THE BULLETIN

OF THE

AUSTRALIAN ACOUSTICAL SOCIETY

VOL. 1 NO. 3

SPRING 1972

Published by Australian Acoustical Society
P.O. Box 80, CROWS NEST NSW 2065

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CONTENTS

EDITORIAL

A difficult problem faces anyone with a vital concern for some particular aspect of the environment and with a special knowledge of the measures required to improve conditions to the necessary extent. That problem is to decide how far he should commit the community in terms of cost for implementation of such measures. While, by reason of his special knowledge, he can see clearly the consequences of inaction and the course that should be followed, he is not the one who has to meet the expense. Certainly, he will pay in part as a member of a community that collectively will have to meet the cost. In all probability he will pay that part willingly because of his understanding and his particular interest in improvement of that aspect of environment. However, he must clearly exercise great care and responsibility when in a position to influence decisions which implicate the community as a whole. Others may not share his particular concern. Their priorities may list many other aspects of the environment, also important, as more urgent, or they may simply doubt the seriousness of the problem.

Control of noise is an important matter for reasons of amenity and, more seriously, of health. Noise control has its price tag and, in some circumstances, a large one. At a time when legislation and regulations are under active consideration there is need to emphasise the value of perspective. Of equal or even greater significance is the forerunner to legislation which is the drafting of standards. A crucial question is how far standards should leap ahead of current good practice into the realms of specification of conditions deemed desirable but which may not be attainable. Is it the role of a standard to specify the desirable in this sense, or is it to ensure that the best practice currently attainable is followed by all? Answered one way and the pressure towards improvement is reduced. However, it may be argued in reply that only elected representatives, who are answerable to the community that pays, have the right to decide that more rigorous requirements must be met at some appropriate future date. That would mean, in effect, that it is the task of the informed mainly to educate the community and its elected representatives to the need for more stringent standards.

It is not for the Bulletin to hold any view or enter any such controversy. It is considered proper however, that it should point to the need to resolve the issues involved. The Society as a whole clearly recognizes this need and seeks to assist by providing opportunities for discussion and debate at technical meetings and conferences. However, it is ultimately the responsibility of the individual. He must make his own decision and having done so be prepared to declare his position and accept any criticism that this may incur.

A.A.S. ACTIVITIES

PROGRESS WITH I.C.A. PROPOSAL

The President of the Society, Mr. H. Vivian Taylor, in February submitted to the International Council of Acoustical Societies the background information which was requested at the Budapest meeting of the International Congress of Acoustics where the President and Jack Rose, the Chairman of the N.S.W. Division of the Society, supported our original application for the 1977 I.C.A. to be held in Australia.

The background information was quite impressive, consisting of a list of acoustical activities in Australia, both scientific and industrial, together with detailed information of budgetary estimates, social activities, committee composition and other supporting data.

However, after considering this information and that forwarded by other acoustical societies which were keen to hold the 1977 meeting, the Council decided to award that event to Spain and to make us front-runner for the 1980 meeting.

Though this is disappointing to some extent, it means that we will be much stronger and perhaps more able to hold a successful meeting in 1980.

TECHNICAL MEETING

The next Technical meeting for the N.S.W. Division is scheduled for mid to late November. This promises to be a very technical meeting in the form of our annual get-together. The venue will probably be "Dirty Dicks" at North Sydney.

We understand a night at Dirty Dicks is a bawdy riot so don't bring your mother. More news will be circulated by the N.S.W. Division when firm bookings have been made.

TECHNICAL MEETING ON DRAFT AUSTRALIAN STANDARDS

The Technical Programme Sub-Committee of the N.S.W. Division announced its intention earlier in the year to arrange technical meetings to discuss draft Australian Standards on acoustics during the period when these are being circulated for public review. The expressed purpose of these meetings was to provide a forum for open discussion on public review documents with a view to obtaining guidance for A.A.S. representatives on the Standards Association's technical committees. Other members of the technical committees could be expected to benefit also from fruitful discussion at meetings of this type.

The inaugural meeting in the series was held on 31 August, 1972 at the Aquatic Club in East Sydney. The meeting was preceded by drinks and dinner. The Technical Programme Sub-Committee must have felt justifiably satisfied with the success of the venture. The attendance was good, the dinner was good, and the discussion was lively and purposeful. The chairman of N.S.W. Division, Mr. J. Rose, summed up the situation in his closing remarks by saying that the numbers present and the quality of the discussion confirmed the value of both sessions of the meeting. He urged those present to put the points they made in writing and forward them to SAA as comment on the documents discussed.

The first session for the evening dealt with SAA Draft Document 72091 "Standard Test Methods for Air Duct Silencers". Mr. J.A. Irvine acted as chairman for this session.

There was strong criticism of the document on the grounds that measurement of sound attenuation under conditions of airflow in the duct had been omitted from the proposed test. The point was made also that the use of a reverberant room for the sound source had been excluded, although it can be shown that such a procedure is a valid one with certain advantages.

At the conclusion of this first session the following resolution was proposed and approved. "It is the opinion of this meeting of members of the N.S.W. Division of the Australian Acoustical Society that the draft standard, Document 72091, should be revised to include test methods suitable for accurate rating of the dynamic acoustical performance of duct attenuators and lining materials.

The meeting further believes that the sub-committee concerned with standardisation of these measurement systems should seek to include, as far as practicable, more representatives of those who design and manufacture such duct attenuators and lining materials."

The second topic dealt with was the SAA Draft 72084/72085 "Australian Standard Code of Practice for Hearing Conservation" and "Australian Standard Specification for Hearing Protection Devices". Dr. W.F. Hunter acted as Chairman. These documents were heavily criticised.

Some of the main points made were:

1. That such a Draft Standard should be restricted to a description of methods of measurement of noise exposures and the hearing hazards associated with them. The prescription of noise exposure levels to be observed by industry, or elsewhere should be in the hands of the legislators (i.e. the Government).
2. That the documents under discussion, especially DR 72084, were diffuse, confusing, and in places contradictory. It was stated that there was much irrelevant detail while at the same time important matters were omitted. An example was given that while much was said regarding measuring equipment, yet no guidance was given in its use under real factory conditions, especially with respect to intermittent noise assessment.
3. The definition of hearing impairment in the Draft was held by some to be unrealistic. The use of the C.A.L. method, where an average over three frequencies was used, was thought generally to be preferable to the basing of impairment on the exceedance of any one of a range of five frequencies, as required by DR 72084.
4. It was generally agreed that if any guidance were to be provided regarding maximum acceptable noise levels, it should be placed in an Appendix rather than in the body of the draft. Opinion was not unanimous regarding the desirability of including such guidance, though some held strongly to the view that it was needed by the legislators.
5. The section on Engineering Control was considered by some as unnecessary, and in effect usurping the proper task of acoustic specialists and text books.
6. The restriction imposed by the Code upon the frequency distribution of the noises to be considered (i.e. a slope no greater than $\pm$ 5 dB per octave) was held to invalidate the whole procedure in many, if not most, industrial situations.
7. The almost mandatory statement that 85 dBA should be regarded as the base time (para. 3.3, Note 1) was deplored by many. It was stated that 90 dBA, or even higher, was accepted very generally overseas, and that this choice was made on economic or socio-economic grounds rather than from the purely medical angle. A fear was expressed that early choice of a level as low as 85 dBA could force industry because of costs, to consider ignoring the noise hazards and simply paying compensation.

