratory benches, power supply and collapsible mast". Although this requirement could be satisified by a towed caravan it was decided that a unit incorporating a prime mover would be preferable because of the greater flexibility and space available. The Bruel and Kjaer, type 5713, Mobile Acoustics Laboratory was used as a basis for the initial plans. This Bruel and Kjaer Laboratory can be constructed within any vehicle supplied by the customer, however it is usually designed to fit within an omnibus or a large van. When the costs of freight and duty ex Denmark were determined it became apparent that it would be much more economical to construct the laboratory locally. After much consideration of the relative merits of an omnibus body and a truck cab-chassis as the basic vehicle it was



decided that a truck with a 5 tonne rear axle load capacity would be ideal to provide the necessary working space and to accommodate all the equipment.

The cab-chassis was purchased directly from the manufacturer and the body was constructed and internally finished to our specifications. The early plans for this body allowed for benches, cupboards, drawers, head level lockers and a rear compartment for the battery power supply, control panel and cable storage. One door allowed access and a telescopic mast protruded through an openable hatch.



3. CONSTRUCTION OF THE LABORATORY

The actual shape of the laboratory body evolved following discussions with the Body Builders and when the specific dimensions of fixed items were obtained. It became apparent that the batteries for the power supply could be located below the floor and between the wheels. Thus the separate battery compartment was not longer necessary within the body and an access door at the rear could be provided, in addition to the side doors.

Careful consideration was given to the temperature gain that might occur inside the laboratory during extended measuring periods in summer. Air conditioning was considered but rejected because of the (relatively) high noise emission of readily available units. Thus reliance is placed on the body construction for thermal control. This has been achieved by constructing the walls and roof with white-painted steel, glass fibre thermal insulation and an internal lining of laminated plywood. Above the main roof is a "tropical roof" comprising a 125 mm airpsace and a second roof of white-painted steel. Air-driven rotary ventilators are fitted in the main roof and air vents are located close to the floor. Additional electrically operated exhaust fans are located in the side walls and can be operated when necessary.

A ladder is provided at the front of the body for access to the strengthened front portion of the tropical roof. This is to allow fixing of equipment to the telescopic mast which is fitted between the laboratory body and the truck cab. Support brackets for the stabilising cables for the mast are located at the rear of the body and at the front of the cab. When the mast is extended to its full height, or when strong winds prevail, these cables may be fixed directly to the ground using steel pegs.

Internally, the laboratory has positive locking cupboards and drawers under the benches and lockers with swing down doors at head level. At appropriate locations small ledges are provided for some lightweight instrumentation, e.g. display oscilloscope. There is clear space below one section of bench to allow for two large loudspeaker units or for any other bulky items. Cargo straps are fixed to the bench tops at two positions to retain tape recorders. The other items of measuring and analysis equipment are provided with specially designed clamps incorporating rods with hooks at one end and wing nuts at the other. Each item has a specific location which is identified by strips on the bench top with depressions corresponding to the position of the feet of the instruments. To remove the instruments the wing nuts are loosened and the restraining framework removed. In the future when different items of equipment are to be used in the laboratory additional base strips can be screwed to the bench top. Trials on rough suburban roads have shown this fixing to be satisfactory with no effective movement of the instruments. It also allows for fast removal and/or replacement of the instruments.

4. FIXED ITEMS

4.1 Power Supply

The power supply comprises batteries, inverter and control panel with safety device to provide a 240V, 50Hz supply at power outputs and for lights and ventilation. Alternatively an external mains power supply can be used via two input connectors on the outside of the body.

Four 12V commercial quality batteries each weighing 60kg and capable of providing 200 Amp. hours are installed in the laboratory. A pair of batteries are placed in lockers below the floor on each side of the body for stabilisation during vehicle movement. They can be recharged in situ, using a portable battery charger, if a mains power supply is located nearby. Alternatively, the batteries can be removed by pulling them across a roller system onto specially constructed trolleys. (Insulating caps are placed over the terminal connectors when the batteries are removed). The wiring has been arranged so that a supply of 24V is available from each pair of batteries

separately (one battery from each side of the vehicle) to allow for continuous operation whilst one pair is being recharged. If the load requires it, all four batteries are used with the two pairs in parallel. When there is no need to charge the batteries during the measurement period this latter arrangement for the batteries, i.e., in parallel, is preferred, to minimise the current drain on each one.

The inverter provides a 240V AC (Sine-wave) signal from the 24V DC supply and is placed within a sealed cupboard inside the laboratory. Ventilation is provided by a vent directly to the outside air. The Volt Ampere Rating of the output from the inverter is 1000. It is estimated that for the normal usage of equipment inside the laboratory, the power supply will be adequate to last for periods in excess of 24 hours, without recharging the batteries. The inverter is designed to keep radio interference to a minimum and no further supression has been required at this stage.

As the 240V power supply is contained fully within the laboratory no earth connection is provided and a safety device is included on the outward supply from the inverter. This is a core balance earth protection unit which continuously monitors the currents flowing from the active conductors. When leakage currents exceeding the predetermined acceptable levels are detected, the protector device rapidly switches off the current supply.

4.2 Loader

The floor of the laboratory is approximately 1m above ground level and, for the movement of equipment, a loading platform has been located at the side doors, which have an opening width of 1.26m. The movement of the platform is controlled by an electro-hydraulic system with a separate battery (connected to the truck generator) and a manually operated switch. The platform is normally stored in a vertical position inside the loading doors. A hinged section of the platform is tapered to allow smooth movement of a trolley from the ground. However, in some circumstances, extension tapered pieces have to be used to allow for uneven ground surfaces.

4.3 Telescopic Mast

The telescopic mast which is fitted to the outside of the laboratory body (see Section 3.) is designed to carry a Bruel & Kjaer Outdoor Microphone Unit or a Sound Level Meter plus meteorological instruments. The extended height of the six sections is 10m and the maximum recommended headload is 13.6kg. The electrically operated compressor which provides the pneumatic lift uses the main truck battery, and it is fitted in a weatherproof enclosure on the outside of the laboratory.

