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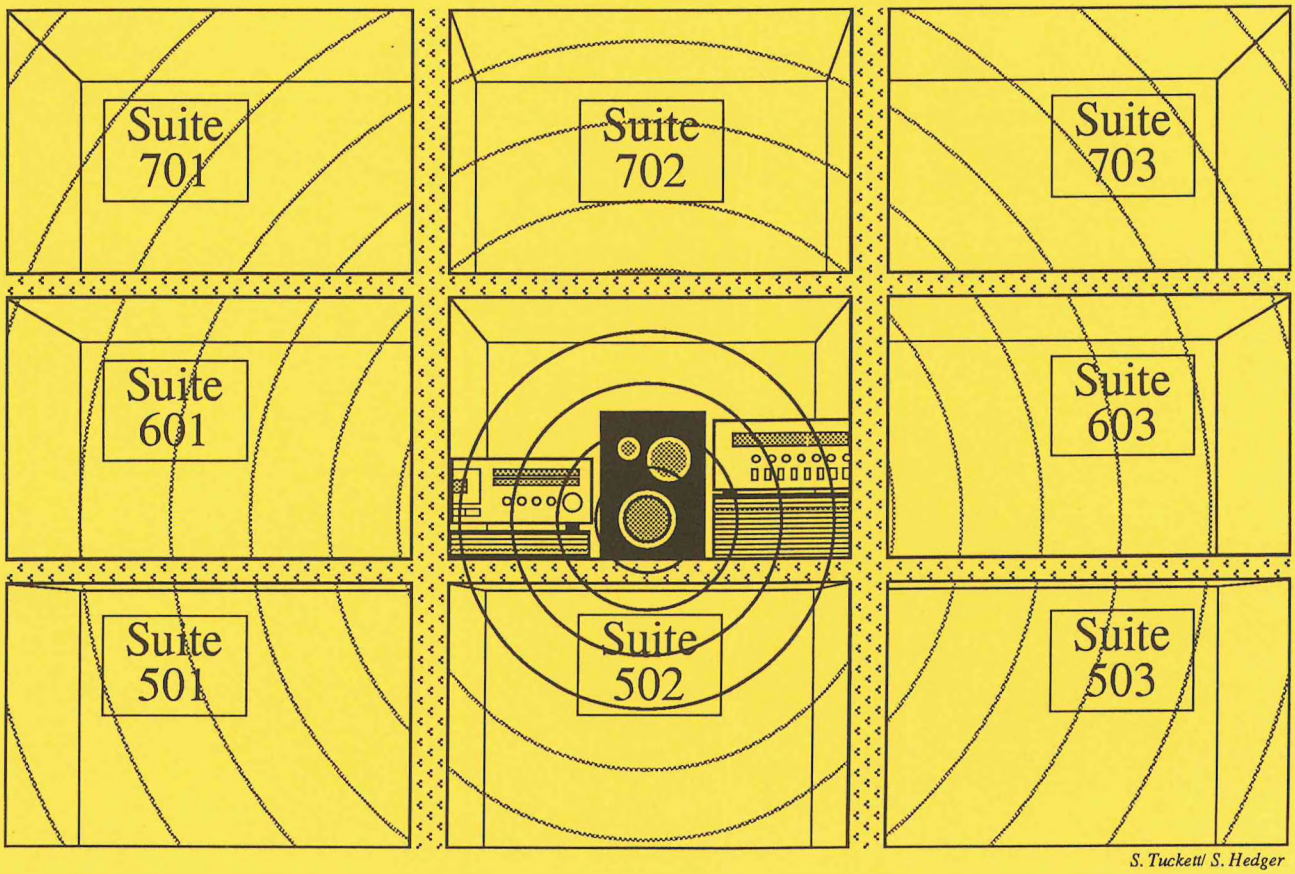

S. Tuckett/ S. Hedger

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The Canadian Acoustical Association
P.O. Box 3651, Station C
Ottawa, Ontario K1Y 4J1

l'Association Canadienne de l'Acoustique
C.P. 3651, Succursale C
Ottawa, Ontario K1Y 4J1

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CANADIAN ACOUSTICS publishes refereed articles and news items on all aspects of sound and vibration. Papers reporting new results as well as review or tutorial papers, and shorter research notes are welcomed in English or in French. Two copies of submission should be sent to either the Editor-in-Chief (English articles), or to the Editor (French articles). Complete information to authors concerning the required camera-ready copy is given in the first issue of each volume.

ACOUSTIQUE CANADIENNE publie des articles arbitrés et des informations sur tous les domaines du son et des vibrations. Les manuscrits seront inédits ou bien des aperçus, ainsi que des notes techniques, rédigés en françcais ou en anglais. Deux copies seront soumis au rédacteur en chef (articles en anglais), ou au rédacteur (articles en français). La forme et la préparation des manuscrits exigées pour reproduction se trouveront dans le premier numéro de chaque volume.

EDITORIAL

The year of the 12th ICA has at last arrived and Canadian acousticians will soon be hosts to the major international acoustical conference. As you will see from the 12th ICA report in this issue, plans have progressed well, but it is now time for increased effort from all of us. Considerable sums of money are involved and a small cost over-run would put the Canadian Acoustical Association in the red for many years. Make sure you are involved!

This issue contains two papers that differ from our usual scientific contributions and concern acoustical requirements for multiple residence buildings. As you will discover, both papers start from the assumption that the National Building Code is inadequate in this area. Although this seems to be a common assumption, there is little effort to change the situation. It is your Building Code; if you don't like it you must do something about it. This is especially true if you are in any way involved in the construction industry. Your letters and comments would of course be most welcome.

After discussions with several consultants and much contemplation, we have decided to compile and publish a survey of Canadian companies engaged in acoustical consulting. Although we will attempt to approach most companies individually, a response form and instructions are included in this issue. If you wish to be included, you must respond!

EDITORIAL

L'annee de l'ICA-12 est arrivée et les acousticiens canadiens seront les hôtes d'une importante manifestation scientifique internationale cet été. Beaucoup de nos membres sont impliqués, soit dans l'organisation ou comme auteurs et l'approche de l'été signifie une augmentation de leurs efforts. Vous trouverez dans ce numéro un rapport des activité sur le congrès. Il faut aussi souligner que l'organisation de l'ICA-12 représente pour l'Association Canadienne d'acoustique un fardeau financier considérable. C'est pour cette raison d'ailleurs que l'association demande une contribution au 12e ICA à chaque renouvellement de votre abonnement. L'argent recueilli de cette façon sert à alléger les risques financiers pour l'association.

Ce numéro contient deux articles qui diffèrent des contributions scientifiques habituelles. Ils se consacrent aux exigences acoustiques des édifices à logements multiples et leur point de départ est l'insuffisance du code national du bâtiment du Canada dans ce domaine. Quoique cette hypothèse soit généralement admise, il semble y avoir peu d'effort pour changer cette situation. Nous espérons que ces deux articles stimuleront des commentaires, spécialement de la part des gens dans l'industrie de la construction.

Après mointes consultations et réflexions nous avons décidé de compiler et publier un aperçu des entreprises offrant des services de génie conseil en acoustique. Nous essayerons de contacter chaque entreprise individuellement. Cependant une réponse au formulaire inclu dans ce numéro assurerait que votre entreprise soit incluse.

Il y a deux ans, une nouvelle équipe de rédaction était mise en place. En ce moment, et d'après ce qui semblait être un désir général, l'ACOUSTIQUE CANADIENNE fut légèrement remanié et les derniers numéros ont vu une série ininterrompue d'articles arbitrés. Cependant, au moment de cette rédaction l'ACOUSTIQUE CANADIENNE a un manque soudain de contributions. Après l'appui initial, que se passe-t-il?

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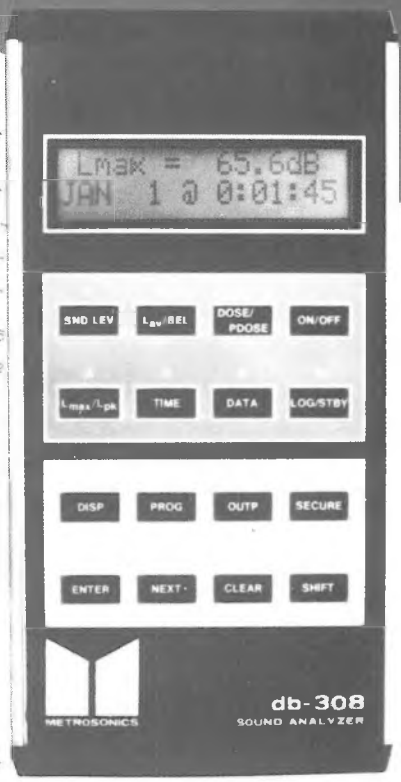

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BRANCHES THROUGHOUT CANADA

NOISE ISOLATION STANDARDS IN CONDOMINIUMS -- AWAITING REVISION OF SECTION 9.11 OF THE NATIONAL BUILDING CODE

Paper presented at the Canadian Acoustical Association meeting in Ottawa - October 1985

Michel Morin
Architecte
MJM CONSEILLERS EN ACOUSTIQUE
MJM ACOUSTICAL CONSULTANTS
6555 Côte des Neiges, suite 440
Montréal, Québec, H3S 2A6

SOMMAIRE

Jusqu'à récemment, la plupart des édifices à logements multiples de la région de Montréal n'avaient qu'une vocation locative. Les prix des loyers étaient fixés selon le marché et selon la qualité des constructions. Le déménagement était la solution la plus souvent adoptée lorsque les conditions de location étaient jugées inacceptables, à cause du manque d'isolement acoustique, ou pour toutes autres raisons.

L'accession à la propriété par condominium modifie les règles du marché. La réglementation existante régissant l'isolement acoustique entre les logements des édifices à vocation locative ne semble plus être appropriée lorsqu'appliquée aux édifices vendus en copropriété divise.

A l'intérieur du présent article, l'auteur passe en revue la réglementation existante régissant l'isolation sonore des condominiums bâtis à l'intérieur des limites de la communauté urbaine de Montréal. Il propose de plus une liste de critères d'isolation sonore dont il juge l'application souhaitable durant la conception et la construction d'édifices destinés à la vente en condominiums.

SUMMARY

Until recently, most multi-dwelling buildings in the Montreal area were intended solely for rental purposes. Rental rates were generally based on the

state of the market and the quality of the construction. When rental conditions were deemed unacceptable because of insufficient acoustical isolation or other reasons, most tenants simply moved.

The trend towards condominium ownership has changed the rules of the market. The existing regulations governing acoustic insulation between dwellings in rented buildings no longer seem appropriate when applied to buildings intended for divided co-ownership. In this paper, the author reviews the current regulations in the Montreal region and proposes a series of noise isolation criteria for condominiums. These criteria are not intended to cover exhaustively all the aspects of noise isolation in multi-dwelling buildings; they are intended to serve as guidelines during the design and construction.

Municipal Regulation

At the present time, with the exception of Ville Lasalle, the member municipalities of the Montreal Urban Community have no construction regulation dealing specifically with noise control in condominium buildings. They usually refer to the requirements set forth in the National Building Code, section 9.11.

According to the new regulation of Ville Lasalle (bylaw 1873-1), each dwelling must be separated from any other space in a building, or from any adjacent building, by a construction having a sound attenuation capability of at least 55 decibels for buildings having one (1) to four (4) dwellings inclusively, and of at least 58 decibels for buildings with five (5) or more dwellings. Underground dwellings are not taken into account when calculating the number of dwellings but must be isolated in the same way as the rest of the building. The composition and Sound Transmission Class of these constructions must be indicated on the plans and specifications, complete with reference to the standards used and approved by Ville Lasalle. (It should be noted however that the standards approved by Ville Lasalle are not defined in the regulation).

National Building Code (NBC)

Section 9.11 of the National Building Code (NBC), 1985 edition, stipulates that each dwelling unit belonging to a multi-dwelling building must be separated from any space likely to contain a sound source by a construction having a Sound Transmission Class of at least 45. Furthermore, a partition separating a dwelling from an elevator or garbage chute must have a Sound Transmission Class of at least 50.