LEICHHARDT COUNCIL (SYDNEY) NOISE ABATEMENT PANEL

For some years now the Society has been represented on the panel by Mr. J.A. Irvine; the panel's activities are of great value.

This panel has met regularly at two month intervals, and always has a large, though constantly changing, number of items on the Agenda. Local noise complaints are considered in full detail, supporting evidence from actual measurements being made available from various sources. Invitations are extended to those persons directly concerned to attend these meetings for purposes of discussion. Site visits by members of the panel are also arranged from time to time.

Very considerable success in noise mitigation has been achieved by the panel, both by the use of persuasion and by giving direct technical assistance when appropriate. The idea of providing a forum, where opposing views can be expressed under the guidance of a sympathetic and able chairman, would seem to represent a model approach to those difficult and often highly subjective problems.

1972 CONFERENCE "NOISE LEGISLATION AND REGULATION"

Since the Winter issue of the Bulletin the Society's 1972 conference was held at the Hotel Florida, Terrigal, over the long week-end, Saturday, 30th September to Monday, 2nd October.

An opening session addressed by His Honour Mr. Justice R. Else-Mitchell was followed by seven sessions in which were discussed problems of legislation and control in regard to such aspects as hearing conservation and industrial noise, the acoustic requirements of buildings, noise from industrial equipment and appliances, and community noise annoyance.

A concensus of opinion suggests strongly that the event was regarded as highly successful both as a conference and as a social occasion. Dr. V. Mason, the conference organiser, deserves congratulations for the outcome of the considerable effort he applied to ensuring its success. The conference programme is placed on record below.

AUSTRALIAN ACOUSTICAL SOCIETY

1972 ANNUAL CONFERENCE

"NOISE LEGISLATION AND REGULATION"

29th September to 2nd October 1972

CONFERENCE PROGRAMME

FRIDAY, 29TH SEPTEMBER

6 pm - 10 pm	Registration
8 pm	Annual Meeting of Australian Acoustical Society

SATURDAY, 30TH SEPTEMBER

10 am	OPENING SESSION
	Welcoming speech: Mr. J. Rose, Chairman, NSW Division, Australian Acoustical Society
	Opening speech: His Honour Mr. Justice R. Else-Mitchell, Judge of NSW Supreme Court "Noise Control and the Law"
10.45 am	Morning Tea
11.45 am	SESSION 1
	Miss J.H.H. Blackman, Barrister: "The Present State of Noise Law in Australia - a Few Examples"
	Mr. P. Martin, Peter R. Knowland, Acoustic Consultants: "Noise Measurement Techniques"
12.15 pm	Lunch
2.00 pm	SESSION 2 NOISE AND PEOPLE 1
	Dr. R.N. Reilly, Consultant Otologist: "The Physiological, Psychological and Sociological Effects of Noise on Man"
	Dr. V. Mason, School of Mechanical & Industrial Engineering, The University of New South Wales: "Noys and Noise Annoyance - and Other Noise Units"
3.00 pm	Afternoon Tea
3.30 pm	SESSION 3 NOISE AND PEOPLE II
	Mr. H. Weston, Scientific Officer, Division of Occupational Health and Pollution Control, NSW Department of Health: "Complaints, Their Cause and Assessment"
	Dr. S.S. McCullagh, James Hardie & Co. Pty. Ltd.: "Some Comments on DR72084: Draft Australian Standard Code of Practice for Hearing Conservation"
	His Honour Judge J.S. Ferrari, Workers' Compensation Commission of New South Wales: "Workers' Compensation for Industrial Deafness"
7.30 pm	CONFERENCE DINNER-DANCE

SUNDAY, 1ST OCTOBER

9.30 am	SESSION 4 OVERSEAS NOISE LEGISLATION
	Mr. R.J. Satory, Satory Acoustic Services, New Zealand: "Idealised Acoustic Legislation, or an Anarchistic Approach to Dealing with Noise"
	Mr. R. Sawley, King, Sawley and Associates Pty. Ltd.: "Overseas Noise Legislation - Success or Failure?"
	Dr. C. Mather, Architectural Division, Public Works Department, West Perth: "Overseas Noise Legislation - Buildings and their Equipment"
11.00 am	Morning Tea
11.30 am	SESSION 5 AUSTRALIAN REQUIREMENTS FOR NOISE
	Mr. M. Hunt: "The Needs and Intentions for Australian Legislation"
	Mr. W. Steele, Victa Ltd.: "Limitation of Noise from the Appliance Manufacturer's Point of View"
12.30 pm	Barbecue Lunch
2,00 pm	Free Time. No Sessions arranged for afternoon. Coach tour of district starting 2.30 pm. for those interested.
6.30 pm to 7.30 pm	Evening Meal

MONDAY, 2ND OCTOBER

9.30 am	SESSION 6 AUSTRALIAN REQUIREMENTS FOR NOISE CONTROL II	
	Mr. V. Moore, Chief Health Officer, Newcastle City Council: "More Anti-Noise Law - a Need or a Notion"	
	Mr. K. Cottier, Allen, Jack and Cottier, Architects: "The Needs and Intentions for Better Noise Control in Buildings"	
10.30 am	Morning Tea	
11.00 am	SESSION 7 LEGAL AND ADMINISTRATIVE PROBLEMS	
	Mrs. A. Lanteri, Law School, Melbourne University: "A Critical Analysis of Noise Legislation"	
	Mr. C. Johnson, Assistant Technical Director, Standards Association of Australia: "The Role of Standards in Legal and Administrative Aspects of Noise Control"	
12.00 noon	CLOSING SUMMARY AND DISCUSSION	
	A discussion of points raised by conference delegates by a panel of the following speakers:	
		His Honour, Mr. Justice R. Else-Mitchell Dr. R.N. Reilly Mr. R. Sawley Mr. W. Steele Mr. H. Weston
12.45 pm	CLOSING REMARKS	
	Mr. H.V. Taylor, Federal President, Australian Acoustical Society.	
1.15 pm	Lunch	
2.30 pm	Buses depart for Gosford to connect with Sydney train.	

NEWS AND NOTES.

ACOUSTIC STANDARDS COMMITTEE

The affairs of those Committees of the Standards Association of Australia whose concern is with acoustics are guided by the Acoustic Standards Committee, and its Executive.

Since the inception of this Committee some years back, the Executive has consisted of Chairmen of the various committees, plus five members elected from the main Committee.

At the last meeting of the Executive on 8th July, 1972 it was decided that, with the growth of technical committees, there was no longer any need to maintain a sufficient number of members in the Executive by the device of election. A recommendation to the Acoustics Standards Committee, duly agreed to, was that henceforth the Executive should consist of Chairmen to technical committees, headed by the Chairman of the main committee (at present Professor R.G. Barden) and the Deputy Chairman of the Committee (at present Mr. H. Vivian Taylor) along with the Standards Association of Australia Technical Secretary (Mr. R.D. Mearns).

The Executive acts as the "Steering Committee", whose function is to advise the Acoustics Standards Committee, and the Standards Association of Australia, on the establishment of Technical Committees. It also acts in urgent matters such as collaboration with I.S.O., and co-ordination of work between Acoustic and other S.A.A. Committees, in between meetings of the full Acoustic Standards Committee.

At the July meeting the Acoustics Standards Committee endorsed the recommendations of the Executive for re-organisation of the technical committee structure and the allocation of work. This involved the formation of the following:

A new Committee AK/7, Engineering Acoustics.