5. CONCLUSION

The Mobile Acoustic Laboratory has proved to be a very versatile facility for research work, teaching projects and consulting work involving field measurements. When permanent records, on magnetic tape, are not required the analysis can be performed immediately which leads to a considerable saving in time. A second advantage is that the results can be checked at the time of the measurements and any problems with equipment or any unusual effects detected, immediately.

6. ACKNOWLEDGEMENT

The assistance of Bruel & Kjaer Australia Pty. Ltd., in the early planning for the laboratory is gratefully acknowledged. The useful discussions with the body builders of Brighton Body Works and Mr. Alan Butt of Land Cruiser Conversions led to the improved design for the laboratory. The personal interest taken by Mr. Richard Rosenberger of the Faculty of Architecture in the design, construction and finishing of the laboratory ensured satisfaction with the completed unit.

APPENDIX: Details of Truck and Special Equipment.

Truck :International ACCO - 510A Cab and Chassis.

Batteries :Chloride Commercial 12V Batteries Type Automotive No.95.

Inverter :Inverters & Constavolt Electronics, Model 24-IK-240S.

Earth Protection Unit :Scanelec Safeguard Core Balance Unit, Model Fi25/E6/4.

Loading Platform :Maxon Tuk-A-Way Tailgate Loader.

Instrument Mast :Clark Telescopic Mast Type PT 11.

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Traffic Noise - Its Effect on Road Design

R.E. Saunders

Country Roads Board, Victoria

TRAFFIC NOISE AND COMMUNITY RESPONSE

Traffic noise is no new thing. Noisy chariot wheels rumbling over cobbled streets caused complaints in first century Rome. In the twentieth century, motor vehicles are the dominant form of transport in our society. They provide us with great personal mobility, but traffic noise has become a major source of annoyance. Studies undertaken in London in 1948 and 1962 showed that persons annoyed by traffic noise doubled in number during the period, from 23 percent to 50 percent (OECD, 1971).

The introduction of legislation and the attention of the mass media play a part in stimulating an awareness of the problem, and in giving direction to the response. A review of the impact of the 1971 Chicago Noise Ordinance (Chicago Department of Environmental Control 1972) showed a 1500% increase in complaints over the 1970 base period. "The significance of these statistics is three-fold. First, they reflect the new stringency of the noise ordinance. Second, they indicate an expanded public awareness of noise as an environmental pollutant. Third, and perhaps, most significantly, they can be directly related to the well-publicized inauguration of the ordinance and the existence of a single, known, place to which complaints can be addressed."

There is some evidence to suggest that as people become more aware of the problem, then there is more concern at lower levels of traffic noise. Comparison of median dissatisfaction from surveys in Greater London in 1967 and 1972 are shown in Figure 1 (Langdon, 1976). "Thus while the slope of the regression relationship is identical, dissatisfaction levels equal to those of the 1968 study now occur at noise levels some 4 dB(A) lower than previously. This difference, though slight, is statistically highly significant and may reflect a difference in attitude to, and awareness of noise. On the other hand, part of the difference may be due to a better estimate of dissatisfaction by the present survey arising from more accurate noise measurement and a greater number of sites and respondents".

An Australian study (Brown and Law, 1977) of the effects of freeway traffic noise has shown that the noise from semi-trailers, motor cycles and vehicle actions (braking, cornering, etc.) caused the most widespread annoyance. The contribution of heavy

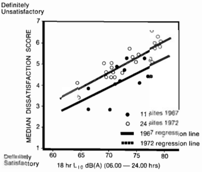


Figure 1 DISSATISFACTION RELATED TO NOISE LEVELS MEASURED IN TWO SURVEYS. 1967 & 1972.

commercial vehicles to annoyance is particularly pertinent in relation to the increasing volume of trucks on the road at night. The relationship between sleep disturbance and noise levels has been studied (Langdon and Buller, 1977) who reported "Sleep is disturbed not only by external noise but by pain, discomfort, worry, anxiety and insomnia .... at noise levels suggested by the Wilson Committee (a desirable standard for night noise in an urban environment of 35 dB(A) within the dwelling) traffic noise has no appreciable effect on sleep, though there may remain some 20% of the population whose sleep is disturbed for reasons other than noise. At the other extreme, where external levels during the night hours reach 78 dB(A) L_{10}, over 50% of the sample population would be disturbed if they allowed bedroom windows to remain open".

A study of the Economics of Road Vehicle Limits (NAASRA, 1975) incorporated an Australian-wide attitude survey involving about 1200 persons, to determine the extent to which the operation of heavy vehicles is perceived to be a problem, and to investigate what particular aspects are significant. Table 1 indicates that traffic noise is seen as a problem in urban areas.

Consideration of the physical factors influencing traffic noise can be conveniently grouped into the three components of the system: the source, the path of the sound, and the receiver. These aspects are discussed below. In the discussion, reference is made to the L_{10} scale and the L_{10} (18 hour) index.

MAIN PROBLEMS WITH TRAFFIC IN CITIES, TOWNS AND SUBURBS	TOTAL % *
Speeding	41
Too much traffic on main roads	35
Confusing road rules	30
Trucks and Semis	23
Too much through-traffic on residential streets	19
Inadequate provision for pedestrians	19
Fumes and smoke	16
Rough road surfaces	15
Not enough divided roads	15
Noise	14
Not enough traffic signs	11
Other	10
Not enough signs and line marking	9
Don't know	5

*Respondents were asked to indicate the three main problems from the list.