The National Building Code (NBC) deals with buildings intended to be sold as condominiums on the same basis as rental buildings. Also partitions separating dwelling units from hallways are subject to the same requirements as those separating two dwellings. One could note on this subject that activities taking place in hallways are generally not as noisy as those resulting from human activity in dwellings. In addition, the NBC does not regulate the degree of insulation provided by access doors to dwellings, which constitute a weak point in a partition adjacent to a corridor.

Finally, experience has proven that the requirements set forth in the current edition of the National Building Code are clearly insufficient to assure future condominium occupants a satisfactory degree of noise isolation. One can therefore expect a high rate of dissatisfaction on the part of residents with regard to the degree of interdwelling acoustical privacy afforded by condominiums built in strict accordance to these requirements.

Current standards in the construction industry

After realizing the inadequacy of the inter-dwelling noise isolation criteria set forth in section 9.11 of the NBC, the Canada Mortgage and Housing Corporation (to be more precise, the CMHC branch offices of the Province of Quebec) has set its own noise isolation criteria in an attempt to improve the quality of the condominium projects in which it is involved. According to these criteria, all inter-dwelling partitions (including floors and walls) should have a composition capable of achieving an air-borne sound isolation of at least STC 55. In addition, it is required that the floor/ceiling assemblies be designed to provide an impact noise isolation of at least IIC 65. These criteria seem to be accepted by most builders of the Province of Québec as the current standards in the construction industry.

Towards a new regulation

Several factors influence condominium owners' subjective impression of the noise isolation provided by their dwelling. Among these factors are:

- their auditory acuity
- their, and their neighbors' habits and lifestyle
- their rapport with their neighbors
- the background noise level inside their dwelling
- the spectrum, nature and frequency of occurence of the transmitted sounds
- the message carried by the transmitted sounds, etc.

The National Research Council of Canada is currently conducting a study across Canada in order to simultaneously observe the subjective reactions of condominium and apartment

occupants and the transmission loss provided by the partitions separating them from their neighbours. This research will attempt to correlate the residents' subjective evaluation of the noise isolation provided by the partitions of their dwelling, with the actual performance of the same partitions measured objectively using a recognized standard. A preliminary report based on a small sampling of data collected in the Ottawa region was published in Canadian Acoustics (1) and is available from the National Research Council (2). In this report it is established that inter-dwelling partitions with a Field Sound Transmission Class (FSTC) of 55 met the noise isolation expectations of 90% of the condominium owners surveyed. An FSTC 52 rating leads to a percentage of satisfaction of approximately 80%.

Ultimately, it is expected that the final compilation of all the results collected across the country will serve to redefine the criteria for noise isolation and to rewrite section 9.11 of the National Building Code.

PROPOSED SOUND ISOLATION CRITERIA IN CONDOMINIUMS

While awaiting a revision of section 9.11 of the NBC, the author proposes a series of minimal sound isolation guidelines which in his opinion should be applied during the design and construction phases of buildings intended for sale by divided co-ownership.

1.0 EXTERIOR NOISES *

1.1 The building envelope should be capable of attenuating the noises produced by vehicular traffic or by industries and businesses located near the site to the sound pressure levels shown in Article 1.2.

1.2 Sound pressure level criteria in interior spaces:

- bedrooms:	Leq (24 hrs) = 35 dB(A)
- living room, dining room, den:	Leq (24 hrs) = 40 dB(A)
- kitchen, bathrooms:	Leq (24 hrs) = 45 dB(A)

1.3 Vehicular traffic noise should not exceed Leq (24) = 55 dBA in outdoor living or recreation areas (balcony, exterior courtyard, etc.).

* Criteria established by the CMHC for buildings in urban areas (3).

2.0 NOISE PRODUCED BY HUMAN ACTIVITY WITHIN DWELLINGS

2.1 Partitions separating two dwellings
Horizontal and vertical partitions separating two

dwellings should have the following sound isolation characteristics:

2.1.1 Possess a Sound Transmission Class of at least 55 (average of at least 5 different laboratory tests)

NOTE: As was mentioned earlier, according to the preliminary report produced by the Division of Building Research of the National Research Council, 80% of the occupants express satisfaction with a partition rating FSTC 52. This percentage of satisfaction has been selected by the author as a minimum acceptable noise isolation target.

In item 5.3 of the present guidelines, the acceptable deviation between the Sound Transmission Class obtained in laboratory conditions (STC) and that measured in the field (FSTC) is 3 decibels. Consequently, STC 55 has been selected as the design performance criteria of interdwelling partitions.

2.1.2 Provide a transmission loss of at least 35 decibels in the third octave band for which the central frequency is 125 Hz.

NOTE: Rock and pop music contains a considerable amount of energy in the lower end of the frequency spectrum. The author ran a third octave band analysis of a 257 sec. sample of a popular rock music extract: Michael Jackson - Beat it. The Leq and L 10 levels were then obtained and used to calculate the transmission loss required to reduce the L 10 levels produced in the source room (listening level Leq = 85 dBA), to levels equal or below the Preferred Noise Criteria (PNC) 25 in the receiving room. With this specific sample, it was found that a TL of 40 dB was required in the third octave band for which the center frequency is 125 Hz.

As a TL of 40 dB at 125 Hz represents the practical limit which can be attained in wood construction, the author has opted for a minimum TL of 35 dB at 125 Hz.

2.1.3 Floor/ceiling assemblies should have an Impact Isolation Class of at least 55 in kitchens and bathrooms, and 65 in the other rooms.

NOTE: The Impact Insulation Class Standard has been criticized for not providing results which can be used to predict the subjective evaluation of the occupants with regards to the impact noise isolation which is provided by the floor/ceiling assembly separating them from their neighbors. The argument at the base of these criticisms is that the characteristics of the impacts produced by the tapping machine bare no resemblance to those produced by a human being walking on a floor.

The author uses the much criticized Impact Insulation Class standard for the sole purpose of ensuring that carpet will be used in living rooms, and that some means will be provided to attenuate the high frequency content of the transmitted sound resulting from impacts on the hard floor surfaces in kitchens and bathrooms.

2.2 Partitions separating a dwelling from a corridor

2.2.1 Partitions separating a bedroom from a corridor should have a Sound Transmission Class of at least 50.

NOTE: The STC 50 value was obtained by calculating the transmission loss required to attenuate to PNC 25 or below, the noise levels which could be generated in corridors during a discussion held at normal voice (the levels used for calculations are those contained in the ANSI S35-1969 Standard).

2.2.2 In the case of partitions separating a common hallway from any other room of a dwelling, a Sound Transmission Class of at least 45 is required.

NOTE: The background noise in living areas is generally higher than in sleeping quarters. See item 1.2 of the present criteria.

2.2.3 The use of carpeting with a resilient underlay as floor treatment in the hallways is highly recommended.

NOTE: For reducing the levels of both reverberant airborne noise and impact noise produced in hallways.

2.2.4 Access doors to dwellings should have a Sound Transmission Class of at least 25. To preserve the sound-insulating qualities of the doors, they should be installed in appropriate frames equipped with air-tight gaskets.

NOTE: STC 25 is generally the highest rating which could be expected from a normal solid core door (the core is generally made out of particle board), when the door is fully gasketed. Some 1 3/4" wood sound rated doors such as Weyerhauser DPC-1 are rated at STC 31; the use of such doors or vestibules with two doors could be considered in order to improve sound isolation between dwellings and corridors. For fire security reasons, double doors such as those used between hotel rooms are not recommended for access from a corridor to a dwelling.

2.3 Partitions separating a stairwell from a dwelling

2.3.1 Partitions separating a stairwell from a bedroom should have a Sound Transmission Class of at least 55. The partition should consist of two leaves free of any mechanical coupling (i.e. each leaf should have its own frame). If an unbalanced construction is considered (e.g. two layers of drywall on one side, one layer on the other side of the partition), the heavier leaf should be installed on the side of the dwelling.

NOTE: The salt and sand used on Montreal streets to melt the snow during the winter generally creates maintenance problems in the entrance of buildings. In a large number of walk up apartments, the main stairway is located at the entrance of the building; for maintenance reasons, the floor covering of the landings and of the stairs is a hard washable finish. This results in a very reverberant space, where the reverberant noise build up can be considerably higher than that which would be experienced if the space were carpeted. For this reason, it is deemed that a STC of 55 is required for the partition located between a stairwell and a bedroom.

The landings are usually attached to the stairway walls. Providing independant structures for each leaf should reduce the amount of impact noise transmitted during the use of the stairs. If an unbalanced construction is used for these partitions, installing the heaviest leaf on the side of the dwelling should provide a better impact noise isolation.

2.3.2 A partition which separates a stairwell from any room of a dwelling other than a bedroom, and which does

not contain an access door to the stairwell, should have a Sound Transmission Class of at least 50. The partition should consist of at least two leaves with a minimal amount of mechanical coupling.

NOTE: Cf. notes 2.2.2 & 2.3.1.

2.3.3 Partitions incorporating an access door to the stairwell should have a Sound Transmission Class of at least 45.

NOTE: This is to provide an STC Value appreciably higher than that provided by the door which represents a weak point in the partition. It is worth noting that sound leaking through the doors is more easily accepted by occupants than sound leaking through the partitions. Providing a partition having a STC rating 20 points superior to the rating of the door appears to be more than sufficient to insure that sound leaks will be perceived to be coming from the door and not the partition.

2.3.4 The use of carpeting with underlay as floor treatment in the stairwells is highly recommended.

3.0 VENTILATION

3.1 The noise levels generated in the hallways by ventilation or pressurization systems should not exceed the Preferred Noise Criterion of 40. (45 dBA).

3.2 If for ventilation purposes it is necessary to introduce an opening in a partition separating a hallway from a dwelling, this opening should be located above the door and acoustically treated to provide a noise reduction consistent with that provided by the door.

NOTE: The ventilation opening can be located anywhere in the partition as long as it is treated to provide a noise attenuation consistent with that of the partition in which it is located.

For economy, the author opted for the location of the opening above the door: the vent should then be treated to achieve a noise reduction consistent with the noise isolation provided by the door (STC 25) instead of that provided by the partition (STC 45).

4.0 PLUMBING

4.1 The water speed in the pipes should be limited to 1.8 m/sec in circulation systems, and 2.4 m/sec in water supply systems.

4.2 Pressure in the pipes should be reduced to a minimum acceptable level.

4.3 All rigid contact between the piping and the building structure should be avoided.

NOTE: These guidelines are intended for the control of cavitation noise at the source. Additional measures should be recommended by the acoustical consultant during the project design phase.

5.0 ACCEPTED STANDARDS

5.1 The recognized standards for the measurement of the Sound Transmission Class (STC) of a partition are:

Laboratory measurement
ASTM E90-85
ISO 140/3 1978 (provided that a TL measurement is performed at 4000 Hz).

Field measurement
ASTM E336-84
ISO 140/4, /5 1978 (provided that a TL measurement is made at 4000 Hz).

5.2 The recognized standards for the measurement of the impact noise isolation provided by a floor/ceiling assembly are ISO 140/6, /7 1978 and ASTM 492-77.

5.3 The acceptable deviation between the Sound Transmission Class obtained in laboratory conditions (STC) and that measured in the field (FSTC) is 3 decibels.

NOTE: It is the author's opinion that a wideband, "A" weighted noise reduction made by a qualified consultant would be all that is necessary to provide a quality control on the airborne noise isolation performance of the inter dwelling partitions (horizontal and vertical).

This simple test could be performed quickly and easily on a large number of partitions using a pink noise source and a type II SLM.

If as a result of these tests, it is felt that certain partitions do not perform as well as they should, more complete testing using appropriate standards should be undertaken to determine the cause of the poor performance and to recommend mitigating measures.

6.0 GENERAL CONSIDERATIONS

6.1 It is highly recommended that a professional consultant in acoustics be engaged from the preliminary design stage.

6.2 The Sound Transmission Class (STC) of partitions and floor/ceiling assemblies governed by the present sound isolation criteria should be indicated on the plans and specifications and confirmed by the acoustical consultant.

6.3 The methods and materials used to preserve the sound-isolating qualities of the partitions and floor/ceiling assemblies should be indicated on the plans and specifications (e.g. caulking, gaskets around the doors, etc.).