The terms of reference include the preparation of methods of measurement of noise and vibration from equipment.

A new sub-committee AK/7/1, Noise in Ships.

A new working group, Building Insulation for Aircraft Noise.

STANDARDS ASSOCIATION OF AUSTRALIA - GOLDEN JUBILEE SEMINARS

The S.A.A. will be holding a series of seminars on the 23 - 25 October in Sydney and repeating a similar series in Melbourne on the 13 - 16 November. Of special interest for N.S.W. members is session 8 on the 24th of October, headed "Noise and the Environment". The Victorian members will have the opportunity to attend an equivalent programme held as Session 1 on Monday, 13th November. The programme for the two sessions is given on page 6. Members who are interested in attending for the reasonable fee of $5.00 can contact the Standards Association in their state for application forms.

HANDLING THE MEDIA

In recent months there has been an increasing awareness within the community on matters of noise. Inevitably, accompanying the trend has been increased publicity. Such publicity is generally to be commended, but, regrettably, there have been cases of distorted reports by the media. Attention has therefore been focussed on the problems faced by members of the Society in seeking to ensure that reports by press, radio, and television are accurate and in perspective. Aspects of the difficulties experienced in achieving balanced reporting have been discussed at length by the Committee of the N.S.W. Division. The matter has now been referred for consideration by the Federal Council of the Society.

NEW ZEALAND CONFERENCE

Members may not be aware of the existence of a devout band of New Zealanders carrying the banner for acoustics in the North and South Islands. An acoustic conference was held in Wellington in 1971, which was attended by three members of AAS, and proved to be a great success.

The hospitality was extremely warm and much interchange of ideas occurred. Recently the return air fare to N.Z. was reduced to $80.00 which makes a combined Australian-New Zealand conference to be held in New Zealand a strong possibility. Accommodation and food costs are cheaper in New Zealand, the all-up cost of the conference could be less than its equivalent in Australia.

Feelers have been put out to the New Zealanders on a possible conference. The indications are that they would be very happy to be hosts to an Australian contingent.

If you are in favour of an Australian-New Zealand conference, would you inform a Society Committee member or the Secretary.

THE SOUND INSULATION OF DOORS

M.A. BURGESS
J.A. WHITLOCK

Commonwealth Experimental Building Station
North Ryde

INTRODUCTION

The sound insulation of a partition incorporating a door is usually governed by the sound-insulating properties of the door and jamb. In this respect the situation is similar to that of a wall containing a window[1], except that the problem is made more difficult by the need to seal the door in a manner that will maintain a high degree of sound insulation without interfering with the use of the door.

The sound insulation of the door panel can be improved at the expense of increased weight or thickness of the door. However, if there are small gaps around the door or in the jamb, the improvement in the overall sound-transmission performance might be negligible.

During November, 1971 the Commonwealth Experimental Building Station measured the sound-transmission loss of several proprietary doors, and investigated the effect of different sealing and latching arrangements on the sound insulation afforded by a solid-core door. The effect of opening a solid-core door was also investigated for openings ranging from 5/64 in. to 16 in. Additionally, the sound-transmission losses of doors 2 in. thick comprising hardboard bonded to sheet-lead on a timber frame were determined. These results were compared with those for framed partitions sheeted with the same materials. All the doors used in the investigation were nominally 6 ft. 8 in. x 2 ft. 8 in.

SUMMARY OF RESULTS

The efficacy of the seals around the doors was shown to be the most important factor in imparting additional sound insulation to doors.

The six doors examined had superficial weights ranging from 3½ psf to 9 psf and, if they had been tested as fixed panels of the same construction, they could have been expected to have had sound-transmission classes in the approximate range of STC 30 to STC 50. When examined as doors, the sound-insulation values were within the range of STC 26 to STC 34. One specimen, determined to be STC 30 when tested as a door with gaskets on both vertical edges and at the top, and with an unsatisfactory gasket at the bottom, was able to achieve STC 39 when fitted with a second gasket along the bottom edge. The use of this additional gasket, however, was not regarded as a practical arrangement, but served rather to indicate the sound insulation possible from the door panel and jamb. The best values of sound transmission class that were obtained for the various doors with the normal gasketing on their edges were as follows:-

Type of Door	Thickness in.	Weight psf	STC
Solid-core door	1-3/8	3.7	28
Proprietary door	1-1/2	4.3	31
Proprietary door	1-7/8	4.7	34
Proprietary door	2-3/8	4.3	31
Door of 3/16 in. hardboard bonded to 2 psf lead on both sides of a timber frame	2	7.8	30
Door of 3/16-in. hardboard bonded to 3 psf lead on both sides of a timber frame	2	9	31

In one instance the sound insulation of the solid-core door was less when the door was fitted on all four edges with one type of gasket than it was with a gasket along the bottom edge only of the door. Sound transmission through the door assembly was increased between 3 dB to 16 dB, depending on frequency, by unsatisfactory sealing when compared with the results obtained with the best seal.

Other aspects to which attention was given in the investigation were the effects of different latching arrangements, and of small openings between door panel and jamb. No particular advantage could be demonstrated for latching doors top and bottom as against the use of a latch near the mid-height of one side.

The effect of a door being closed but not latched was to cause an immediate increase in sound transmission. The solid-core door when closed and pushed against the gaskets around the jamb showed increases in transmission ranging from over 2 dB in the low and medium frequencies to 14 dB in the high frequencies.

As would be expected, the transmission of sound through the door assembly increased as the door was progressively opened. The most notable feature was the initial rapid increase in transmission that resulted from the first small increments in the extent of the opening. As the opening became wider there was a less rapid increase in transmission.

THE DOORS AND THEIR INSTALLATION

The doors noted in the previous section were hung in a frame constructed from 6-in. x 2-in. timber bolted and sealed into an opening measuring 7 ft. high x 2 ft. 11-3/4 in. wide that was provided in a 9-in. solid brick wall built into the 9-ft x 9-ft specimen frame of CEBS noise-investigations laboratory. In this laboratory the specimen provides virtually the only means for transferring airborne sound between the source room, where specified sound is generated, and the receiving room.

Three different proprietary gaskets designated types A, B, and C, were used around the door jamb, as shown in Fig. 1. A drop gasket shown in Fig. 2 was installed in the door in conjunction with the use of gasket type C (Fig. 3). When gaskets types A and B were used, the door panel had two bottom gaskets built into it and separated by a perforated softboard spacer (Fig. 4.). The door panels were hung so that they closed tightly against the gasket as shown in Figs. 5 and 6 with the aid of either barrel bolts at the top and the bottom of the door panel, or either a barrel bolt or a latch at the mid-height of the panel.

A solid-core door panel 1-3/8 in. thick and weighing 3.7 psf was used with the different types of gasket, and was opened different amounts for purposes of the study. Two doors with timber frames clad with hardboard bonded to 2-psf lead and to 3-psf lead were also examined. These doors were 2 in. thick, and had superficial weights of 7.8 psf and 9 psf.

TEST PROCEDURE

A Bruel & Kjaer random-noise generator Type 1402 located in the control room, and connected to a single loudspeaker placed near one corner of source room, generated broad-band noise in the source room. Sound-pressure levels in both source and receiving rooms were measured with the aid of a condenser microphone and cathode follower in each room coupled via a Bruel and Kjaer microphone selector type 4408 to a Bruel and Kjaer real time, one-third-octave analyser Type 3347.