TABLE 1: MAIN PROBLEMS WITH TRAFFIC IN URBAN AREAS

VEHICLE CLASS	MEAN NOISE LEVEL AT 7.5 m (dB)	MEAN SPEED (km/h)
PRIVATE CARS	75	62
LIGHT TRUCKS	78.5	58
MEDIUM TRUCKS	81.5	56
HEAVY TRUCKS (3 AXLE)	86	56
HEAVY TRUCKS (4 AXLE)	87	51
HEAVY TRUCKS (5+ AXLE)	88.5	54

TABLE 2: MEAN NOISE LEVELS FOR VARIOUS VEHICLE CLASSES

TRAFFIC NOISE SOURCE

Mean noise levels for various vehicle classes are given by Saunders and Jameson (1978) and are shown in Table 2.

The noise is a combination of intake, fan, engine, exhaust and tyre sources, typically as shown in Figure 2. Reducing the individual vehicle noise at source is the single most important aspect of traffic noise control.

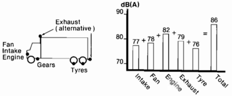


Figure 2 TYPICAL NOISE SOURCES FOR A HEAVY VEHICLE.

The traffic noise prediction method given by the Department of the Environment and Welsh Office Joint Publication (1975) entitled 'Calculation of Road Traffic Noise' (DoE Procedure) includes relationships between L_{10} (18 hour) noise values and traffic volume, grade, speed and percentage heavy vehicles. The latter are reproduced schematically in Figure 3. The DoE procedure also gives a correction for random deep grooving. In Australia, the effect of tyre tread design and road surface has been investigated by Samuels (1978), and work by Country Roads Board Officers has shown an increase of about 2.5 dB(A) for individual car noise at moderate speed on a size 10 sprayed seal, compared with a normal dense graded asphalt, based on limited data.

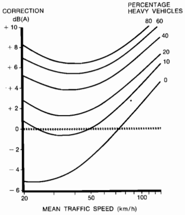


Figure 3 CORRECTIONS TO BASIC NOISE LEVELS FOR VARIATION IN MEAN SPEED & PERCENTAGE OF HEAVY VEHICLES.

	Arterial	Sub Arterial 1	2	3
Existing volume	15000 vpd	3000	3000	3000
L_{10} (18 hour)	70 dB(A)	63	63	63
Strategy 1 volume	18000 vpd	5000	5000	5000
L_{10} (18 hour)	71 dB(A)	65	65	65
Strategy 2 volume	24000 vpd	3000	3000	3000
L_{10} (18 hour)	72 dB(A)	63	63	63

TABLE 3: ALTERNATIVE STRATEGIES TO ACOMMODATE PREDICTED TRAFFIC GROWTH

Various methods of arranging the traffic stream to ameliorate traffic noise have been proposed. Measures to promote freely flowing conditions such as linked traffic control signals will not significantly reduce the overall measured L_{10} (18 hour) values, but may result in a noise signature which is less annoying than that from stop-start conditions. Advisory truck routes have been implemented in South Melbourne as a method of removing heavy vehicles from residential streets. The benefit resulting from reducing the truck component from say 10 percent to 3 percent is about 2 dB(A), and the reduction in annoyance can be expected to be worthwhile.

A third traffic management method is the establishment of a road hierachy, and the containment of traffic growth to selected major routes. Conceptually an arterial road and say three parallel sub-arterials may take 24,000 vehicles per day, and growth of 9,000 vehicles per day in the corridor is expected. Table 3 shows alternative strategies.

Assuming equal residential densities along each route of say, 100 houses in the length under consideration, then Strategy 1, which spreads the traffic increase over all four roads, will result in 300 houses experiencing an increase of 2 dB(A), and 100 houses experiencing an increase of 1 dB(A). Strategy 2, which concentrates the whole traffic growth onto the selected arterial route, will result in only 100 houses experiencing an increase of 2 dB(A). If Strategy 2 is adopted on the grounds of minimum impact, the rights of individuals living on the major arterial should be considered. If they are to sustain the noise increase, over and above the already noisy conditions existing, for the general welfare of the community, some form of compensation would seem appropriate. In practice, additional capacity on major arterials result from the flaring of intersections, the provision of clearways, and from major road widening. At the time of opening the new works to traffic, immediate relief can be expected on parallel sub-arterials.

The improvement will be eroded unless traffic management measures are devised and implemented.

The construction of a town bypass can provide a significant improvement in the noise environment and general amenity. In May 1976 the Country Roads Board opened a 34 kilmetre section of the Hume Freeway bypassing the towns of Wallan, Kilmore and Broadford. Noise levels were measured at three sites on the main street of Kilmore, formerly the Hume Highway, before and after the opening of the bypass. Following the opening of the bypass, the L_{10} (18 hour) level decreased by 10 dB(A) from levels in excess of 70 dB(A). In addition, the frequency of occurrence of individual truck noises in the nightime decreased by a factor of 10.

One potential measure to reduce traffic noise is to lower the vehicular speed along a route. A reduction from 80 to 60 km/h will reduce the L_{10} (18 hour) value by about 1.5 dB(A). The measure has not found much favour in view of the difficulty in enforcing the lower speed limit. In the urban area, roads signed for 80 km/h often have divided carriageways, and the speed limit may have previously been increased from 60 km/h to bring it in line with actual measured operating speeds. In such cases, a reduction in legal speed limit would be most difficult to enforce.

THE NOISE PATH

Spatial separation between sources and receiver provides some amelioration from traffic noise. When the surface between the source and the observer is soft, the effect is enhanced by ground attenuation. The provision of generous right of ways is usually only possible for major new facilities in outer urban and rural areas. When the reservation is about 100 metres wide, a typical at-grade freeway with say 30,000 vehicles per day will give an L_{10} (18 hour) level of about 69 dB(A) at the boundary fence. (The addition of 2.5 dB(A) for facade correction is not included).