It should be noted that these guidelines:

a) are considered minimal;
b) are also applicable to multi-dwelling buildings intended for rental;
c) are not intended to cover all possible situations which could occur during the design of multi-dwelling units; care and judgement should be exercised at all times by the design & construction team to ensure a proper degree of acoustical comfort within each unit.

Comments will be well received by the author.

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1- J.S. Bradley, "Subjective rating of Party walls" Canadian Acoustics, Vol. 11(4), p.37 - 45, 1983.

2- J.S. Bradley, "Subjective rating of Party walls" NRC Division of Building Research, Paper 1147 Ottawa, 1983.

3- Canada Mortgage and Housing Corporation, "Road and Rail Noise: Effects on Housing" Publication NHA 5156, October 1981.

A PROPOSAL FOR SOUND TESTING PRIOR TO OCCUPANCY OF MULTI-FAMILY DWELLINGS

H. Gordon Pollard
#221, 4815-48th Avenue
Delta, British Columbia
V4K 1V2

ABSTRACT

The STC (Sound Transmission Class) of a construction does not include the adverse effects of "flanking transmission." Less confusion would exist if building codes referred to the NIC (Noise Isolation Class). NIC tests are less time-consuming and less expensive. Samplings of completed constructions should be field tested, prior to occupancy of multi-family dwellings, to measure overall acoustic privacy. If test results indicate that the minimum NIC rating has not been met, remedial steps should be taken. Measurements obtained should be filed at building inspectors' offices, and available for public scrutiny. Impact noise can be measured in the field according to existing IIC (Impact Isolation Class) standards, using readily available equipment. Any occupant whose unit has not been field tested should have the right to require a field test of his unit. If the unit is acceptable, the cost of the test is his responsibility, otherwise, the building owner must pay for it and improve construction.

SOMMAIRE

Le STC (indice de transmission du son) d'une construction ne tient pas compte des effets néfastes des "trajets indirects du son." Il y aurait moins de confusion si les codes du bâtiment parlaient le NIC (indice d'isolation acoustique). Les essais visant à déterminer l'indice d'isolation acoustique exigent moins de temps et d'argent. Il faudrait examiner un échantillonnage de logements multifamiliaux, avant leur occupation, afin de mesurer l'isolation acoustique globale. Si les résultats des essais indiquent qu'ils ne satisfont pas à le NIC minimum, il faudrait remédier à la situation. Les mesures effectuées devraient être déposées aux bureaux des inspecteurs du bâtiment et être accessibles au public. On peut mesurer les bruits d'impact sur place en fonction des normes actuelles concernant l'IIC (indice d'isolation aux bruits d'impact) au moyen d'appareils faciles à obtenir. Tout occupant d'un logement qui n'a pas été testé sur place devrait avoir le droit d'exiger que cela soit fait. Si le logement répond aux normes, il doit assumer les frais de l'essai, sinon le propriétaire de l'immeuble doit les prendre à sa charge et apporter les améliorations nécessaires.

1. FOREWORD

CAVEAT EMPTOR

In today's burgeoning, complex, concentrated and technologically oriented society ... subjected constantly to an onslaught of mental or physical aggravations, conscious or subconscious fears, competitive or peer pressures, apprehensions of an emotional or financial nature and encompassed by a pervasive unremitting barrage of noise ... the 'need' (if not the inalienable 'right'), of every person to acoustical privacy within their home, is of paramount physiological, psychological and sociological importance.

Partial acknowledgement and recognition of this 'need' was accorded by the American Society for Testing and Materials, when, in approximately 1961, Committee C20 which has since become ASTM Committee E-33 on Environmental Acoustics formulated and published the "Sound Transmission Class," which is the direct responsibility of Subcommittee E33.03.

Today, some 24 years later in every province, the need is greater and more pressing and the effectiveness of design and/or construction techniques/methods for multi-family housing, affecting isolation from interior, exterior and impact noise sources, should be critically assessed.

In these respects, ASTM Designation: "E597-81"[1] (originally published as: E597-77T) should be perused and taken into account by architects, developers, contractors, tradesmen and building inspectors, involved in the construction and/or inspection of multi-family housing projects.

Acoustical privacy is particularly essential and vital to the 'peace of mind and well-being' of modern twentieth century cliff-dwellers, residing as they do (mainly out of necessity), in a proliferation of multi-family dwellings, such as: low or high-rise apartment complexes, condominiums, townhouses and rowhouses. Frequently, the 'life-styles' and daily or nightly routines of many, are radically different from those of their adjoining neighbours, in that coping with society's demands and needs, requires substantial numbers in various occupations, to 'toil, while others relax or sleep'.

Within each of the above heterogeneous groups, most, if not all of the inhabitants, own or lease and utilize within their respective 'caves' (homes), a multiplicity of electrically-powered 'sound-producing' (labour and time-saving devices), as well as electronic equipment used for viewing and/or leisure listening, relaxing and sleeping, or for acquiring information, knowledge, learning and/or recreational purposes including the inputting, storing, retrieving or transmitting of data. Furthermore, many possess one or more musical instruments which, when played, generate sound.

Consequently, the interior sounds created are transmitted and attenuated laterally, vertically and diagonally, into adjoining caves above, below or beside them, at varying intensity levels, not only through the separating wall(s) and/or floor(s), but, by way of one or more 'flanking transmission paths'.

At varying times, over long and short periods, attenuated sounds are augmented by those associated with other mundane daily or nightly actions and activities, such as: social gatherings and discussions involving family members and/or their guests, private and personal acts, including the interactions of children, any or all of

which, may be audible, understandable and/or identifiable to/by their neighbours. In these instances, questions coming to mind are: "HOW, WHY AND WHO IS NOW INVADING WHOSE PRIVACY?"

Additionally, 'cliff-dwellers' in proximity to any of the following:

- domestic or international airports
- primary highways
- secondary traffic arterials
- freeways
- mainline railways
- automated light rapid transit routes
- industrial and/or manufacturing facilities
- stadiums

are subjected to the intrusion of exterior noises from one or more of these sources which, periodically, is horrendous.

Dr. William H. Stewart, former U.S. Surgeon General, said "CALLING NOISE A NUISANCE IS LIKE CALLING SMOG AN INCONVENIENCE. NOISE MUST BE CONSIDERED A HAZARD TO THE HEALTH OF PEOPLE EVERYWHERE." Noise is a serious problem! In July 1983, the Division of Building Research, National Research Council of Canada, published BPN 44, "HOW TO REDUCE NOISE TRANSMISSION BETWEEN HOMES (APARTMENTS).[2] While it may be debatable, it appears somewhat obvious that if only a few isolated queries or complaints, concerning noise transmission in multi-family dwellings, including related criticisms of wall(s) and/or floor(s) construction(s), were known, or had been communicated to members of the Division of Building Research and/or to the Associate Committee on the National Building Code (Housing and Small Buildings), then collectively, they would not have warranted the time and expenditures involved in formulating, printing, distributing and issuing BPN 44.

FOR THE VAST MAJORITY OF CANADIANS, 'HOME ISN'T JUST WHERE THE HEART IS, IT'S WHERE THE MONEY IS TOO'. IT IS THE SINGLE GREATEST PURCHASE (FINANCIAL COMMITMENT) OF A LIFETIME AND A MORTGAGE, THE BIGGEST INVESTMENT. Obviously, privacy is highly valued by everyone, especially by those contemplating the purchase or rental of a unit in a multi-family dwelling described or advertised as "quality construction" and/or "luxurious" and where "exclusive privacy", is both stressed and assured. Invariably, when questioned in these respects, the developer and/or the marketing agents, will provide oral assurances in one or more ways, that satisfy the purchaser or renter and allay any doubts they may have, before completing the necessary documentation and contractual obligations.

After occupancy, numbers of owners subsequently discover to their dismay, that they "didn't get what they paid for" or "expected." If they complain about 'noise and noisy neighbours,' they are usually informed that:

(a) this is not unusual;
(b) noise is to be expected wherever numerous people reside in the same building;
(c) mutual cooperation and consideration between adjoining neighbours is now necessary;
(d) it is unlike residing in a detached single-family residence;
(e) the STC rating of the "party wall(s)" equals or exceeds the minimum requirements specified in the National Building Code;
(f) they can always resell or rent their unit and move elsewhere if they are dissatisfied.

* Reference (e) above. The importance and significance of STC (Sound Transmission Class) ratings, being sound measurements of partitions obtained in a laboratory under optimum conditions and where precautions are taken to negate the adverse effects/degrading performances caused by "flanking transmission paths," are neither understood, nor appreciated, by laymen purchasers and/or renters of units in multi-family housing projects.

** Legal proceedings threatened or initiated by the purchaser(s), are rarely followed through to trial and the matter ends. But, the noise problem(s) remain(s).

The Book of Joshua, Chapter 6, verses 1 through 21, contains the first recorded account of the aftermath and effect upon a standing structure, after a controlled and concurrent sequence of noise and vibration activities were conducted in its proximity, over a seven-day period. The structure, was the massive stone wall (surrounding and protecting the city of Jericho and its inhabitants) which collapsed, after the besieging armed forces, implemented and completed the 'field test' instructions, received by Joshua from a knowledgeable source. The 'test procedures' required that the besieging forces and seven priests with seven trumpets of rams' horns, march in step around the wall once for six consecutive days, with the priests blowing their trumpets in regular and repeated succession. The process was repeated seven times on the seventh day, followed by a long blast of the trumpets, with the warriors and the camp followers shouting loudly and simultaneously. It is possible that if Joshua, the priests, warriors and others engaged in the siege, had access to and synchronized the use of today's 'bull' horns, stereo equipment, public address systems, amplifiers and percussion instruments, including 'punk rock' groups, the resultant cacophony would have caused the walls to disintegrate and fall in less than seven days.

2. NOISE AND HEALTH

A U.S. report[3] makes it clear that noise is not just a nuisance but is also a health problem. In this section, excerpts and quotations from this report are used to illustrate the severity of the effects of noise on our health. Day and night, at home, at work and at play, noise can produce serious physical and psychological stress. No one is immune to this stress. Though we seem to adjust to noise by ignoring it, the ear in fact never closes and the body still responds, sometimes with extreme tension, as to a strange sound in the night.

The annoyance we feel when faced with noise is the most common outward symptom of the stress building up inside us.

> "We now have millions with heart disease, high blood pressure, and emotional illness who need protection from the additional stress of noise."
>
> **Dr. Samuel Rosen, Mt. Sinai Hospital**

2.1 Heart Disease

While no one has yet shown that noise inflicts any measurable damage to the heart itself, a growing body of evidence strongly suggests a link between exposure to noise and the development and aggravation of a number of heart disease problems. The explanation? Noise causes stress and the body reacts with increased adrenalin, changes in heart rate, and elevated blood pressure.

As William Stewart, former Surgeon General of the United States, has pointed out, there are many incidences of heart disease occurring daily in the U.S. for which "the noise of twentieth century living is a major contributory cause".

The idea that people get used to noise is a myth. Even when we think we have become accustomed to noise, biological changes still take place inside us, preparing us for physical activity if necessary.

"Noise does not have to be loud to bring on these responses."

What happens to the human body when confronted with ever-present noise? In a world where steady bombardment of noise is the rule rather than the exception, the cumulative effects of noise on our bodies may be quite extensive. It may be that our bodies are kept in a condition of near-agitation. Researchers debate whether the body's automatic responses build on each other, leading to what are called the "diseases of adaptation." These diseases of stress include ulcers, asthma, high blood pressure, headaches, and colitis.

2.2 Special Effects of Children

In Inglewood, California, the effects of aircraft noise on learning were so severe that several new and quieter schools had to be built. As a school official explained, the disruption of learning went beyond the time wasted waiting for noisy aircraft to pass over. Adults have worried about the effects of noise on children ever since the early 1900s when "quiet zones" were established around many of the nation's schools. Because they are just learning, children have more difficulty understanding language in the presence of noise than adults do.

A study of reading scores of 54 youngsters, grades two through five, indicated that the noise levels in their four adjacent apartment buildings were detrimental to the children's reading development. The influence of noise in the home was found to be more important than even the parents' educational background, the number of children in the family, and the grades the youngsters were in.