The signal received from the microphone, placed at each of ten positions in each room was filtered simultaneously in all of the one-third-octave bands of the real-time analyser. The values of the levels in eighteen of the one-third-octave bands with centre frequencies of 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000, 1250, 1600, 2000, 2500, 3150, 4000 and 5000 Hz were stored and subsequently recorded from the digital output display. The results for each position in each room were statistically analysed to obtain the mean-sound-pressure levels for each room and an indication of the precision of measurement.

The airborne-sound-transmission loss of the specimen doors was determined in accordance with ISO R140 (Jan. 1960,) 'Field and Laboratory Measurements of Airborne and Impact Sound Transmission', by which the differences between the sound-pressure levels in the source room and receiving room were corrected for the sound absorption in the receiving room. The sound-transmission class for each specimen was then determined from the classification set out in E413-70T in accordance with the requirements of ASTM E90-70, 'Standard Recommended Practice for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions'.

For an assessment of different gaskets and door openings, however, the airborne-sound-transmission loss could not readily be determined because of difficulty in applying the required adjustment for absorption as there was coupling through the opening between the rooms. Instead, in each case differences in sound-pressure level between the rooms were obtained without correction being applied for the absorption in the receiving room. The difference in sound-pressure levels for the solid-core door with Type A gaskets fitted all round was taken as the datum for comparison in those experiments, so that the results for other gaskets and for openings are given here as the increase in sound transmission relative to this.

RESULTS

The results of the determinations of airborne-sound-transmission loss of specimens (to the nearest decibel) and increased in sound transmission with opening a door (to the nearest tenth of a decibel) for the eighteen one-third-octave bands with centre frequencies between 100 Hz and 5000 Hz are set out in Tables 1, 2, 3 and 4 in the Appendix. The precision of measurement of the airborne-sound-transmission loss is within 1 dB for the lowest frequencies, and within 1/2 dB above 200 Hz. The increase in transmission as a door was opened is expressed in tenths of a decibel so that small differences are not lost in premature rounding-off of values. The results are shown graphically in Figs. 7 to 14. The difference between sound-transmission loss for a solid-core door and difference in sound-pressure level in the two rooms can be seen from Figs. 7 and 10.

DISCUSSION

(A) Solid-core Door

The solid-core door with a superficial weight of 3.7 psf examined with the Type-A gasket fitted around the top and sides (and with two bottom gaskets built into the panel and separated by a perforated softboard spacer - as previously described) and a barrel bolt at the top and bottom of the door was found to have a Sound Transmission Class of 28. The mass-law predicts for a panel of material of this weight that the average sound-transmission loss should be about 30 dB.[2] These figures compare very favourably, and indicate that the door panel was correctly installed in the door jamb, and that the gasketing arrangement used was very satisfactory.

The increase in sound transmission through the door with a Type-A gasket along the bottom edge only of the door is shown in Fig. 11. Even though the door was very well constructed, and it fitted tightly into the door jamb, there was still considerable transmission of sound, particularly in the higher frequencies. This shape of curve is obtained when there are leakage problems through small cracks around a specimen.

The latter arrangement with a Type-A gasket along the bottom edge was further examined with a barrel bolt at the centre of the door only; the results are shown also in Fig. 11. There is very little difference between the results obtained on the one hand with the barrel bolt at the top and bottom of the door and, on the other hand, with the centrally located barrel bolt only. This should be the case so long as the door is not warped, or installed incorrectly in the jamb.

The increase in sound transmission with the Type-B gasket around the top and sides and the two bottom gaskets separated as described earlier is shown also in Fig. 11. It can be seen that this gasket is less effective than the situation with no gasket around the top and sides. In this regard, the door seemed to be very much harder to close with the Type-B gasket in position, and the gasket became very badly deformed along the hinge side of the door panel. Once again the increase in sound transmission was greater in the higher frequencies, indicating small leakage paths around the door panel.

The airborne-sound-transmission loss for the solid-core door with the Type-C gasket around the top and sides and a drop gasket along the bottom (Fig 3) is shown graphically in Fig. 7. This result can be compared with the sound-transmission loss for the solid-core door with the arrangement incorporating the Type-A gasket, for which an STC of 28 was obtained. The sound-transmission loss is as much as 5 dB less with the Type-C gasket than with the Type-A gasket, particularly at the higher frequencies. As originally installed, the drop gasket had to fall about 1/2 in. and, as it was made of thin steel with soft PVC along the bottom edge, there was the possibility of transmission both through and around the seal when it was in the dropped position. A second examination was made with an additional gasket along the step tread of the door jamb so that the seal had to fall less than 1/4 in. These results are included in Fig. 7. It can be seen

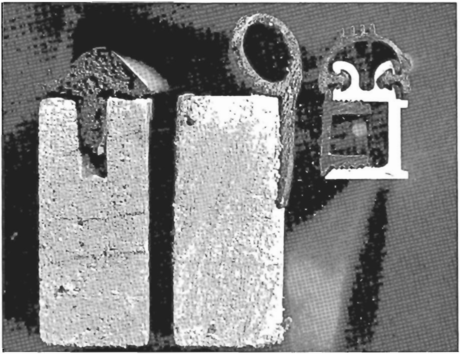

Fig. 1. Types of gasket designed a, A, B, and C (from left to right)

Fig. 2. Drop gasket used with Type-C gasket.

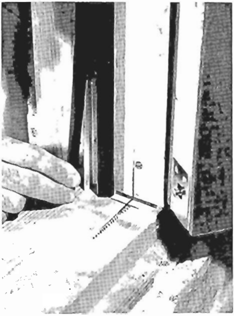

Fig.3. Type-C gasket

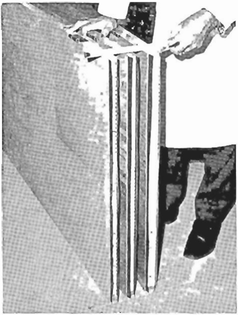

Fig.4. Bottom gasket used with Type-A and Type-B gaskets on the proprietary doors.

Fig.5. Door and frame installed in brick wall.

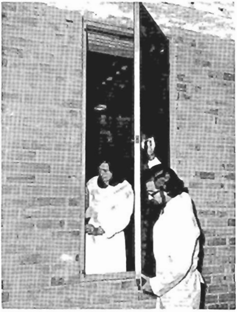

Fig.6. Framed door panel sheeted both sides with hardboard bonded to sheet lead.

that there was an improvement of a few decibels at the higher frequencies, and the STC improved to 27. There was still a clearance of about 1/8 in. at both ends of the bottom drop gasket, which would allow the transmission of some sound.

(B) Doors Incorporating Lead

Two doors faced on both sides of their timber framing with 3/16 in. hardboard bonded to 2-psf and to 3-psf lead respectively, were examined when fitted with Type-C gaskets. As originally installed, the door with 2-psf lead had an STC of 30, and the door with 3-psf lead had an STC of 31. To determine the maximum sound-transmission loss obtainable with this type of door and gasket, the door incorporating 2-psf lead was re-examined with a complete seal along the bottom edge, and the 1/8 in. clearance at both ends sealed also. The STC obtained with this arrangement was 39, with improvements of the order of 10 dB at the higher frequencies. These results are shown in Fig. 9. This would, however, be an impractical method of sealing doors, but it does give an indication of the sound insulation that can be achieved with this type of door and jamb. The result does not compare well with STC 50 for a 9-ft x 9-ft framed partition sheeted both sides with 3/16-in. hardboard bonded to 2-psf lead over 4-in x 2-in timber studs. The difference might possibly be accounted for by transmission around the edge of the door panel, and through the timber door jamb.