The provision of a plantation reserve of 15 metres outside the road reserve will reduce the noise level by a further 3 dB(A) due to the additional spatial separation, and it will provide space for screen planting. The effectiveness of screen planting in lowering noise levels is dubious, but there is not doubt of its psychological value in reducing annoyance. In 1977 an amendment to the Cranbourne Planning Scheme was sought to allow residential development adjacent to the planned South Gippsland Highway deviation at Cranbourne. The Environment Protection Authority objected to the proposed amendment on the grounds that

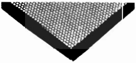
ABSORPTION

SOUNDFOAM

Urethane foam developed specifically to absorb maximum sound energy with minimum weight and thickness. Used to absorb airborne noise in industrial and EDP equipment, machinery enclosures, over-the-road and off-highway vehicles and marine and airborne equipment. Meets UL 94, HF-1 flame resistance test procedure.

SOUNDFOAM (Embossed)

The surface pattern increases sound absorption performance 25 to 35 percent in the most critical low and mid-frequency bands when compared to other foams of the same thickness and density. Ideal solution for low frequency absorption problem. Meets UL 95, HF-1 flame resistance test procedure.



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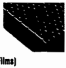
An outstanding sound absorbent foam with a tough, abrasive-resistant film surface designed specifically for use where unprotected foams won't hold up, and where appearance is important, such as in over-the-road and off-highway vehicle cabs and equipment enclosures.



SOUNDFOAM (With Films)

Highly efficient Soundfoam acoustical foams are available with a surface of Tedlar, metalized Mylar, urethane film or vinyl film. Surface treatment provides attractive appearance and resistance to various chemicals and sunlight.

SOUNDFOAM (With Perforated Vinyl)

Provides a tough, handsome finish for use in vehicles and other places where appearance is important. Leather-looking surface is bonded to highly efficient acoustic foam.

DAMPING

GP-2 DAMPING SHEET

A thin (0.050") sheet of pre-cured damping compound with pressure sensitive adhesive backing. Easily and inexpensively die cut and shaped to fit and form to flat areas and simple curves.

FOAM DAMPING SHEET

Consists of a thickness of embossed foam bonded to a sheet of highly efficient GP-2 damping material. Provides a single solution to damping and absorption problems.

DYAD

A polymer specifically developed to provide effective constrained layer damping on thick, heavy, metal plates. Applied by cementing the polymer sheet to both the structure being treated and a metal constraining layer.

EPOXY 10

A quick curing resin based damping paste which can be applied by trowel or spray. Completely resistant to severe environmental conditions, including water, acid and alkalis. Popular for marine and outdor applications.

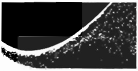
GP-1 DAMPING COMPOUND

A non-toxic, non-flammable plastic which is applied by trowel or spray. Cures quickly in air or oven. A thin coating on steel (1/2 to 1 times metal thickness) removes tinniness and ringing.

BARRIERS

SOUNDMAT LF

Soundmat LF is made up of a vibration isolation layer of foam, a lead septum sound barrier, and a layer of embossed foam to provide maximum absorption, together with noise attenuation.



SOUNDMAT FV

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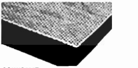

SOUNDMAT (With perforated vinyl)

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insufficient set-backs had been provided to give protection from noise pollution. Joint discussions between officers from Cranbourne Shire, the Country Roads Board and the Environment Protection Authority resulted in an agreed course of action to minimise the impact of traffic noise on future dwellings. This will be achieved partly by a twelve metre plantation reserve, and partly by a minimum set back of twelve metres beyond the plantation reserve. These measures are designed to achieve an L_{10} (18 hour) value not exceeding 65 dB(A) at the future dwelling sites.

Land use zoning provides another method of providing spatial separation between the traffic stream and sensitive receptors. In America it is common for a strip of land each side of freeways to be used for light industry, providing a buffer zone for the residential areas behind. Where new residential areas abutt major arterials, two forms of setbacks have been used by the City of Berwick to obtain increased spatial separation for residents. When a very large parcel of rural land was being developed adjacent to Heatherton Road, the City Council was able to negotiate with the developer to provide a 9 metre treed reserve separating the road reserve and the residential lots. The developer's original lot yield was maintained by a flexible approach to lot size. The treed reserve was planted by the developer, and the title is held by the Council who maintain the reserve. The reserve also limits access to defined points. Along the south side of the Princes Freeway the City Council has set aside a 6 metre reserve for future transport systems. In a pocket of residential development behind the reserve, the developer has been encouraged to provide deeper blocks than normal, of some 50-55 metres, with the first 9 metres intensively planted with trees.

Any obstruction between the source and the observer will give a reduction in noise level due to the "barrier effect". It should be noted that obstructions which just fail to cut the line of sight have the potential to reduce noise levels. In Figure 4 two zones are shaded, a "shadow zone" and an "illuminated zone". Observers at the boundary of the two zones will get a reduction of 5 dB(A). Where roads are depressed below ground surface, the top edge of the cut barrier acts as a barrier. Typical values of the noise attenuation are given in Figure 5. Elevated roadways with solid parapets provide some advantage over at-grade roads at close distances. At greater distances the advantage is lost by the lesser ground attenuation and the reduced barrier effect of the parapet. Of course, roads on fill, or elevated, are much more difficult to shield with barriers, and the attenuation from single storey intervening buildings is reduced. In Japan, some elevated roads are enclosed to provide abutting land users relief.

The provision of purpose built noise

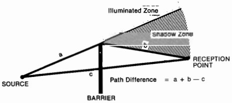

Figure 4 THEORY OF NOISE BARRIER ATTENUATION.

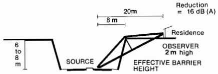

Figure 5 TYPICAL NOISE ATTENUATION FOR ROADS IN CUT.

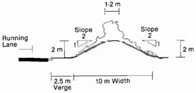

Figure 6 DETAILS OF TYPICAL EARTH MOUND.

barriers by the Country Roads Board is becoming more common in Victoria. Where surplus cut, or material unsuitable for fill, is available it can be used to provide earth mounds which act as noise barriers. It is often possible to provide land shaping and planting in conjunction with the mounds to obtain a pleasing visual effect. Figure 6 shows details of a typical earth mound.