The fetus is not fully protected from noise. A Japanese study of over 1,000 births produced evidence of a high proportion of low-weight babies in noisy areas. These birth weights were under $5\frac{1}{2}$ pounds, the World Health Organization's definition of prematurity.

2.3 Intrusion At Home And Work

If there is one common denominator degrading the quality of all our lives, it may well be the almost constant intrusion of noise in the home, at work, and in public areas.

"Noise is more likely to reduce the accuracy of work rather than the total quantity."

Relaxing at home after a noisy workday may not be an easy thing to do. When the home is noisy itself, the tired and irritated worker may never be able to work out the day's accumulated stress during the course of the evening.

2.4 Sleep Disruption

Sleep is a restorative time of life and a good night's sleep is probably crucial to good health.

> "Noise affects the quantity and quality of sleep."
>
> "The elderly and sick are more sensitive to distruptive noise."

Noise can make it difficult to fall asleep, it can wake us, and it can cause shifts from deeper to lighter sleep stages. If the noise interference with sleep becomes a chronic problem, it may take its toll on health.

> "The din of the modern city includes noises far above levels for optimum sleeping. Result: insomnia and instability."
> **Dr. Edward F. Crippen, former Deputy Health Commissioner, Detroit**

2.5 Mental and Social Well-Being

The most obvious price we pay for living in an overly noisy world is the annoyance we frequently experience. Perhaps because annoyance is so commonplace, we tend to take our daily doses of it for granted ... not realizing that the irritability that sometimes surfaces can be a symptom of potentially more serious distress inside us. Some people cope with noise by directing their anger and frustration inward, by blaming themselves for being upset and by suffering in silence. Others resort to a denial of the problem altogether, considering themselves so tough that noise does not bother them. Still others deal with noise in a more direct manner: they take sleeping pills and wear ear plugs.

> "Research in the United States and England points to higher rates of admission to psychiatric hospitals among people living close to airports."

2.6 A Final Word

Except for the serious problem of hearing loss, there is no human illness known to be directly caused by noise. But throughout dozens of studies, noise has been clearly identified as an important cause of physical and psychological stress, and stress has been directly linked with many of our most common health problems.

"HOWEVER, MOST AMERICANS ARE LARGELY UNAWARE THAT NOISE POSES SUCH SIGNIFICANT DANGERS TO THEIR HEALTH AND WELFARE. THE REASONS FOR THIS LACK OF AWARENESS ARE CLEAR. NOISE IS ONE OF MANY ENVIRONMENTAL CAUSES OF STRESS AND CANNOT BE EASILY IDENTIFIED AS THE SOURCE OF A PARTICULAR PHYSICAL OR MENTAL AILMENT BY THE LAYMAN. ANOTHER REASON IS THAT BIOMEDICAL AND BEHAVIOURAL RESEARCH IS ONLY NOW AT THE POINT WHERE HEALTH HAZARDS STEMMING FROM NOISE CAN ACTUALLY BE NAMED, EVEN THOUGH SOME SPECIFIC LINKS HAVE YET TO BE FOUND."

Dr. William H. Stewart, former Surgeon General, in his keynote address to the 1969 CONFERENCE ON NOISE AS A PUBLIC HEALTH HAZARD, made the following point:

> "Must we wait until we prove every link in the chain of causation? I stand firmly with Surgeon General Burney's statement of 10 years ago. In protecting health, absolute proof comes late. To wait for it is to invite disaster, or to prolong suffering unnecessarily. I submit that

those things within man's power to control which impact upon the individual in a negative way, which infringe upon his sense of integrity, and interrupt his pursuit of fulfillment are hazards to public health."

3. DISCUSSION

3.1 Available Knowledge and Assistance

During the five years immediately preceding the formulation of A PROPOSAL FOR SOUND TESTING PRIOR TO OCCUPANCY OF MULTI-FAMILY DWELLINGS, the compilation of relevant and/or supporting documentation from Canadian and foreign sources was undertaken. Discussions were also held with building inspectors, contractors (housing), acoustical consultants, architects, land title registrars, suppliers of building materials and others, in various cities and municipalities in British Columbia, as well as with provincial and federal housing authorities.

Among members of all groups contacted, the least cooperative were building inspectors and officials of their respective permits and licences departments. These persons either refused to discuss or consider, that there could be construction faults in multi-family dwellings affecting sound transmission, or that the building inspection procedures in these respects, were inadequate. The approval process was seemingly based and determined primarily upon a review and examination of the plans, drawings and specifications submitted. However, the procedures detailed and technical advice contained in ASTM Designation E597-77T[1] together with other noise control engineering data available to them, were ignored or disregarded.

Since 1971/72, the most widely distributed technical sales brochures in Canada regarding 'Noise Control' (which are lithographed in colour), are those produced by Fiberglas Canada Inc., with 13 sales offices in various provinces. In the brochure titled "NOISE CONTROL FOR COMMERCIAL AND RESIDENTAL CONSTRUCTION" on pages 6, 7 and 8, there are "Wall System Section Charts" for "Wood and Metal Stud Walls." The charts also show the STC ratings for various constructions and qualify their respective Noise Control Performance as "Excellent," "Good," "Marginal" or "Poor."

The inclusion of the name "Division of Building Research, National Research Council" under the headings of the Wall System Selection Charts, suggests that all the information on the page was produced by the National Research Council. This gives, in most people's minds, added credibility to the results and to the rating scale, and even suggests that NRC endorses Fiberglas Canada products. Although this is not true and the rating scale was not devised by NRC,[4] the years of exposure that this document has had, have surely led many to accept these categories of "Excellent," "Good," etc.

3.2 Make Up of the Building Code Committee

In ISSUE No. 107, February 1984, issued for the Associate Committee on the National Building and National Fire Codes, the heading was "CANDIDATES NEEDED TO FILL VACANCIES ON STANDING COMMITTEES."

> "To apply for membership on a particular ACNBC or ACNFC is quite straightforward. Anyone who has a background in the field of building construction or similar activity may apply in writing to the secretary of the appropriate Associate Committee."

"Committee members are selected in accordance with an established matrix ..."

In ACNBC Policies and Procedures (NRCC No. 19678) the MATRIX FOR THE STANDING COMMITTEE ON HOUSING AND SMALL BUILDINGS, shows the minimum number of members as totalling 20, reflecting specific or general interests. With respect to engineers, under the heading "General Interest," two members are shown and under the heading "Sources to be Drawn From," it states:

"At least one with background in the light construction field and one with a background in fire protection."

The foregoing indicates that recognized and experienced Consulting Acoustical Engineers in Canada are probably ineligible for membership on the Standing Committee. Confirmation of this was contained in a letter (13 January 1983 - File Reference: M4-B6-S9) from the Executive Officer, ACNBC, who stated:

"The National Building Code and the Associate Committee do not 'recognize' disciplines."

"... ACNBC committees are encouraged to draw upon the latest technical information and expertise available within the Division of Building Research ... Thus, when noise control questions arise, the Standing Committee is able to have the best advice of Dr. Warnock and his group available."

There are three elements involved in the foregoing. To have the latest technical information, expertise and best advice available is the first element. To seek and obtain it is the second, and most importantly, to accept the advice and act upon it is the third. It would be interesting to know, how often this three-stage sequence has occurred in the past decade.

3.3 The Cost of Complaining

Persons who are not members of the condominium community, probably do not understand why the owners of units in specific multi-family dwellings, as a group, rarely take legal action against the developers and others, regarding obvious or proven inadequacies in the wall(s) and/or floor(s) construction(s) separating units, which contribute to the transmission of noise.

That litigation takes time and costs money, plus the fact that the plaintiffs may not be successful, or may obtain a 'dry' judgment, are not the main reasons for the lack of legal action.

The overriding concern and opinion of the majority of owners, who are guided by an elected governing body; i.e., their Strata Council, is that the attendant publicity surrounding the law suit and general knowledge of same, within the community at large, concerning the 'alleged' sound deficiencies in their particular residential complex, may make it difficult for any owner(s) to subsequently sell their unit(s).

If a disclosure is made of the 'facts', it will also impact drastically upon the 'asking' price for the property and the net proceeds ultimately received. In turn, this would affect future sales in the same complex, because real estate personnel are made aware of all listings and sales, within their operational area. Furthermore, after the 'change of ownership' has been registered in the appropriate "Land Title" office, the same information is available to anyone.

3.4 Municipal Liability

Regardless of where any person resides in Canada and of what their residential accommodation consists, everyone is strongly urged to obtain and study an important commentary appearing in "MUNICIPAL WORLD" (September 1984), published by Municipal World Inc., 360 Talbot Street, St. Thomas, Ontario, N5P 3V3.

The commentary (printed on pages 237 through 241 and 247) is headed as follows:

LIABILITY
Enforcement of by-laws - private law duty of care
imposed on local government

NIELSEN v. CITY OF KAMLOOPS et al.

"Although this is just a three to two (three justices in favour, two opposed) decision, it is of the Supreme Court of Canada and it is now the law. A private law duty of care has been imposed on local government across Canada and the liability for breach of that duty can be considerable."*

This would appear to imply that authorities that do not vigorously enforce their building codes would be responsible for the consequences.

4. PROPOSAL

1. For many years the National Building Code of Canada (now in its Ninth Edition), has specified in PART 9 HOUSING AND SMALL BUILDINGS, SECTION 9.11 SOUND CONTROL SUBSECTION 9.11.2.1 that:

   "... every dwelling unit shall be separated from every other space in a building in which noise may be generated by construction providing a sound transmission class rating of at least 45 ..."

   and in SUBSECTION 9.11.2.3 that:

   "Building services located in an assembly required to have a sound transmission class rating shall be installed in a manner that will not decrease the required rating of the assembly."

2. The intention of these requirements, is to ensure that occupants enjoy adequate acoustic privacy. However, in actual practice, this is not assured. The Sound Transmission Class (STC) does not consider or take into account, the adverse or 'degrading' effects of "flanking transmission;" i.e., sound transmission around the perimeter of the assembly or assemblies, constructed and/or installed.

3. In recognized sound laboratories, where Airborne and Impact Sound Transmission tests are conducted, the massive walls and floors are totally independent of one another to minimize noise transmission within the building. Furthermore, extraordinary precautions are taken to avoid "flanking transmission," through sound leakage openings and/or surrounding construction(s).

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*The 'reported decision' (July 26, 1984) of the Supreme Court of Canada - "CITY OF KAMLOOPS v. NIELSEN et al," should also be perused. It appears in its entirety in "DOMINION LAW REPORTS" (Fourth Series) Volume 10 - pages 641 through 687. Reports of cases from all the courts of Canada are published weekly by CANADA LAW BOOK INC., 240 Edward Street, Aurora, Ontario.

4. It would be highly unusual, if the 'field' test ratings obtained for assemblies in completed buildings, were not lower than the STC or IIC ratings achieved in a sound laboratory, for identical construction assemblies.

   It is the ratings obtained in 'field' tests of assemblies in completed multi-family dwellings, that directly affect and have an impact upon their occupants. It is 'NOT' the STC or IIC ratings, achieved in a laboratory under optimum and stringent test conditions.

5. Field surveys, undertaken in some provinces during the past two or three years, either by the Division of Building Research, or by private acoustical consultants under 'contract,' have been concerned with the subjective ratings of party walls of condominiums.

   In a related report appearing in Canadian Acoustics,[4] among the many observations made, the following statement appears:

   "Measured STC values ranged from 39 to 60, with a mean of 51.2."

   Since the National Building Code specifies that an STC rating of at least 45 is required, it is obvious that an STC rating of 39 is totally unacceptable. This leads to the conclusion, that the 'specifications' and/or inspection procedures were inadequate, or based upon 'questionable' assumptions. Regardless of what 'did' or 'did not' occur, it corroborates the comments made in paragraph 4 above.

6. It is noted that the "EXPLANATORY MATERIAL FOR THE NBC 1985" does NOT form part of the Code requirements. However, the importance and ramifications of all the comments in Subsection A-9.11.1.1 cannot be stressed too strongly. This gives rise to some basic and pertinent questions, such as:

   How does a consumer; i.e., a 'prospective' buyer or tenant of a unit in a multi-family dwelling, or a person already occupying a unit, 'know' or 'determine' or 'verify' (either before or after occupancy), that care has been taken during construction, to ensure that there are no significant sound leakage openings, or flanking transmission paths?