(C) Effect of Opening the Solid-core Door

The effect on sound transmission of opening the solid-core door was determined from the change in sound-pressure levels between the two rooms, using as the datum the conditions where the solid-core door was sealed with the Type-A gasket and locked. The differences in the eighteen one-third-octave bands are shown in Fig. 10. The increases in sound transmission with the door opened different amounts are shown in Figs. 12 and 13. It can be seen from Fig. 12 that there is a rapid increase in sound transmission with quite small initial increases in the size of the door opening. Even with the door pushed tightly against the jamb but not locked with the barrel bolts there is an increase in transmission of about 12 dB in the one-third-octave band centred on 5000 Hz. When the opening exceeded about half an inch the rate of increase in sound transmission became less rapid and for large openings the door was providing very little sound insulation.

The increase in sound transmission with increased size of opening between the solid-core door and its jamb was dependent on frequency although the relationship was not linear as will be seen from Fig. 12. Instead, the increases in transmission for increasing widths of opening, shown as a function of frequency in Fig. 13, provide curves which are very similar in shape to those plotted in Fig. 10 for the differences in sound-pressure level between the two rooms. Graphs of the actual sound-pressure differences between the rooms for different widths of door opening are given in Fig. 14, from which it will be seen that as the door was progressively opened the room sound-pressure differences approached a linear relationship with frequency. This indicated that the resonance, coincidence, stiffness and mass effects that produce the peaks and dips in the transmission-loss curve were no longer the dominant factors determining the sound-insulating properties.

CONCLUSION

When considering the sound-insulating properties of doors it is important to realise the benefits of correct installation and adequate sealing. A door that has very high inherent sound-insulating properties will not in practice achieve its potential unless adequate sealing arrangements are devised and faithfully implemented.

ACKNOWLEDGEMENT

CEBS records its appreciation of the assistance given by Kell and Rigby Pty. Ltd., Burwood, N.S.W., by supplying some of the specimens used in the work, and permitting the publication of data from an investigation they sponsored.

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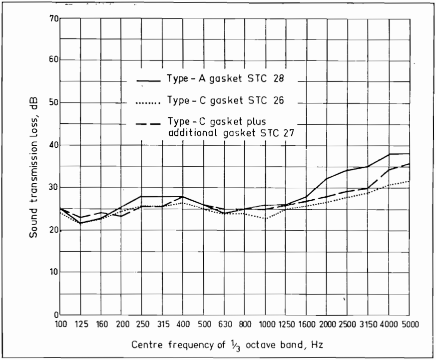

Fig. 7. Effect of sealing solid-core door

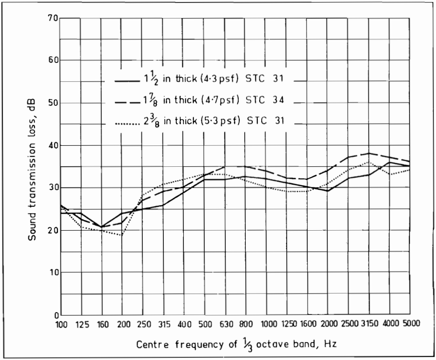

Fig. 8. Sound-transmission losses of three proprietary doors

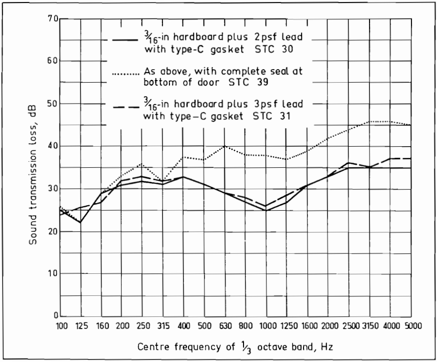

Fig. 9. Sound-transmission losses of three variants of a framed-and-sheeted door.

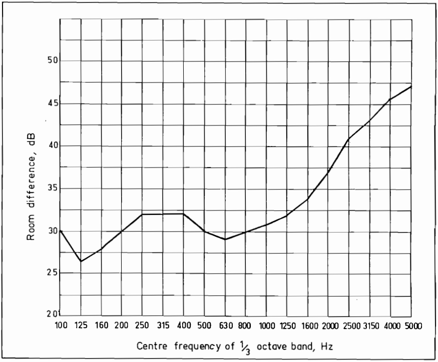

Fig. 10. Sound-pressure differences between rooms with solid-core door in position. (No correction for absorption in receiving room.)

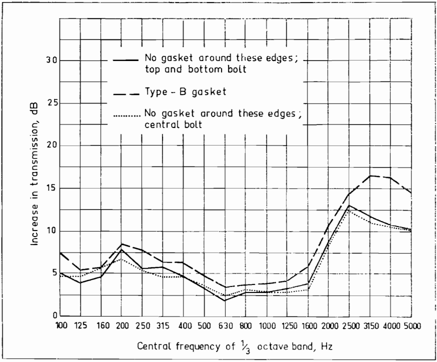

Fig. 11. Influences of seal and bolting using solid-core door. (There is increased transmission compared with the situation with Type-A gasket along the bottom edge.)

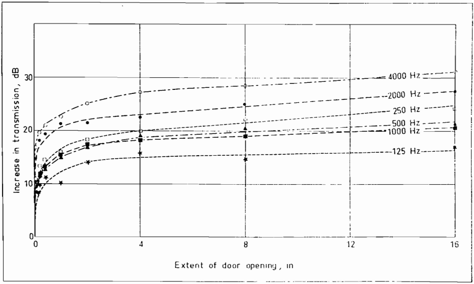

Fig. 12. Increase in sound transmission with progressive opening of solid-core door for the one-third-octave bands, with the octave centre-frequencies shown.

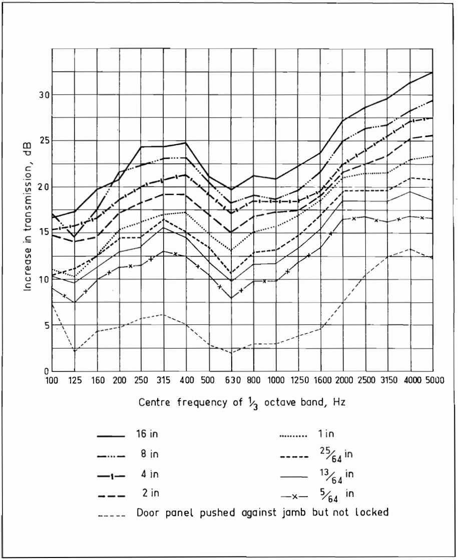

Fig. 13. Effect on sound transmission of progressive opening of solid-core door.

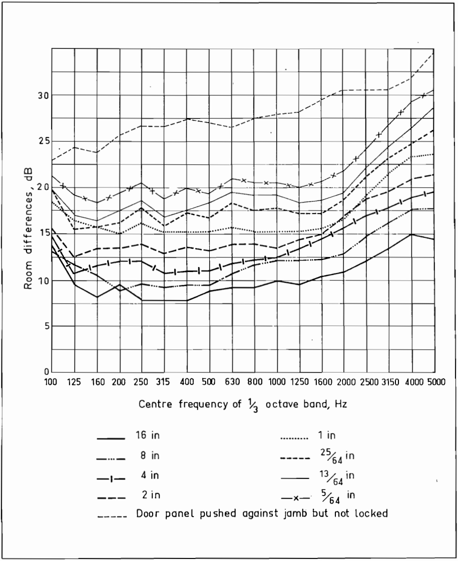

Fig. 14. Differences in sound pressure between rooms with progressive opening of solid-core door.