Batter slopes of 4 to 1 are used where practicable. Flat slopes generally look more natural, are easier to maintain and promote the establishment of shrubs and trees.

Where there is insufficient room for earth mounds, or where surplus spoil is not available, solid noise barriers can be constructed. The design requirements of such barriers are that they be continuous and free of air gaps, capable of withstanding wind forces, and of a density of at least 5 kg/m^2. Figure 7 shows a timber barrier constructed at a cost of about $60 per metre on top of an earth mound on the Eastern Freeway, Kew. The grevilla rosmarinifolia planted on the

'the big clang bang' or 'the controlled hush'

Bestobell can provide a complete service from survey to installation including acoustic curtains and modules; acoustic connectors; treatment of pipes and ducts; attenuating materials (Coustibell) for enclosing feed pumps, power units, compressors, tumblers, bottling and canning plants, conveyors and other noisy machinery; attenuating/absorptive materials (Coustilam) for sound studios, computer rooms, boats, barriers, curtains, in manufacturing plants, process and assembly lines; damping/absorptive/attenuation materials (Dempison) for sound insulation, vibration damping on sheet metal structures, such as motor cars, tractors, buses, railway carriages, lifts and household machines. Bestobell can also supply a range of acoustic foam materials, fibreglass, rockwool and lead sheet materials. See Bestobell Engineering Products acoustic materials catalogue.

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mound will, in time, provide a dense screen for the mound and fence. The final decision on the height of the fence was not dependent solely on the noise attenuation it provided. Residents in Kellet Grove overlook the Latrobe Golf Club, and a trade-off between noise protection and aesthetics was desired. The adoption of the two metre high timber fence

Figure 7 TIMBER NOISE BARRIER ON MELBOURNE'S EASTERN FREEWAY.

was the result of consultation with the affected owners. While the transmission loss through a double brick wall exceeds 30 dB(A), the value of a noise barrier is usually in the range of 4 to 7 dB(A) due to sound which passes over the top of the wall. For this reason, materials less dense than brick are commonly used for noise barrier construction. Experiments on typical Melbourne paling fences are currently in progress, to determine their value as noise barriers in suitable conditions. Figure 8 shows some recent European noise barriers, where innovative design has produced aesthetically pleasing results (International Construction, 1978).

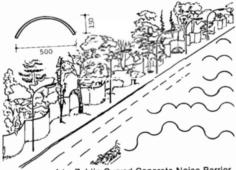
The use of solid high fences on front property boundaries is a form of noise barrier seen increasingly often along Melbourne's busy roads. They provide satisfactory noise attenuation, but their use is subject to certain qualifications. Where the street architecture is intact in period and quality, the introduction of high front boundary fences is unlikely to be in harmony with the streetscape. The full value of the fence will only be obtained if solid, close fitting gates are provided and kept shut. Finally, they may be unacceptable to the resident, either for aesthetic reasons, or because they shield the front of the house, from the passing pedestrian. This latter effect can decrease a resident's sense of personal safety, and make an unattended home more prone to burglary.

RECEIVER

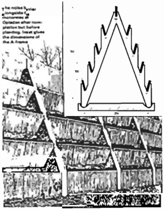
In situations where it is not practical to ameliorate traffic noise by traffic management measures or by noise barriers, and where further reductions are desired, noise insulation to the building can be considered. Values for the reduction of noise resulting from normal brick construction were measured at the Nurses Home of Prince Henry's Hospital, Melbourne in 1976 (Eastern Approaches to West Gate Bridge, 1977). The results confirm the general reductions in external noise levels which can be expected from brick construction, which are shown in Table 4.

Windows Open	5 - 10 dB(A)
Windows Closed	15 - 25 dB(A)
Double Glazing	30 - 35 dB(A)

TABLE 4: TYPICAL REDUCTIONS IN EXTERNAL NOISE LEVEL FOR BRICK CONSTRUCTION



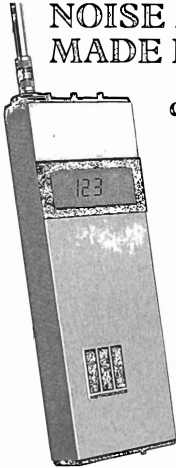
A.) Zublin Curved Concrete Noise Barrier.



B.) Noise Barrier at Opladen, Erected but not Planted.

FIGURE 8 RECENT EUROPEAN NOISE BARRIERS

NOISE MEASUREMENTS MADE EASY...



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Alexandra Parade is an inner city route leading to the Eastern Freeway, with residential dwellings very close to the property line. At a single fronted brick house in Alexandra Parade, Clifton Hill, measurements were taken inside and outside the building facade. The external L_{10} (18 hour) value was 75 dB(A), while the internal noise levels in the front room and entrance hall were about 66 dB(A) with the windows open, and 50 dB(A) with the windows shut.

Noise insulation work on the front windows and door is now being undertaken, and it is anticipated that a further reduction to the single window closed condition of about 7 dB(A) will be achieved. The cost of the insulation work is about $2,000 and includes double glazing the window, provision of a close fitting, heavy door, forced draft ventilation, and the possibility of some ceiling insulation.

A further example of building noise insulation is given by Modra (1978). The Victorian Environment Protection Authority undertook noise measurements at Montrose State School, where classrooms facing Lilydale-Montrose Road had a typical internal L_{10} noise level of 55 dB(A) with the windows shut. The typical L_{10} level with widows open was 63 dB(A), while the external noise level was about 67 dB(A). Following the carpeting of the floor and the fixing of acoustic tiles to the ceiling, a reduction to the internal noise level of 5 to 6 dB(A) was achieved.

In the design of new buildings along heavily trafficked roads, careful layout of the various elements can greatly improve internal noise levels. Areas not sensitive to noise, such as garages, stairs and laundries, can be placed facing the road in such a way that they sheild more sensitive areas.