   It is considered that these questions, should be addressed to and answered by developers, architects, housing contractors and especially building inspectors, who are responsible for the issuance of Occupancy Permits.

   It is these persons, as well as members of the ACNBC (Housing and Small Buildings), who should either 'accept' or 'refute' the technical advice and data contained in ASTM E597, taking particular note of the comments in the "INTRODUCTION" and in the related subsection of "Appendix A - Explanatory Material."

7. The rating procedure that would measure overall acoustic privacy, taking into account all sound paths and other relevant factors, such as, area of partition, size of receiving room, etc., is the Noise Isolation Class (NIC). The NIC is defined in and measured according to ASTM E336-84, "Measurement of Airborne Sound Insulation in Buildings."

   Although some building inspectors loosely interpret 'STC' as essentially having the same meaning as NIC, it would be less confusing if the building code referred to NIC rather than STC.

8. To ensure that the barest minimum of acceptable acoustic privacy is achieved, the NIC rating between dwellings (or the STC in the sense that it is presently used in the Code), should be at least '50' and not '45.' However, this by itself is not sufficient and would do little to improve the existing situation.

   Wall constructions should be categorized and 'graded' in the Code, as follows:

NIC 58 - or higher:	Category A
NIC 54 - 57 inclusive:	Category B
NIC 50 - 53 inclusive:	Category C
NIC 45 - 49 inclusive:	Category D

   Under such classification, Category 'A' would apply to 'deluxe' accommodation, Category 'B' to 'quality' accommodation and Category 'C' to standard accommodation built according to the revised Code. Category 'D' would exist only in 'standard' accommodation built before revision of the Code.

9. Having established NIC requirements, it is not sufficient for building inspectors to simply review drawings and specifications, which indicate the 'proposed' constructions, or even to inspect the constructions as they progress. Errors, omissions and deficiencies, pertaining to sound insulating constructions, including flanking transmission oversights, are difficult to detect and identify. Consequently, a 'sampling' of completed constructions should be 'field' tested to determine their 'actual' acoustic performance.

   Although this might seem impractical at first glance and that the 'costs' would exceed the 'benefits' is simply not true. It is an acknowledged fact, that NIC tests are less time-consuming than field STC tests. Therefore, with the technical equipment and techniques now available, the testing can be performed more economically than in the past and would benefit everyone.

   Furthermore, in major population centers where acoustical consultants are close at hand, it is probable that NIC testing could be performed for $300 - $400 per test. For a 50-unit building, a 4% sampling test (consisting of two walls and two floors), could result in a total cost of between $1200 - $1600. This could be 'averaged' as a 'cost factor' per unit of between $24 - $32.

10. The testing, which is considered necessary and is strongly recommended, should be conducted prior to the issuance of Occupancy Permits. If the test 'results' indicate that the 'minimum' NIC rating has NOT been achieved, remedial measures MUST be undertaken.

    Regardless of whether the 'minimum' has been achieved or exceeded, it is necessary that copies of all test reports be filed at the building inspectors' offices and made available for public scrutiny at any time, during office hours.

    If the foregoing recommendations are adopted and implemented, consumers would then be able to determine for themselves, the category or 'quality' of sound transmission to be expected in multi-family dwelling units, instead of relying on inaccurate or misleading information, based upon false assumptions.

11. Although a prospective buyer/tenant, or an existing occupant, could examine the NIC test reports, he would not be 100% assured that the unit chosen by him was acceptable, even though the tested 'walls and floors' indicated otherwise. For

this reason, any occupant should have the 'right' to require an NIC test of his unit, if it has not been previously tested. If he instigates such a test and it indicates the construction is acceptable then the costs involved are his responsibility. If the measured NIC is below the 'minimum' required, then the building owner is required to pay for the test and MUST improve construction.

12. Another very common cause for complaint in multi-family dwellings is the transmission of 'impact noise' through floors. Impact noise can be measured in the field according to existing standards, using readily available equipment. The most common rating scale for impact noise is the Impact Insulation Class (IIC).

    IIC ratings of 58 or higher should be required for all rooms, with the possible exception of bathrooms and kitchens. Since these two rooms are normally quite small, impact noise is often less troublesome. Moreover, because they are usually uncarpeted it is difficult to achieve high IIC ratings in these areas. It is considered, therefore, that a minimum IIC rating of 50 would be appropriate.

13. To ensure that impact transmission is adequately controlled in all new multi-family dwellings, the same approach should be taken as previously described for "airborne sound insulation." Field tests should be required on selected sample floors 'prior to occupancy' and the test results filed at the building inspectors' offices and available for public scrutiny.

14. Inasmuch as fiscal and financial responsibility is now the 'order of the day', budgetary restraints are being exercised at the federal, provincial, municipal and civic levels, as well as by all segments of society.

    Consequently, any new proposals, suggestions or recommendations (regardless of their merits) and especially those which may be considered 'radical,' will receive 'short-shrift,' if the related dollar costs are thought to be 'too much' and the benefits 'too little.'

15. Finally, in the formulation of this 'paper,' consideration was given not only to the prevailing economic conditions and restrictions outlined, but also to the implications and ramifications of the proposal itself. Therefore, the following points are emphasized:

    (i) the proposal is considered to be feasible, practical and economical;
    (ii) its adoption and implementation, should not require the hiring of 'any' additional qualified and/or specialized personnel (or anyone else), on a 'casual' or 'contract' or 'permanent' basis, by any Permits and Licences Departments or Building Inspectors' Offices;
    (iii) the purchasing or leasing of acoustical equipment by the above noted departments and offices, is not necessary;
    (iv) training sessions for staff members regarding NIC or IIC tests of structures and assemblies, is not required;
    (v) the workload of employees should not be increased materially, by making the field test reports available to the public; it may reduce the time consumed in responding to queries and questions concerning 'noise,' (generally and specifically), in multi-unit dwellings;
    (vi) the data obtained from field tests (conducted by acoustical consultants and employed by the developers) should be invaluable to building inspectors, who, in the past, have been concerned or confronted with 'inexplicable' or unexpected sound control problems in multi-unit housing;

(vii) the field test data and its availability, could also be used to advantage by property managers, rental agencies, mortgage financing institutions, property tax assessors, property 'value' appraisers, real estate agents and insurance companies;

(viii) the excessive or unrealistic claims and statements frequently made by some developers or real estate personnel and repeated in sales brochures or newspaper advertisements, concerning quality construction 'sound proofing' in multi-unit dwellings and assurances or guarantees of 'exclusive privacy' for the occupants, might be curtailed or restricted to the 'facts,' if the field test data was available to all interested or concerned persons and the relevant section of the "National Building Code" was amended, as detailed and recommended.

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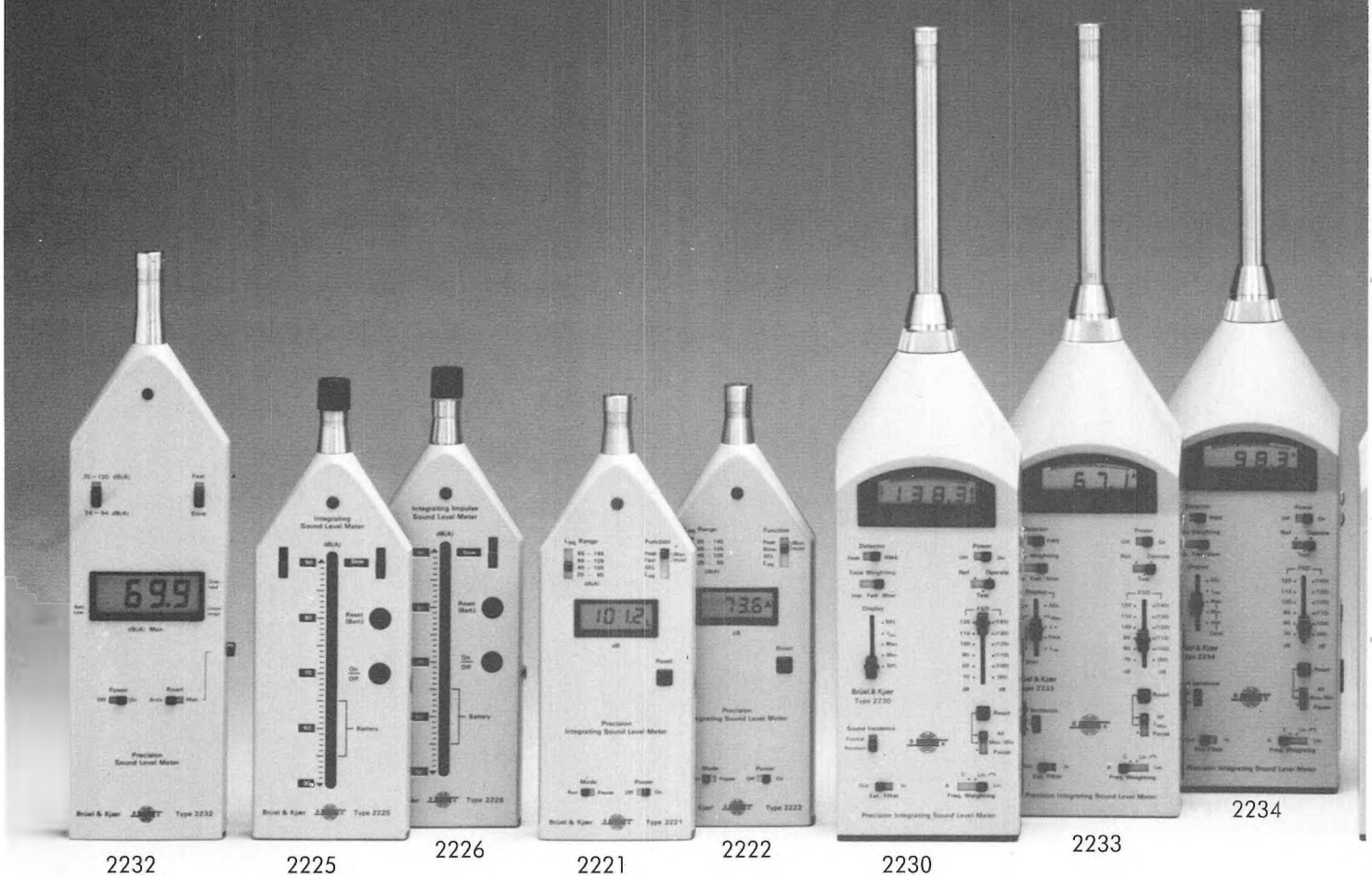
WHAT'S ALL TH