APPENDIX

Table 1. AIRBORNE SOUND TRANSMISSION LOSS (dB)

Centre freq. of $\frac{1}{3}$-octave band (Hz)	Proprietary door, $1\frac{1}{2}$ in thick 4.3 psf, fitted with type-A gasket	Proprietary door, $1\frac{7}{8}$ in thick 4.7 psf, fitted with type-A gasket	Proprietary door, $2\frac{3}{8}$ in thick 5.3 psf, fitted with type-A gasket	Solid-core door, $1\frac{3}{8}$ in thick 3.7 psf, fitted with type-A gasket	Solid-core door, $1\frac{3}{8}$ in thick 3.7 psf fitted with type-C gasket	Solid-core door, $1\frac{3}{8}$ in thick 3.7 psf, fitted with type-C gasket and additional gasket along bottom edge
100	24	26	26	25	24	25
125	24	23	21	22	22	23
160	21	21	20	23	23	24
200	24	22	19	26	24	23
250	25	27	28	28	26	26
315	26	29	31	28	26	26
400	29	30	32	28	27	28
500	32	33	33	26	25	26
630	32	35	33	24	24	25
800	33	35	32	25	24	25
1000	32	34	30	26	23	25
1250	31	32	29	26	25	26
1600	30	32	29	28	26	27
2000	29	34	31	32	27	28
2500	32	37	34	34	28	29
3150	33	38	36	35	29	30
4000	36	37	33	38	31	34
5000	35	36	34	38	32	36
STC	31	34	31	28	26	27

Table 2. AIRBORNE SOUND TRANSMISSION LOSS (dB)

Centre freq. of $\frac{1}{3}$-octave band (Hz)	Framed doors 2 in thick sheeted both sides with 3/16-in hardboard bonded to sheet lead. Fitted with gaskets		
	2-psf lead, type-C gasket (7.8 psf)	2-psf lead, type-C gasket, and additional seals to all gaps (7.8 psf)	3-psf lead, type-C gasket (9 psf)
100	25	26	24
125	22	22	26
160	29	29	27
200	31	33	32
250	32	36	33
315	31	32	32
400	33	38	33
500	31	37	31
630	29	40	29
800	27	38	28
1000	25	38	26
1250	27	37	28
1600	31	39	31
2000	33	42	33
2500	35	44	36
3150	35	46	35
4000	35	46	37
5000	35	45	37
STC	30	39	31

Table 3. SOUND TRANSMISSION, SOLID-CORE DOOR

Increased transmission (dB) over that when Type-A gasket fitted

Centre freq. of $\frac{1}{3}$-octave band (Hz)	Fitted with Type-B gasket	No gasket; barrel bolt near top and bottom	No gasket; central barrel bolt only	Door pushed against jamb, but not latched
100	7.3	5.0	4.8	7.1
125	5.2	3.9	4.5	2.4
160	5.8	4.6	5.6	4.2
200	8.4	7.6	6.8	4.7
250	7.7	5.7	5.4	5.5
315	6.3	5.8	4.7	6.1
400	6.1	4.8	4.8	4.9
500	4.8	3.3	3.7	3.0
630	3.2	1.8	2.4	2.3
800	3.6	2.7	3.0	2.9
1000	3.7	2.8	2.8	2.9
1250	4.0	3.2	2.9	3.8
1600	5.8	3.8	3.4	4.3
2000	10.3	8.7	8.2	7.6
2500	14.1	12.9	12.3	10.4
3150	16.4	11.7	11.0	12.4
4000	16.2	10.7	10.5	14.1
5000	14.6	10.4	10.0	12.3

Table 4. SOUND TRANSMISSION: OPENING OF SOLID-CORE DOOR

Increased transmission (dB) over closed-door situation compared with values given in Table 2, Col. 4

Centre freq. of $\frac{1}{3}$-octave band (Hz)	Approx. extent of door opening			
	5/64 in	13/64 in	25/64 in	1 in
100	8.9	10.5	10.4	11.5
125	7.3	9.7	11.2	10.1
160	9.6	11.3	12.3	12.5
200	11.2	13.0	14.3	15.5
250	11.6	13.3	14.5	16.0
315	13.1	15.3	16.3	17.0
400	12.3	14.7	15	17.1
500	10.3	11.8	13.4	14.8
630	8.0	9.9	10.7	13.2
800	9.9	11.6	12.9	15.1
1000	10.0	11.8	13.1	15.5
1250	11.7	13.7	14.7	16.8
1600	13.3	15.5	16.8	18.5
2000	16.2	18.3	19.4	21.3
2500	16.6	18.5	19.7	21.9
3150	16.1	18.5	19.8	21.4
4000	16.7	19.7	21.0	22.7
5000	16.4	18.3	20.7	23.1

Table 4 Cont'd. SOUND TRANSMISSION: OPENING OF SOLID-CORE DOOR

Increased transmission (dB) over closed-door situation compared with values given in Table 2, Col. 4

Centre freq. of $\frac{1}{3}$-octave band (Hz)	Approx. extent of door opening			
	2 in	4 in	8 in	16 in
100	14.7	15.2	17.1	16.5
125	14.0	15.8	14.7	17.0
160	14.7	16.3	17.2	19.9
200	17.1	18.5	21.6	20.8
250	18.2	20.0	22.3	24.2
315	19.1	21.1	22.9	24.3
400	18.9	21.4	23.0	24.7
500	16.8	19.0	20.3	21.1
630	15.0	17.1	18.1	19.8
800	16.6	18.3	18.9	21.2
1000	17.3	18.3	18.7	20.8
1250	17.5	18.5	19.8	22.2
1600	19.0	19.6	21.6	23.7
2000	21.6	22.6	25.0	27.2
2500	22.2	24.0	26.1	28.7
3150	23.4	25.4	26.7	29.7
4000	25.1	27.2	28.3	31.2
5000	25.5	27.4	29.1	32.5

THE SOUND INSULATION OF SINGLE CEILINGS

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SUMMARY

A series of tests was carried out with the aim of measuring the sound insulation provided by typical suspended ceilings. The passage of sound through a single ceiling was the subject of study; the attenuation room-to-room via two ceilings and the plenum above is measurable by a standard procedure described elsewhere.

No standardised method for single ceiling test is known to this laboratory, and we were thus obliged to evolve our own. Details of our method are described; briefly, an "insertion loss" procedure was used.

We found that a useful approximation to the sound insulation of a single ceiling may be obtained from the formula:-

$$\text{Single Ceiling Insulation} = \frac{\text{Room-to-Room Attenuation less } 10}{2}$$

GENERAL

This particular study was made while measurements of Ceiling Attenuation were in progress. Our regular 2-Room facilities were thus employed, and in fact the ceilings examined were those upon which attenuation tests had been run in connection with the effect of light fittings and air ducts.

There does not appear to be any standard method laid down for the in situ testing of single ceilings. Following advice from Mr. P.R. Knowland, Sydney, we decided that an "insertion loss" procedure was appropriate. Our tests were accordingly made in this way. Measurements were along the same lines as for the testing of duct liners, and the precision was thus generally the same as required by our N.A.T.A. (National Association of Testing Authorities) registration for Ceiling Attenuation and Duct Liner testing.