CRB PRACTICE

The Country Roads Board has adopted the L_{10} (18 hour) index for evaluation purposes, and the value of 68 dB(A) as the criteria for examining ameliorative measures for new freeway and expressway facilities. During the planning of a new road or road improvements, predictions of future noise levels are made for the alternatives under consideration. Ameliorative measures such as noise mounds are investigated at critical locations, and the overall noise impact of each alternative is assessed. This information is carried through to the evaluation, where it is considered along with other aspects such as cost and traffic performance before a favoured alternative is recommended.

Detailed design will normally proceed in the pre-construction phase, one or two years before construction is commenced. During detailed design all aspects of the conceptual design are carefully reviewed. Detailed calculations of traffic noise levels are carried out where the road passes through residential or other sensitive land uses. Noise levels are reduced wherever practicable, by depressing the road level, providing spatial separation and by earth shaping which is also an important element in landscaping. Where noise levels are still above the design criteria, noise mounds and fences are incorporated into the design.

It is not always possible to reduce external noise levels below 68 dB(A). Following the opening of the Eastern Freeway, traffic noise levels increased by some 5 dB(A) at the eastern end of Alexandra Parade to about 75 dB(A) L_{10} (18 hour). The Government has approved the purchasing of dwellings in Alexandra Parade between Gold Street and Brunswick Street from owners wishing to sell. Alternatively, owners may have their homes insulated. As mentioned earlier, noise insulation measures are being undertaken at one dwelling in Clifton Hill.

It is sometimes possible to use a freeway boundary fence as a noise barrier by constructing a solid fence. Such combined function fences can be particularly effective along the top of road cuttings, where their acoustic value adds to the barrier effect of the top of the cutting. Careful screen planting on both sides of such fences is desirable to soften their visual impact. Where retaining walls are used, it is desirable to avoid completely vertical surfaces, which can cause multiple reflections and higher noise levels both within and outside the cuttings. Modest laybacks of the order of 1 in 6 will direct reflected noise upwards rather than outwards, as shown in Figure 9. The use of planted crib walls will also reduce reflections. In harsh urban conditions, drip irrigation is necessary. Figure 10 shows a recently constructed crib wall on the Eastern Freeway exit at Hoddle Street, where the rhagodia gaudichaidiana (salt bush) is thriving.

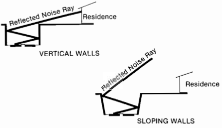

FIGURE 9 MULTIPLE REFLECTIONS FROM ENCLOSED CUT

PREDICTION AND MONITORING

At this stage the Country Roads Board has adopted the DoE Procedure previously mentioned for the prediction of traffic noise levels. A continuous programme of field

Report	Mean difference Predicted-Measured	Standard Deviation
Saunders & Jameson 1978	+0.6 dB(A)	1.6 dB(A)
Brown & Hollingworth 1978	+1.1 dB(A)	0.9 dB(A)
Brown 1978	+0.2 dB(A)	1.9 dB(A)
Gunn et al and Goodram 1977	+0.2 dB(A)	2.1 dB(A)

TABLE 5: COMPARISON OF DoE PROCEDURE PREDICTIONS OF L_{10} (18 HOUR) VALUES WITH MEASURED

VALUES IN AUSTRALIAN CITIES

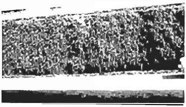

FIGURE 10 CRIB WALL ON MELBOURNE'S EASTERN FREEWAY

measurements is being carried out in conjunction with routine road studies, which provides a guide to the accuracy of the DoE Procedure.

In other Australian States, comparisons of measured and predicted noise levels have been reported, notably by Gunn et al (1977) and Brown and Hollingworth (1978). The DoE Procedure has been generally confirmed as being as accurate as any other, while also providing detailed rules for factors such as attenuation over soft and hard ground, barrier effects and partial angle of view.

The difference between DoE Procedure predictions and measured L_{10} (18 hour) values given by Australian reports are summarised in Table 5.

Recent measurements in Alexandra Parade have shown differences between predicted and measured L_{10} (18 hour) values of up to 5 dB(A), and it is clear that the influence of factors such as urban clutter, parked cars and driving patterns need to be accommodated in our models. The National Association of State Road Authorities has recently set up a Working Group to report on available traffic noise prediction models. The Working Group is currently assembling a comprehensive data base of Australian measurements of road traffic noise which conform to the NAASRA Procedure for the Measurement of Road Traffic Noise.

THE FUTURE

Injurious affects resulting from traffic on approach routes to major facilities, and from traffic management measures, are areas of important community concern. Continued efforts are needed from Road Authorities to ensure road designs sympathetic to abutting land uses, and conversely abutting land use should be planned and co-ordinated in an integrated operation. Further research is required in predicting road traffic noise, in building aesthetically pleasing noise barriers and other ameliorative measures.

SA DIVISION REPORT

Technical Meeting 19th November 1980

The proprietors of "Sound Craftsmen" Mark and Paul Bayley presented a paper complete with practical demonstrations on the theme of "An Alternative Approach to Frequency Analysis". This comprised a Commodore mini-computer, a one third octave analysis board and software developed by themselves, enabling simple incorporation of a variety of correction curves and a visual display of the spectrum on a cathode ray tube. This provided a low cost analysis system with the bonus that the non-dedicated controller is available for a variety of other tasks when not required for acoustic analysis.

A wine and cheese supper complemented the evening.

Proposed Future Program

June 17th

The Impact of Motor Vehicle Noise on Architectural Acoustics.

July 15th

Dr. D. Bies to speak on his recent visit to the USA.

September 16th.

Environmental Noise - Some Case Histories

November 18th

Underwater Communications.

LETTERS

Dear Sir,

I notice in the December 1980 issue of the Bulletin that you have listed courses in acoustics available at universities and CAEs in Australia but I am disappointed to see that our own offerings are not included. It is true that we do not have any specific degree or diploma course in acoustics but the offerings in this University are quite similar to those in many of the other universities listed and, indeed, our research record of twenty odd papers and two books in acoustics in the past eight years is quite reasonable. Two departments are involved in work on acoustics - Physics and Psychology - though we do not have any particular interaction.