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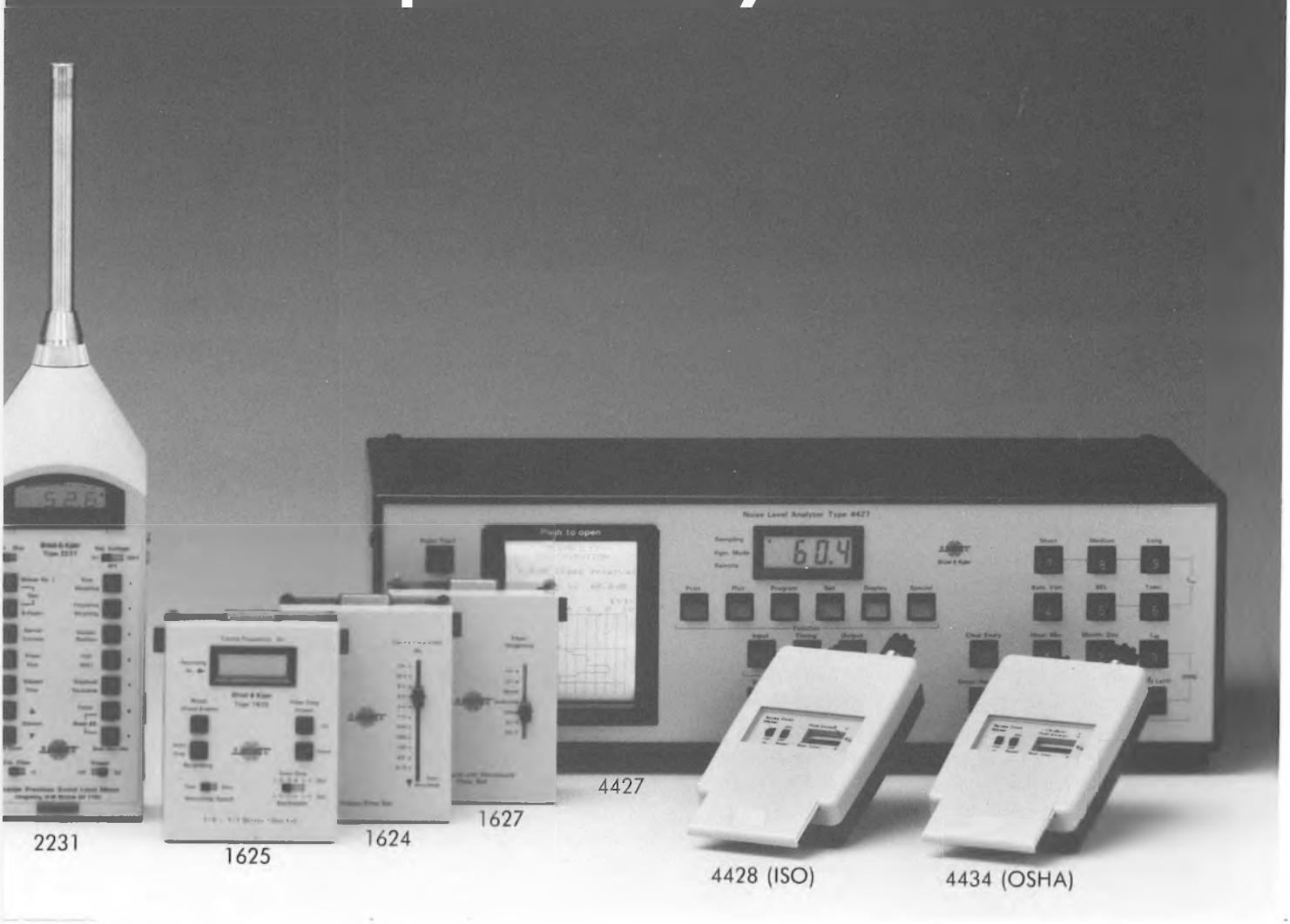

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REVIEW OF "SPEECH AND SPEAKER RECOGNITION"

Manfred R. Schroeder, Editor

No. 12 in the Series Bibliotheca Phonetica, Karger, Basel

This book apparently came about by Professor Schroeder writing to a number of well known speech researchers inviting them to contribute a chapter on a topic of their choice. No constraints were specified apart from the maximum length of the contributions, and the authors had no opportunity to cross-reference the contributions of others. The result, described by Schroeder in his preface as "a modest snapshot" of the field is neither a comprehensive survey nor an exposition of a single point of view but rather a collection of six quite interesting papers describing aspects of the research activities of each of the contributors. Only one of the contributions, that by Strube, Helling, Krause and Schroeder himself, is in fact concerned with speech and speaker recognition, all the others deal only with speech recognition, so a reader whose interests were primarily in speaker recognition might find the title of the book misleading.

Two of the chapters, that by Elman and McLelland of the University of California at San Diego and that by De Mori and Probst of Concordia University, Montreal, describe phonetically oriented approaches in the sense that the selection and weighting of evidence used in evaluating a particular hypothesis depends explicitly on its supposed phonetic content. Both papers are primarily descriptions of actual or planned systems with relatively little emphasis on experimental tests of performance of the systems. Elman's system is a multi-level network designed to be implementable efficiently on the highly parallel computing devices that are now emerging. De Mori's system is rule based, but with a capacity to learn and generalize rules automatically.

A paper by Steven Marcus of the IPO, Eindhoven, sets out his ideas for relaxing the strict serial ordering normally imposed on the acoustic data in speech recognition and for replacing it by a non-ordered set of context-sensitive units. The context sensitivity implicitly retains information on serial ordering, but in a manner that allows the ordering to be broken without penalizing the match score as heavily as it would be when words are compared in most other approaches to speech recognition.

Strube, Helling, Krause and Schroeder describe speech and speaker recognition experiments in which isolated words are represented by a vector describing the shape of the two-dimensional pattern in time and frequency of the energy distribution in the word. The justification for such a description has to rest on its experimentally determined effectiveness and on its relative simplicity, since it seems to have no basis in known properties of speech or human auditory perception. Many speech recognition experiments are indeed described, but despite the use of statistical comparison techniques that are more sophisticated than those normally used in speech recognition, the results seem neither to justify the approach nor to lead to useful insights. The application of the approach to speaker recognition is effectively confined to speaker verification, since the need to induce the pronunciation of specific works in isolation implies a cooperative speaker. Here again, the results are not outstanding; and the simulated telephone connections used in some of these experiments are unrealistic because they omit the most troublesome feature of telephone links, namely their variability.

The last two papers could be said to be more conventional than the others in the sense that they contain descriptions of techniques of the kind that are used in commercially available products capable of performing useful tasks. The first of these papers, by Bourlard, Kamp, Ney and Wellekens of Philips on speaker-dependent connected speech recognition, provides a clear account of dynamic programming algorithms and Hidden Markov methods using both Viterbi and maximum likelihood decoding and the relationships between them.

The final paper, by Levinson and Rabiner of AT & T Bell Laboratories, describes what must be one of the most comprehensive systems yet constructed for spoken interaction with a machine. The system engages in a dialogue in which the user can obtain flight information and make reservations. The system accepts continuously spoken input over dialed-up telephone lines without need for speaker-specific training. The input must conform to the rules of a finite-state syntax defining a subset of natural English concerned with flight enquiries. A semantic analysis of the input allows implicit information to be deduced. Although this stage is separate from the recognition process, there is some limited capability to remedy recognition-stage errors by means of semantic considerations. The information requested by the user is returned to him via a text-to-

speech synthesis system. The system incorporates the level-building algorithm developed at Bell Labs for connected speech recognition, which is described in some detail here but which seems to have little to recommend it over the more efficient and elegant alternative described in the previous chapter and referenced in this chapter. A system of the kind described here is a potentially rich source of information on how humans react to a spoken dialogue with a machine. It is unfortunate that the size of the vocabulary and the complexity of the grammar put real-time performance out of reach for the present: dialogues lose their spontaneity when the user has to wait two minutes for a response.

The style of most of the contributions to this book make it suited primarily to specialists in the field. But much if not all of the material presented here has appeared in publications that specialists might already have read. In view of this, and the fact that the two-hundred page book costs around $56 in Germany, where it is produced, and perhaps more in Canada, it is hard to imagine that many but the most affluent speech researchers would decide to buy a copy for themselves, though technical libraries might usefully add it to their stock.

Melvyn J. Hunt
National Research Council

REVIEW OF "ACOUSTICS AND WORSHIP SPACES"

D. Lubman and E.A. Wetherill, Editors

Published by the American Institute of Physics for the Acoustical Society of America, 1985

This is the second book of this type published by the Acoustical Society of America containing essentially the contents of an ASA meeting poster session. The first was titled "Halls for Music Performance: Two Decades of Experience 1962-1982" and was published in 1982. In this second book the editors have included several short introductory articles as well as the poster session material, and have improved the quality of the type relative to the earlier book.

The ten introductory pages are started with an article by David Klepper that gives a good concise summary of the essential problems for the design of worship space acoustics. Klepper includes mention of new developments such as the electronic church that are not found in older texts on this subject. This is followed by an article by David Lubman that in a more academic tone discusses the conflicting needs of speech and music. There is then a text by Anna Nabelek pointing out the needs of special groups who are more sensitive to the interference of noise and reverberation. The final introductory article attempts to point out the value of acoustical consultants and how they might be selected, but seems to be largely an advertisement for the National Council of Acoustical Consultants, an American association of acoustical consultants.

The main body of the book contains the poster session material for 43 different worship spaces. For each project there is one page containing drawings, photographs, and sometimes technical details, and another page containing a short description of the project. These descriptions vary from a single sentence to several paragraphs of usually only qualitative information. Among the more interesting aspects of the examples are the many electronic media churches that are often said to have sound and video electronic equipment that would rival many television and recording studios. For example, one church claims to have a system with 272 microphone inputs; another has a sound system that will produce levels of 119 dB at the back row of the audience. Religion could become a painful experience! One has visions of ministers wearing noise dosimeters and noise impairment warning signs on the walls of the church! Not all of the examples are new buildings; several illustrate the renovation and upgrading of older facilities.

The technical information provided for each church is disappointingly very limited. Although background noise levels are perhaps the most important design parameter for good quality speech and music, measured data is given for only 15 of the 43 examples. Reverberation time data is given for 41 of the 43 examples, usually as measured unoccupied values with calculated occupied values in a few cases. There is no information to indicate that any of the consultants are paying attention, in a quantitative technically meaningful manner, to newer developments in architectural acoustics over the past 20 years.

My other criticisms would concern the presentation of photographs and drawings. These are both very small making them very difficult to use, and the photographs tend to be too dark. More easily readable figures could have been produced if they had been allowed to fill a greater portion of the page by placing all titles on the preceding page of text.

At $15 (U.S.), the book is perhaps reasonable value to those wishing a summary of some architectural and acoustical features of recently built or modified worship spaces largely in the United States.

J.S. Bradley
National Research Council

NEW ICEBERG DETECTING SONAR

Safe navigation in Arctic waters has always presented a major problem to mariners. The presence of ice and icebergs demands the utmost vigilance on the part of ship's personnel. The expected increase in shipping activity, particularly with the transportation of oil, coupled with the realization by commercial and government bodies that the marine environment is an important natural resource means that any new technological advances that can reduce the risk of collision will be evaluated. From a commercial viewpoint, the overall desire to find the quickest and safest route through Arctic waters results from economic considerations. Thus, any additions to present iceberg detecting systems will be of advantage.

Radar has traditionally been used to detect obstacles at sea. Icebergs have approximately nine-tenths of their mass submerged and this underwater mass is invisible to radar. In addition, icebergs may exhibit a low profile or have an illuminated face gently sloping with a very shallow grazing angle. Such conditions seriously affect the detectability of icebergs by radar. Sonar, therefore, should be considered as a complementary method for remote iceberg detection for the following reasons:

1. Sonar operates at relatively low frequencies while marine radar operates at much higher frequencies. It can be considered as an adjunct to radar thereby increasing the probability of detecting targets.

2. The major portion of an iceberg is below the water line and a better target for remote detection using sonar.

The use of sonar in this role is not without problems. From a technological point of view, little information concerning icebergs as individual sonar targets exists. Also near surface horizontal acoustic propagation in the ocean is subject to refraction phenomena and the effects of waves and turbulence. From an engineering perspective, the installation and eventual deployment of a sonar transducer system within the bow area of an icebreaking hull is not trivial. Therefore, any program which addresses some of the above aspects is important in that it will provide useful basic design information concerning the feasibility and practicality of using sonar for iceberg detection.

Canadian Astronautics Limited (CAL) of Ottawa was awarded a research and development contract in September 1985 to continue the investigation of ice hazard detection using sonar. The contract, awarded by Canarctic Shipping Company Limited, represents the first commerical use of forward-looking sonar as a navigation aid to detect icebergs and small bergy bits in ice-covered waters.

At present vessels rely on marine radar to detect obstacles, a method that has not always been satisfactory. As part of Canarctic's program to develop a reliable Shipboard Ice Navigation System, CAL is testing and collecting data on the effectiveness of using sonar.

Canarctic operates the M.V. ARCTIC, a commercial ice breaking vessel, in Canada's Arctic and between the Arctic and ports in the south. Canarctic funds research into methods to improve ice navigation in order to enhance the safety and speed of future transportation of natural resources, such as oil from the Canadian north.

The project is jointly funded by Canarctic and the Transportation Development Centre of Transport Canada. Testing in partially or totally ice-covered waters will begin next spring in Baffin Bay and Lancaster Sound. In future CAL plans to develop a special-purpose ice hazard sonar which would enhance the capability not only of the M.V. ARCTIC, but also of other ships that are planned to provide transportation to the Canadian North.