An important reason for making these measurements was to predict the effectiveness of suspended ceilings against noise originating from air conditioning systems installed in the plenum above. Hitherto the designer has been obliged to make a guess; we hope that more reliable estimates can now be made as a result of this work.

Because they were already available from the other work in progress, two particular ceiling systems were used. Other systems could as well have been investigated but these were regarded as being fairly typical, and sufficiently different in their overall sound insulation to provide a check on the validity of the tests.

EXPERIMENTAL DETAILS

Two series of measurements were made. In the first, the sound source (loudspeaker) was placed in the plenum above the test ceiling, to simulate noise from air conditioning duct work. In the second, the source was in the adjacent room. It was possible with this latter arrangement, also to measure the sound attenuation of the plenum alone, in the absence of ceilings.

Measurements of sound pressures in the receiving room were made in 1/3 octave bands across the frequency range 125 Hz to 5 KHz. The mean sound pressure at each test frequency was obtained by averaging the levels from a number of microphone positions about the room; 12 positions were used at the lower frequencies, this being reduced to 3 only at the higher frequencies. While measuring insertion loss the power fed to the loudspeaker was monitored and held constant for each frequency band.

The estimated precision of measurement is $\pm$ 2.8 dB at 125 Hz and $\pm$ 1.4 dB for all higher test frequencies.

The arrangement of sound source, microphone(s), and test ceilings is shown in the diagrams above each set of tabulated results.

TEST RESULTS

The results of our measurements are shown in Tables 1, 2 and 3.

In the first series, Table 1, the results of an insertion loss measurement are compared with sound insulation values as calculated from regular ceiling attenuation data for the same ceiling.

The results from the second series are shown in Table 2. Here the differences between the mean sound pressure levels in the two rooms for each of the 1/3 octave bands are given for the three conditions of ceiling installation (two ceilings, one ceiling, none). In Table 3 the measured sound insulation of a single ceiling is given for two test arrangements, and a figure is calculated from a third pair of measurements. These results are compared with those derived from regular Ceiling Attenuation results, using the formula:

$$\text{Single Ceiling Insulation} = \frac{\text{Room-to-Room Attenuation less 10}}{2}$$

DISCUSSION

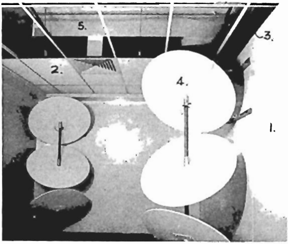
While it would be unwise to draw final conclusions from such limited experimental work, it does seem that a useful indication of single ceiling performance can be obtained from the conventional Room-to-Room Ceiling Attenuation figures.

The data obtained in the second series show encouraging internal consistency. Also, the ratings calculated by formula show good agreement with the measured results for the two quite different ceiling installations.

ACKNOWLEDGEMENTS

The investigation was sponsored by Hardboards Australia Limited, with the purpose of providing information on a common building situation for which no acoustical data appeared to be available.

The author wishes to acknowledge the assistance of Mr. P.R. Knowland for advice on the 'insertion loss' procedure adopted for the determination of the attenuation of single ceilings, and of Hardboards Australia Ltd., and Philips Industries Ltd., for their co-operation in the supply of test specimens.



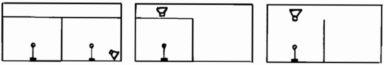
TWO-ROOM TEST FACILITY

View of one of the rooms

1. Partition dividing this room from the adjacent one.
2. Partly installed test ceiling.
3. Open plenum above partition.
4. Sound diffusers.
5. Air duct and register, not in place for this series of tests.

TABLE 1

CEILING SOUND INSULATION



Room to Room — Insertion Loss

SOUND INSULATION VALUES - dB

Test Freq. Hz.	Conventional Room to Room (2 Ceilings)	Single Ceiling by "insertion loss" method.	Single Ceiling by Calculation *
125	22	6	6
160	23	9	$6\frac{1}{2}$
200	24	5	7
250	27	11	$8\frac{1}{2}$
315	28	12	9
400	29	11	$9\frac{1}{2}$
500	32	12	11
630	34	13	12
800	36	12	13
1000	38	13	14
1250	39	15	$14\frac{1}{2}$
1600	41	15	$15\frac{1}{2}$
2000	42	14	16
2500	44	15	17
3150	43	16	$16\frac{1}{2}$
4000	46	15	18
5000	44	16	17

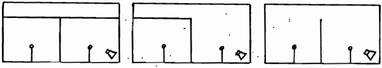
* Calculated by the formula:

$$\text{Single Ceiling Insulation} = \frac{\text{Room to Room Attenuation less 10}}{2}$$

The ceilings were Hardboards Australia Ltd. Moonspot No Flame, drop-in panels 4 ft x 2 ft. Two Philips Industries Ltd. fluorescent lights with slotted side rails were installed in each ceiling. The "insertion loss" is the difference between sound pressure levels measured with ceiling-in and ceiling-out. The ceiling area in each room was 10 ft by 14 ft.

TABLE 2

CEILING SOUND INSULATION



2 Ceilings — 1 Ceiling — Ceilings Out

SOUND INSULATION ROOM TO ROOM - dB

Test Freq. Hz	2 Ceilings (1)	1 Ceiling (2)	Ceilings Out (3)
125	28	20	12
160	27	21	10
200	29	17	8
250	32	21	9
315	33	22	10
400	36	22	9
500	37	24	11
630	39	24	9
800	43	28	10
1000	46	29	10
1250	47	30	9
1600	49	31	10
2000	50	31	10
2500	54	32	11
3150	57	35	10
4000	61	36	11
5000	64	37	10

The ceilings were Hardboards Australia Ltd. No Flame Fissured panels 4 ft by 2 ft. The ceiling area in each room was 10 ft by 14 ft.

TABLE 3

CEILING SOUND INSULATION

CALCULATIONS FROM DATA IN TABLE 2

Three estimates may be made of the single-ceiling performance using the measured data:

1. Difference between values for 2 Ceilings and Ceilings out, over 2,

   That is - $\frac{(1) - (3)}{2}$

2. Difference between values for 1 Ceiling and Ceilings out,

   That is - (2) - (3)

3. Difference between values for 2 Ceilings and 1 Ceiling,

   That is - (1) - (2)

Test Freq. Hz.	Derived as above 1.	2.	3.	Single Ceiling by Calculation*
125	8	8	8	9
160	8½	11	6	8½
200	10½	9	12	9½
250	11½	12	11	11
315	11½	12	11	11½
400	13½	13	14	13
500	13	13	13	13½
630	15	15	15	14½
800	16½	18	15	16½
1000	18	19	17	18
1250	19	21	17	18½
1600	19½	21	18	19½
2000	20	21	19	20
2500	21½	21	22	22
3150	23½	25	22	23½
4000	25	25	25	25½
5000	27	27	27	27

* Calculated by the formula:

$$\text{Single Ceiling Insulation} = \frac{\text{Room to Room Attenuation Loss less 10}}{2}$$

LOW COST SOUND LEVEL INDICATORS

P.R. KNOWLAND

P.R. Knowland, Martin & Associates
North Sydney

INTRODUCTION

Recently three low cost sound level indicators have become available on the Australian Market. These varied in price from $25.00 to $135.00. The purpose of this review is to examine the performance of these devices and to determine if they represent a valid means of indicating specific noise level.