I am enclosing a short paragraph along the lines of those included for other universities, describing in general terms what is offered at both undergraduate and postgraduate levels. I do not know whether it is now appropriate to publish this as an addendum, unless you have several other institutions that were accidently omitted, but perhaps you could at least keep it on hand for the next time you publish such as directory and make sure that an updated version is included then.

Yours sincerely,

N.H. Fletcher,
Professor of Physics,
The University of New England

Editor's Note:

It is a pleasure to publish the following:-

UNIVERSITY OF NEW ENGLAND

The Department of Physics accepts students for final-year specialization in Acoustics for the B.Sc. (Honours) degree and accepts research students for thesis work in musical or biological acoustics for M.Sc. or Ph.D. degrees. The Department of Psychology offers research specialization in audiology.

Further information from:

University of New England,
Armidale, N.S.W., 2351

Dear Sir,

I would like to congratulate the author of "Review of Courses in Acoustics" in Volume 8 No. 3, as it represents I think the first attempt to inform the membership of the existence of such courses. No. 6 of the review however, requires more detail, and I would like to provide information regarding the Department of Applied Physics, Royal Melbourne Institute of Technology.

The undergraduate course leading to Bachelor of Applied Science (Applied Physics) involves students in second and third years in laboratory techniques. The subject at second year level comprises experiments in noise measurement and analysis, vibration studies, audio measurements, measurement of absorption coefficient by impedance tube and by reverberation chamber and field measurements of transmission loss. At the third year level, students are allotted a project in acoustics. Some fifteen hours of a second year theory subject are devoted to theoretical acoustics, and an elective subject at third year on architectural acoustics is also offered.

Post graduate research degrees in acoustics may also be undertaken through the Department.

For the undergraduate diploma courses in Building and Quantity Surveying the subject of Building Science 2 is taken at the second year level. It contains a component of 18 hours of lectures on various aspects of acoustics.

Provisions exist for people to enrol for any of the above as single subjects; detailed syllabi of the above are available on request to:

Department of Applied Physics,
R.M.I.T.
G.P.O. Box 2476V,
MELBOURNE, VIC., 3001

or phone 341 2715.

Yours faithfully,

K.R. Cook

VENSAC

For those members that are unaware of the activities of the Vehicle Emissions and Noise Standards Advisory Committee (VENSAC) it is a committee formed under the Australian Environment Council and comprises representatives from environment and pollution control authorities in the various States, Territories and Commonwealth. The Australian Environment Council comprises the ministers responsible for these authorities. The main function of VENSAC is to prepare "model" regulations for the control of noise and air emissions from new and in-use motor vehicles in Australia. When these are endorsed by the AEC they may be picked up and used by the individual authorities and in this way national uniformity in legislative controls is facilitated.

R. Law

CONFERENCES & SYMPOSIA

INTER-NOISE 81

6 - 8 October 1981, Amsterdam

The 10th International Conference on Noise-Control Engineering will be organized by the Netherlands Acoustical Society NAG in cooperation with the Belgian Acoustical Association ABAV under sponsorship of International/INCE. It is to be held at the RAI-Congress Building in Amsterdam from Tuesday 6 through Thursday 8 October 1981.

The theme of the conference is "Practice of Noise Control Engineering". The technical program will highlight research and development in noise control engineering, state of the art summaries and tutorial/clinical workshops. The program includes:

- Machinery Noise Reduction at the Source
- Reduction of In-Plant Noise Exposure
- Noise Control Engineering in Buildings
- Noise Control on Household Appliances
- Traffic Noise
- Aircraft and Airport Noise
- Rail Transportation Noise
- Shipboard Noise Control
- Noise Measurement, Analysis and Instrumentation
- Designing and Planning for Industrial and Traffic Noise Control
- Government Programs and Legislation for Noise Control
- International Standards for Noise
- An Exhibition for Materials and Equipment for Noise Control

Contributions invited

Contributions in the topics mentioned above to the technical program of INTER-NOISE 81 are welcome. All invited, contributed and poster form papers will be included in the Proceedings, available for all participants at final registration.

General inquiries

Inter-Noise 81
P.O. Box 85542
2508CE The Hague
The Netherlands

11TH INTERNATIONAL CONGRESS ON ACOUSTICS

The 11th International Congress on Acoustics will take place in PARIS, FRANCE, during the month of July 1983. The congress will cover all fields of acoustics and will be preceded and followed by satellite Symposia, organized in various cities such as LYON, MARSEILLE, TOULOUSE.

The principal themes of the satellite Symposia will be selected in the near future from the following subjects:

- Psychoacoustics - Physiology of hearing
- Speech communication
- Active acoustical absorption
- Acoustical metrology
- The fight against urban noise
- Acoustical radiation of mechanical structures.

Congressional publications

Summaries of papers to be delivered will be published and sent to participants prior to the congress. Each summary will be strictly limited to one page in length.

Technical sessions and exhibition

Several technical sessions will be organized simultaneously throughout the duration of the congress, as well as an exhibition of equipment.

Additional activities

- Visits to laboratories specializing in acoustics
- Programme of events for those accompanying the participants
- Sightseeing excursions in and around PARIS.