WORKPLACE SAFETY REGULATION

The Province of Manitoba has published a "Revised Regulation 116/85" under Chapter W210 of the Workplace Safety and Health Act concerning hearing conservation and noise control in the workplace. Noise exposures are measured using an A-weighted Leq type measure. When an equivalent sound exposure level of 80 is exceeded, hearing tests and worker education are required. When 85 is exceeded, voluntary hearing protection is required and when 90

is exceeded, engineering controls or hearing protection are mandatory. Further information is available from the Manitoba Industrial Hygiene Branch, 1000-330 St. Mary Avenue, Winnipeg, Manitoba, R3C 3Z5.

NEW BOOKS

"Sound and Structural Vibration"
F. Fahy, Academic Press
London (1985)

"The Noise Handbook"
W. Tempest, Academic Press
London (1985)

"The Effect of Noise on Man" (Second Edition)
K.D. Kryter, Academic Press
London (1985)

"The Theoretical Basis of Urban Acoustics"
R. Makarewicz, Panstwowe Wydawnictwo, Naukowe
Warsaw, Poland (1984)

"Acoustics of Worship Spaces"
E. Lubman and E.A. Wetherill, eds., AIP
New York (1985)
Compendium (see review this issue)

"Concert Hall Acoustics"
Springer Series in Electrosphysics 17
Y. Ando, Springer-Verlag
New York (1985)
Monograph

"Quantifying Music"
The Science of Music at the First Stage of the Scientific Revolution,
1580-1650.
H.E. Cohen, D. Reidel Publishing Company
Dordrecht/Boston/Lancaster (1984)

"Acoustics of Bells"
Thomas D. Rossing, Ed., Van Nostrand Reinhold
New York (1984)

"Music Speech High-Fidelity"
William J. Strong and George R. Plitnik, Soundprint
Provo, Utah

"An Introduction to the Physiology of Hearing"
James O. Pickles, Academic Press
Australia (1982)

"The Acoustic Sense of Animals"
William J. Stebbins, Harvard University Press
Cambridge, Massachussetts (1983)

"The Amphibian Ear"
Glen Wever, Princeton U.P.
New Jersey (1985)

"Acoustical Imaging, Vol. 13"
M. Kaveh, R.K. Mueller, and J.F. Greenleaf, Eds.
Plenum, New York (1984)

"Nonlinear Acoustics in Fluids"
Robert T. Beyer, Ed., Van Nostrand Reinhold Company, Inc.
A Hutchinson Ross Benchmark Book
New York (1984)

"Adaptive Filters: Structures, Algorithms, and Applications"
Michael L. Honig and David G. Messerschmitt, Kluwer Academic
Boston, Massachussetts (1984)

"Multidimensional Digital Signal Processing"
Dan E. Dudgeon and Russell M. Mersereau
Prentice-Hall Signal Processing Series (1984)

"Array Signal Processing"
J.H. Justice, N.L. Owsley, J.L. Yen, and A.C. Kak, Prentice-Hall
Englewood Cliffs, New Jersey (1985)

"Handbook of Geophysical Exploration, Volume 12: Seismic Resolution: Resolving
Power of Acoustical Echo Techniques"
A.J. Berkhout, Geophysical Press Ltd.
London, UK (1984)

"Seismic Mountings for Vibration Isolation"
Joseph A. Macinante, Wiley
New York (1984)

NEW RESEARCH CONTRACTS

To Offshore Survey and Positioning Services Limited, North Vancouver, British Columbia, $34,214, for "Survey of acoustic profiling of an arctic ice keel – phase II." Awarded by the Department of Fisheries and Oceans.

To S. Dosso, Victoria, British Columbia, $9,000, for "Evaluation of the application of acoustically traced, free drifting "Rafos" floats." Awarded by the Department of Fisheries and Oceans.

To Hermes Electronics Limited, Dartmouth, Nova Scotia, $144,023, for "Investigation of the processing of omnidirectional sonobuoy acoustic data within sonobuoys." Awarded by the Department of National Defence.

To I. Streibl, Ottawa, Ontario, $30,000, for "Surface acoustic wave device design analysis." Awarded by the Department of Communications.

To Knudsen Engineering Limited, Stittsville, Ontario, $238,181, for "Development of an underwater acoustic imager." Awarded by the Department of Energy, Mines and Resources.

To Dalhousie University, Halifax, Nova Scotia, $10,026, for "Acoustic Analysis of Emerald Basin sediments (Dr. L. Mayer, Department of Oceanography)." Awarded by the Department of National Defence.

To Arctic Sciences Limited, Sidney, British Columbia, $170,000, for "Concept design and feasibility study and testing of an in-air acoustic method for detecting icebergs in pack ice." Awarded by the Department of Transport.

To Com Dev Limited, Cambridge, Ontario, $299,382, for "Design and development of fabrication technology and processes for surface acoustic wave filters with narrow bandwidths." Awarded by the Department of Communications.

To Com Dev Limited, Cambridge, Ontario, $119,898, for "Development of design techniques, software and fabrication procedures for surface acoustic wave filters meeting Intelsat V specifications." Awarded by the Department of Communications.

To Techno Scientific Incorporated, Downsview, Ontario, $174,071, for "Study of the ultrasonic detection of interface defects in 155 mm high explosive shell fillings." Awarded by the Department of National Defence.

To Applied Microelectronics Institute, Halifax, Nova Scotia, $160,526, for "Development of an application processor for advanced sonars." Awarded by the Department of National Defence.

To Tektrend International Limited, Montreal, Quebec, $98,933, for "Automated ultrasonic system for submarine pressure hull inspection." Awarded by the Department of National Defence.

To Nova Chem Limited, Halifax, Nova Scotia, $48,119, for "Development of a sonar fluid to inhibit acoustic cavitation." Awarded by the Department of National Defence.

To Université du Québec à Trois Rivières, Quebec, $35,925, for "Consumer survey on recorded music (G. Pronovost, Department of Recreational Sciences)." Awarded by the Department of Communications.

To Tektrend International Incorporated, Montreal, Quebec, $115,170, for "Acoustic emission testing of compressed gas tube trailers." Awarded by the Department of Transport.

To Tektrend International Incorporated, Lachute, Quebec, $48,020, for "Development of an on-line acoustic emission monitoring system for welding thick-walled vessels." Awarded by the Department of Energy, Mines and Resources.

To Jasco Research Limited, Sidney, British Columbia, $37,692, for "Provide data on the temporal characteristics of undersea noise due to precipitation." Awarded by the Department of National Defence.

To Huntec (70) Limited, Scarborough, Ontario, $16,630, for "Evaluation of the Huntec deep tow/surface tow seismic system as a bottom classifier for mine burial." Awarded by the Department of National Defence.

To Noranda Incorporated, Pointe-Claire, Quebec, $320,729, for "Development of a state-of-the-art microseismic monitoring system." Awarded by the Department of Fisheries and Oceans.

To Stednitz Maritime Technology Limited, Eganville, Ontario, $139,840, for "Development of an acoustic velocity meter for remote areas." Awarded by the Department of Environment.

To Carleton University, Ottawa, Ontario, $9,680, for "Vibration forcing function on primary pumps - data analysis (Dr. T. Currie, Department of Mechanical and Aeronautical Engineering)." Awarded by the Atomic Energy Control Board.

AES PUBLISHES STANDARDS

The S4 Committee on audio engineering standards, administered by the Audio Engineering Society, has now been accredited by the American National Standards Institute (ANSI) for the development and publication of standards and information documents in the audio engineering field.

The AES has published five ANSI-approved stan-

dards concerning loudspeaker components for sound reinforcement, magnetic tape, and digital audio engineering. The following are the specific numbers and titles of the standards and information documents.

AES2-1984 (ANSI S4.26-1984) AES Recommended Practice Specification of Loudspeaker Components Used in Professional Audio and Sound Reinforcement.

AES6-1982 (ANSI S4.3-1982) Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment.

AES5-1984 (ANSI S4.28-1984) AES Recommended Practice for Professional Digital Audio Applications Employing Pulse-Code Modulation–Preferred Sampling Frequencies.

AES7-1982 (ANSI S4.6-1982) Method of Measuring Recorded Flux of Magnetic Sound Records at Medium Wavelengths.

AES3-1985 (ANSI S4.40-1985) AES Recommended Practice for Digital Audio Engineering–Serial Transmission Format for Linearly Represented Digital Audio Data.

For further information, contact L.A. Safford, Audio Engineering Society, 60 East 42nd Street, New York, NY, U.S.A., 10165.

ASTM NEWS

A new test method to measure sound transmission loss in the field will be developed by the Task Group on Sound Intensity Measurement Techniques. The new method will use sound intensity measurement apparatus.

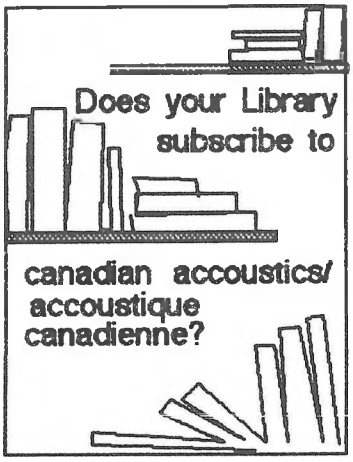
An interlaboratory test series (round robin) using Standard Test Method C384 for Impedance and Sound Absorption of Acoustical Materials by the Impedance Tube Method is being planned by the Task Group on Impedance Tube Tests. This round robin will be run in parallel with a round robin using Standard Test Method E1050 for Impedance and Absorption of Acoustical Materials using a Tube, Two Microphones, and a Digital Frequency Analysis System in order to compare the test results provided by the two test methods. The Task Group seeks participation by testing laboratories equipped to perform either test.

Three new E-33 standards, Guide E1041 for Measurement of Masking Sound in Open Offices, Classification E1042 for Acoustically Absorptive Materials Applied by Trowel or Spray, and Test Method E1050 for Impedance and Absorption of Acoustical Materials Using a Tube, Two Microphones, and a Digital Frequency Analysis System, have been published in the 1985 Annual Book of ASTM Standards, Part 04.06.

SURVEY OF CANADIAN ACOUSTICAL CONSULTANTS

CANADIAN ACOUSTICS is planning to publish a survey of Canadian acoustical consultants. The information will be gathered on a voluntary basis by responses to the following questionnaire. The compiled information will thus represent the responses of individual consultants and of course will not in any way suggest that CANADIAN ACOUSTICS or the Canadian Acoustical Association endorses particular consultants. There will inevitably be some uncertainty as to the accuracy of some of the information, but it is thought that such a compilation would be of considerable value to the Canadian acoustical community. Even a list of names of consultants would surely be of considerable value.

All Canadian companies involved in acoustical consulting are strongly encouraged to complete the following questionnaire as it is potentially as beneficial to them as to our other readers. The completed forms should be mailed to the editor-in-chief within one month to ensure inclusion in the published results that will appear in a future issue of CANADIAN ACOUSTICS.



SURVEY OF CANADIAN ACOUSTICAL CONSULTANTS

COMPANY NAME: _____

COMPANY ADDRESS: _____

_____

_____

TELEPHONE NUMBER: _____

NUMBER OF EMPLOYEES: _____

(Equivalent number of full-time employees to acoustical consulting activities.)