The cheapest in the range was the "Noise Warden" which costs about $25.00. This meter which is a relatively simple device, is supplied by the Noise Abatement Society (England). The meter is housed in a plastic case measuring approximately 140 x 60 x 30 millimetres. Operation is by pushing a slide switch to one of three positions marked 80, 85 and 90 dB'A'. If the level of noise exceeds the selected level the meter indicated this exceedance by causing a red light on the case to glow.

The next meter in the range is the CS15C made by Castle Associates of England and costs $80.00. This is completely conventional in layout comprising the normal 20 dB range moving coil meter, a 10 dB step attenuator giving a range from 40 to 100 dB, fast and slow setting for the meter and a means of checking the battery. This meter reads in dB'A' only.

The highest priced meter in this group was the Swiss made Minophon costing $135.00. The meter is very small measuring only 85 x 40 x 125 millimetres. The moving coil meter is unusual in that the range is from zero to + 25 dB. The scale between 0 and 5 dB is crowded and the accuracy in this range is suspect. A 20 dB stepped attenuator is provided giving a range between 40 and 100 dB. Weighing networks of A, B, and C scale are provided together with a position to measure vibration. Fast and slow damping are provided for the indicating meter.

TEST PROCEDURE

A simplified form of testing was adopted. Each meter was placed in a reverberant sound field and exposed to wide band noise of three different spectrum shapes; the readings obtained were compared to calibrated Bruel & Kjaer 2203 and 2204 sound level meters placed in the same location. The three spectra chosen comprised:

a. Predominately flat over the frequency range 250 Hz to 4000 Hz.
b. Predominately low frequency spectrum.
c. Predominately high frequency spectrum.

The three spectra used are shown in Figure 1.

For the Castle CS 15C and the Minophon further tests were carried out to examine the frequency response of the microphone and indicating system. These meters were exposed to 1/3 octave bands of random noise in the far field of a reverberation chamber. The Frequency range used was from 50 Hz to 10,000 Hz in 1/3 octave bands. The responses of these meters are shown in Figure 2.

The Noise Warden was also checked at the 1/3 octaves of 250, 500, 1000, 2000 and 4000 Hz. These results are also shown in Figure 2.

SUMMARY

Whilst the concept is good the tests indicate that the Noise Warden was an inaccurate device for indicating noise level. The indication provided by the meter was dependant on the frequency composition of the sound field. We found that if noise from machinery contained pure tones, a situation not uncommon, then the noise from the machine could cause the Noise Warden to trigger anywhere from between 70 dB'A' and 90 dB'A' for a setting of 80 dB'A on the meter. Two meters were tested and it was found that there was substantial variation between the two meters.

There was no ready means of calibrating the meter; this is considered a poor feature.

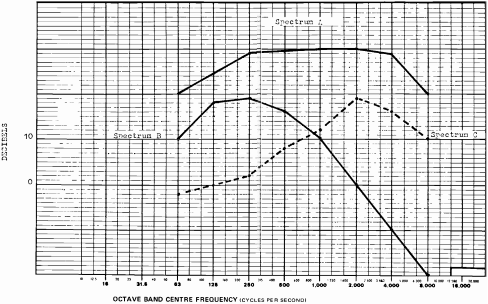
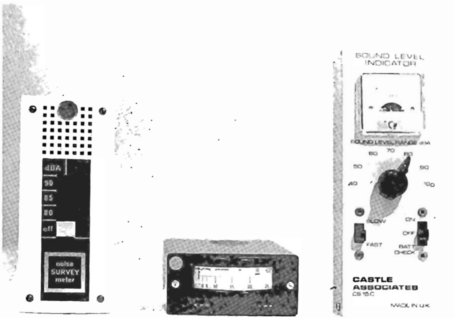


FIGURE 1 NOISE SPECTRA USED TO TEST LOW-COST SOUND LEVEL INDICATORS



THE INDICATORS TESTED

Left to right : Noise Warden, Minophon, Castle CS.15C

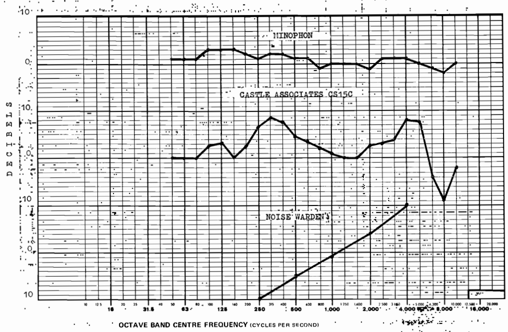


FIGURE 2 FREQUENCY RESPONSE OF THE INDICATORS FOR 1/3 OCTAVE BANDS

TABLE 1

Responses of the indicators to the three different test spectra

TRUE SPL.	SPECTRUM	MINOPHON	CS.15C	NOISE WARDEN
	A	85 dBA	85 dBA	90 dBA
85 dBA	B	83.5 "	83.5 "	90 "
	C	84 "	85 "	80 "
	A	65 "	65 "	
65 "	B	63 "	65 "	
	C	63 "	63 "	
	A	47 "	46 "	
45 dBA	B	46 "	44 "	
	C	47 "	46 "	

Castle CS 15C

The meter had a number of features which restricted its suitability as a general sound level meter.

1. Frequency response of the microphone was outside the limit of the S.A.A. Code Z37.
2. Our particular meter tended to change calibration over a short period of time. (This matter was raised with the importer of the meter who referred this back to the U.K. The manufacturer replied that this was probably the microphone and has despatched a replacement unit from the U.K.).
3. The on-off switch was not positive in action; it was very easy to accidentally switch on the meter.

Despite the poor response of the microphone the indicated readings for wide band noise were surprisingly good. We feel that the microphone supplied was the main limitation. The simple substitution of the piezo microphone with an electret condenser such as the Sony ECM 16 with associated preamp would convert this meter into a useful instrument for general sound measurement. A better method of calibration is required than using a Dawe falling ball calibration.

Minophon

Whilst the meter was very small its ergonomics were not good. It is not as convenient to use as the CS 15C. The response of the microphone was good for a piezo microphone; however, for wide band noise it was fractionally less accurate than the CS 15C. Calibration, we assume, is by the falling ball system or by comparison to a reference sound source and a precision sound level meter.

The Minophon seems to have some practical use but it would not be considered as a substitute for a general sound level meter conforming to S.A.A. Z37.

LETTERS TO THE EDITOR

DUCT LINER TEST

We have received a letter from J.A. Irvine in reply to the Technical article by R.J. Alfredson in the 1972 Winter Bulletin. The main points are outlined below:

1. It seems likely that the use of reverberant rooms at both the source and the receiving end of a test duct would increase the precision of the measurement. Whether it would necessarily improve the accuracy is another matter. (We may define precision as referring to the repeatability of a measurement, while accuracy reflects the nearness of the result, on the average, to what is required to be known).

2. Measurement of duct liner performance under "Dynamic" condition may well be of importance in some circumstances. As the work of Melling and Doak suggests, studies on high By-pass ratio engines for aircraft are a case in point. Air Velocities in such engines may be very high.

3. Whether the proposed Australian test method provides information on the liner, or on the "liner-plus-system", raises an interesting question. In the writer's opinion a strong case exists for testing the "liner-plus-system", on the grounds that this represents a close approach to normal building usage. Although a separate knowledge of the performance of the liner alone may have value in some circumstances, the more general need is to be able to specify how to achieve adequate attenuation in real buildings.