Application for further information

More detailed information will be contained in the circular number one to appear in March 1981. Those wishing to receive this circular should apply to the following address:

11eme Congres International d'Acoustique
Secretariat du Groupement des Acousticiens de Langue Francaise (G.A.L.F.)
C.N.E.T. - B.P. 40
22301 LANNION cedex (France)

ACOUSTICAL EVENTS

1981-1984

1981

June 15-18, 1981, Tel Aviv — Israel
Internat. Sympoisum on Underwater Acoustics
University of Tel Aviv
POB 3054, Tel Aviv

June 30-July 2, 1981, Brighton — Gr.Britain
Ultrasonic International
Dr. Z. Nowak, POB 63,
Westbury House, Bury Street,
Guildford GU2 5BH

July 6-7, 1981, Prague — Czechoslovakia
XXth Acoustical Conference on Ultrasound
Organizer: House of Technology
Mrs. Eva Dostalova,
Gorkeho nam.23, 112 82 Praha 1

August 17-22, 1981, San Diego USA
Ultrasound in Medicine
Dr. R. Brown, University Hospital
POB 26901, Oklahoma City, OH 73190

October 6-8, 1981, Amsterdam Netherlands
INTER-NOISE 81
Secretariat: POB 85542
NL-2508 CE The Hague

November 4-5, 1981, Lyon France
7eme Coll.d'Acoustique Aerodynamique
Assoc.Aeronaut. et Astronautique de France
80 rue Lauriston, F-75116 Paris

November 30-December 4, 1981
Miami Beach USA
Meeting of the Acoustical Soc. of America
Chairman: Mr. John G. Clark
Institute for Acoustical Research
615 S.W. Second Ave., Miami, Florida 33130

1982

Spring 1982, Budapest Hungary
8th Colloquium on Acoustics
Details from: OPAKFI, Anker koz 1
1061 Budapest

Spring, 1982, Mexico Mexico
VI.Latin American Meeting in Acoustics
Details to be announced.

April 26-30, 1982, Chicago USA
Meeting of the Acoustical Soc. of America
Chairman: Mahlon D. Burkhard,
Industrial Research Products, Inc.,
321 North Bond St., Elk Grove Village
Illinois 60007

May 16-19, 1982, San Francisco USA
INTER-NOISE 82
Details to be announced.

September 13-17, 1982, Gottingen FRG
3rd FASE CONGRESS JOINTLY WITH DAGA 82
The Congress program will cover:
Speech research, Architectural acoustics, structure borne sound; Aero acoustics, underwater sound, nonlinear acoustics.
General Secretariat: FASE 82, c/o
Physikalisch-Technische Bundesanstalt
Post Box 3345, D-3300 Braunschweig

September, 1982, Warsaw Poland
Noise Control Conference
Details from: Prof. S. Czarnecki,
Committee for Acoustics of the PAN
PKiN p.2321, 00-301, Warsaw

October, 1982, High Tatra Czechoslovakia
21st Acoustical Conference on Noise and Environment
Secretariat: House of Technology
Ing.L.Goralikova, Skultetyho Street,
881 30 Bratislava

November 8-12, 1982, Orlando, Florida USA
Meeting of the Acoustical Society of America
Chairman: Joseph E. Blue
Naval Research Laboratory
P.O. Box 8337, Orlando, Florida 32856

1983

May 9-13, 1983, Cincinnati, Ohio USA
Meeting of the Acoustical Society of America
Chairman: Horst Hehmann,
1928 Fullerton Dr., Cincinnati, Ohio 45240

July, 1983, Paris France
11th ICA CONGRESS
to be preceded and followed by Satellite Symposia in Lyon, Marseille and Toulouse
Details to be announced.

July 1983, London Gr. Britain
4th Conference of the British Society of Audiology
Details to be announced.

October 1983, High Tatra Czechoslovakia
22nd Acoustical Conference on Electro-acoustics and Signal Recording
Details to be announced.

November 7-11, San Diego, California USA
Meeting of the Acoustical Society of America
Chairman: Robert S. Gales, Code 5152,
Naval Ocean Systems Center
San Diego, California 92152
and
INTER-NOISE 83 will be held in Europe

1984

May 7-11, 1984, Norfolk Virginia USA
Meeting of the Acoustical Society of America
Chairman: Harvey H. Hubbard, Acoustics and Noise Reduction Div., NASA Langley Research Center, Langley Station, Mail Stop 462,
Hampton, Virg. 23665

August 14-17, 1984, Sandefjord Norway
The Scandinavian Acoustical Society Congress

August 21-24, 1984, Sandefjord Norway
FASE 84 -
Congress of the Federation of Acoust. Societies of Europe
Information from:
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INFORMATION FOR CONTRIBUTORS

Items for publication in the Bulletin are of two types

(a) Shorter articles - which will appear typically under the heading 'News and Notes'

(b) Longer articles - which will appear as refereed technical articles.

The closing dates for the receipt of these articles are as follows:

Vol. 9 No. 2 Longer articles: Mid May; Shorter articles: Mid June.
Vol. 9 No. 3 Longer articles: Mid September; Shorter articles: Mid October.

Articles may be sent directly to the editor or via the local State Bulletin representative.

There are no particular constraints on "shorter articles" except that they should be of relevance to the Society and be received on time.

Attention to the following matters will assist when processing "longer articles".

(i) Length - typically from 3 to 4 pages when printed.

(ii) Title and Authors Address - the title should be concise and honestly indicate the content of the paper. The author's name and that of his organisation together with an adequate address should also appear for the benefit of members who may wish to discuss the work privately with the author.

(iii) Summary - The summary should be self contained and be as explicit as possible. It should indicate the principal conclusions reached. That should be possible in less than 200 words. Many more members will read the summary than will read the paper. Everybody seems to be busy these days.

(iv) Main Body of the Article - This should contain an introduction, and be followed by a series of logical events which lead finally to the conclusions or recommendations. The use of headings greatly assists the reader in following the logic of the paper. The conclusions should of course be based on the work presented and not on other material.

(v) References - Any standardised system is acceptable - for example those used by Journal of Sound and Vibration, Journal of the Acoustical Society of America, or The Institution of Engineers, Australia. Page numbers and dates are important.

(vi) Tables and Diagrams - As a general rule, Tables are best avoided. Diagrams may need to be redrawn during the editorial stage. They ought to be totally self explanatory, complete with a title, and with axes clearly labelled and units unambiguously shown.

The papers generally will be subject to review but this is not intended to discourage members. The author no doubt would prefer to have any anomaly drawn to his attention privately rather than to gain notoriety by having errors published widely.

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