AGE OF COMPANY: _____

AREAS OF SPECIALIZATION AND CONSIDERABLE PREVIOUS EXPERIENCE:

_____ (1) Industrial noise control
_____ (2) Hearing conservation
_____ (3) Machinery noise control
_____ (4) Noise control in buildings
_____ (5) Environmental noise
_____ (6) General acoustical design of interior spaces
_____ (7) Specialized acoustical design of theatres, studios, etc.
_____ (8) Electroacoustics and sound system design
_____ (0) Mechanical vibrations of machinery
_____ (10) Structural vibrations of buildings
_____ (11) Underwater and marine acoustics
_____ (12) Ultrasonics
_____ (13) Development of instrumentation
_____ (14) Other _____

SPECIAL FACILITIES:

_____ (1) None
_____ (2) Instrumentation for conventional measurements
_____ (3) More advanced instrumentation and computer-based analysis systems
_____ (4) Special measurement chambers
(give details) _____

SHORT COMMENT OR DESCRIPTION OF COMPANY (50 words or <u>less</u>):

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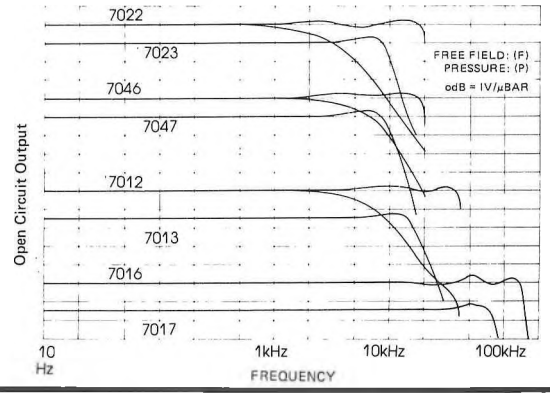
7016	4135	1560-9534*	—
7017	4136	1560-9535*	—
7022	4145	—	—
7023	4144	—	—
7046	4165	—	—
7047	4166	—	—
7048	4148*	—	—

*Similar - Compare specifications

TYPICAL FREQUENCY RESPONSE



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4-7 March
80th Audio Engineering Society Convention
Montreux, Switzerland

14 March
Seminars on Audition
OISE, Toronto

24-26 March
International Conference on Speech Input/Output, Techniques and Applications
London

8-11 April
International Conference on Acoustics, Speech, and Signal Processing (ICASSP 86), (IEEE-ASJ)
Tokyo, Japan

May
3rd International Spring School on Acoustoopics and Applications. Organized by the University of Gdansk
Wiezyca, Poland

12-16 May 1986
Acoustical Society of America
Cleveland, OH, U.S.A.

13-15 May
AICB (Association internationale contre le bruit), Urban Planning and Traffic Noise
Strasbourg, France

15-18 May
3rd International Conference: Stereo Audio Technology for Television
Rosemont, IL, U.S.A.

3-6 June
5th Hungarian Seminar and Exhibition on Noise Control
Szeged, Hungary

14-18 July 1986
ICA Satellite, Acoustical Imaging and Underwater Acoustics

21-22 July 1986
ICA Satellite, Units and Their Representation in Speech Recognition
Montreal, Canada

21-23 July 1986
INTER-NOISE 86
Boston, MA, U.S.A.

24-31 July 1986
12th International Congress on Acoustics
Toronto, Canada

2-4 August 1986
ICA Satellite, Acoustics and Theatre Planning
Vancouver, Canada

6-8 August
IMACS Symposium on Computational Acoustics
Yale University, New Haven, CT, U.S.A.

24-28 August
International Congress of Audiology
Prague, Czechoslovakia

2-6 September
FASE, European Acoustics Symposium
Sopron, Hungary

21-26 September 1986
10th Congress on Building Research
Washington, DC, U.S.A.

21-24 October
8th International Acoustic Emission Symposium
Tokyo, Japan

8-12 December 1986
Acoustical Society of America
Anaheim, CA, U.S.A.

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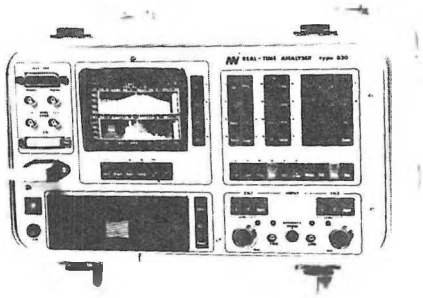

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True dual channel	☑	☐
0.004 sec – 99 hours Leq	☑	☐
Time constants: Fast	☑	☐
Slow	☑	☐
Impulse	☑	☐
Trigger facilities	☑	☐
Sound intensity capability	☑	☐
Level vs. time displays	☑	☐
Reverberation time	☑	☐
Tabular displays	☑	☐
Printer interface	☑	☐
IEEE-488 interface	☑	☐
RS-232 interface	☑	☐
Internal noise generator	☑	☐
Reference spectrum storage	☑	☐
Internal mass storage	☑	☐
Programmeable (BASIC)	☑	☐
Colour video output	☑	☐
Upgradeable	☑	☐
Rugged casing	☑	☐
Portable	☑	☐
Fits under an airplane seat	☑	☐
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SOUND POWER AND SOUND INTENSITY

What the course is about:

Sound power is a property of noise emitting devices that generally does not depend on the environment. It also is the basis for sound transmission loss property measurements, sound absorption coefficient measurements, noise source determination and noise source ranking

This seminar will allow the student to:

review basic acoustics
learn about sound power
learn about the relationship between sound power generated by a device and sound power produced in a given environment
learn about both traditional and modern ways to determine sound power
understand the basic concepts of acoustical properties of materials
review basic techniques and associated standards for sound power measurements
learn about state-of the art in instruments for measuring sound intensity and sound power
learn how to apply sound power concepts to locate noise sources measure properties of materials and control noise.

For whom it is intended

Engineers and Scientists involved in·

Building acoustics
Architectural materials
industrial equipment
- Blowers
- Fans
- Gear boxes
- Machine tools
- Conveyer lines
- Pulverizers

Transportation equipment
- Autos
- Aircraft

Military equipment
- Tanks
- Generators
- Submarines

Business equipment
- Computers
- Copiers
- Printers
- Mailing machines

Ventilating devices

HVAC equipment

WHERE AND WHEN:

LOCATION	DATE
MONTREAL	MARCH 24 1986
HOLIDAY INN TRANS CANADA HIGHWAY POINTE CLAIRE	
TORONTO	MARCH 26 1986
HOWARD JOHNSON HOTEL AIRPORT ROAD MISSISSAUGA	
EDMONTON	APRIL 4 1986
EDMONTON INN	

INSTRUCTORS

R.J PEPPIN P.ENG SCANTEK
G. KRISHNAPPA Phd N.R.C.

TIMES: 9.00am to 5.00PM LUNCH AND COFFEE PROVIDED

OUTLINE

Basic acoustic principles
   Level, Frequency, Frequency weighting
Sound Power concepts
Sound pressure concepts
Sound intensity concepts
Relations between pressure, power and intensity
Methods to measure pressure and intensity
Instruments for measurements
   Real Time Analysers
   FFT Analysers
   Probe design and limitations
Applications
Noise Control - Transmission Loss - Absorption Coefficients

COST: $150.00 (includes lunch) Limited enrollment

Mail cheques to: LEQ MEASUREMENTS LIMITED

NAME----------..TITLE ----------

ORGANISATION----------

ADDRESS----------

----------TEL. NO.----------POSTAL CODE----------

PAYMENT ENCLOSED--------- PLEASE BILL(ADD $10.00 FOR HANDLING)----------

MINUTES OF CANADIAN ACOUSTICAL ASSOCIATION ANNUAL MEETING

1) Welcome

The meeting was called to order at 4:20 on 3 October, at the Chimo Inn, Ottawa. Forty-two people were present.

2) Minutes of 1984 Annual Meeting

The minutes of the 1984 Annual Meeting were circulated to members by publication in Volume 13(1) of Canadian Acoustics.

MOTION: That the minutes of the 1984 meeting be accepted as printed.

CARRIED

3) Visitors From Other Associations

Guests from three related organisations were introduced, and presented a brief outline of their organisations' activities and objectives. These were:

a - Mr. W.D. Havercroft, Society for Nondestructive Testing, Ottawa, (613) 733-1266

b - Mrs. Dion, Administrator, Canadian Hearing Society, 216 Murray Street, Ottawa, K1N 5N1, (613) 236-0509

c - Dr. Jeffrey Crelinsten, Executive Director, Association for the Advancement of Science in Canada (AASC), 2380 Lancaster Road, Ottawa, K1B 3W9, (613) 521-2556

4) Report from the 12 ICA Planning Committee (Appendix 1)

A summary of progress in organising the ICA meeting in Toronto was presented by Edgar Shaw. Reports on the satellite conferences were given by John Leggatt (Halifax), Raymond Hétu (Montreal), and Joe Piercy (Vancouver). Contribution of more papers and attendance by members of our association were encouraged. A written summary of these reports is presented as Appendix 1.

5) Treasurer's Report for 1984-1985 (Appendix 2)

This was presented by the treasurer, Tom Ho. A letter from the auditor, (Doug Whicker) was read; this stated that: "...I have examined the books and the supporting documentation of the Canadian Acoustical Association for the year ending August 31, 1985. While I have not made a detailed examination of the deposits for the membership fees, ICA contributions and sustaining subscriptions to confirm the breakdown between the three categories, I am satisfied as to the combined receipts total. Based on my examinations, I am of the opinion that the statement to be presented by your treasurer at the October 4, 1985 meeting is an accurate representation of the financial status of the Association. Please note that these statements do not include any information as to the financial status of the 12 ICA Toronto 1986 Committee which I presume is being covered by separate statements and audit."

MOTION: T hat the treasurer's report be accepted as read.

CARRIED

6) Correspondence

A brief report of correspondence highlights was presented by the president. Among the correspondents mentioned were:

a - Canadian Pulp & Paper Association

b - Institute of Noise Control Engineering

c - David Chapman

d - Archives of Acoustics - Poland

e - Acoustical Society of America

f - H. Gordon Pollard

g - Engineering Institute of Canada

7) Editor's Report for 1984-1985

John Bradley reported that the journal made a small profit this year, largely because of increased revenue from advertising and reprints. The quality and number of papers is steadily increasing, and efforts are being made to improve its appearance. The retiring of Michael Stinson from his position as associate editor responsible for printing and distribution was announced with regret. A special issue of Canadian Acoustics is planned for distribution at 12 ICA, and submissions were invited from the membership. As usual this report ended with a request for a continuing supply of good papers. Positive comments from the audience followed by applause showed the appreciation of the members for the continuing efforts of the editor and his dedicated staff.

8) Membership Report for 1984-1985 (Appendix 3)

The report on activity to increase membership was presented by Annabel Cohen; a written version of this report is attached as Appendix 3.

9) Directors' Award

For 1984 (Canadian Acoustics Volume 12) only one author satisfied the requirements for this award; rather than present the award by default, the directors decided to present no award this year, and to include the one paper eligible this year with those for 1985 (Volume 13).

10) Report on Activities of the Directors & Executive

The president stated that these activities are all reported under other headings.

11) Annual Meetings

a) 1985 Convenors Report

This was presented by the meeting convener, Robin Halliwell. He reported that 99 people had registered to that point (final registration was 111) and that a moderate profit was anticipated. No written proceedings will be produced for the 1985 meeting. A brief discussion of the merits of proceedings lead to the agreement that the convenor for each meeting should decide whether to prepare printed proceedings.

b) 1986 Annual Meeting

The president announced that as decided at the 1984 meeting, the 1986 business meeting will be held in Toronto in conjunction with the ICA. The exact date, time, and location of the meeting will be announced in due course.

c) Subsequent Meetings

There was active competition among representatives from several cities to arrange subsequent meetings. The tentative schedule is:

1987	Calgary	(P. Vermeulen)
1988	Halifax	(R. Cyr)
1989	Toronto	(A. Behar)

12) Fee Structure for 1986

MOTION: That the membership fee for 1986 be:

$ 5.00 for students
$15.00 for members
$15.00 for subscriptions and organisations

CARRIED

13) Other Business

a) Contact with National Building Code Authorities

The president read the letter from the Associate Committee for the National

Building Code in response to our submission in 1984. The motions from the annual meeting in Vancouver (1983) were reviewed, and the response from the ACNBC was discussed. It was agreed that the president will draft a further submission to the authorities, and suggest possible further co-ordinated action by the membership.

ACTION: C. Sherry

b) Industrial Noise Control Manual

The president reported that sales of the manuals are approaching the financial break-even point. There are approximately 400 copies still in stock, and good prospects for further sales.

c) Membership Directory

Preparation of a membership directory will proceed this year, in conjunction with the annual mailing of requests for membership renewals.The directory will include name, mailing address, telephone number, and an indication of subject areas of interest. There is no intention of selling this; it will be distributed to all members. The cutoff date for printing the directory will be set to permit publishing before July 1986.

14) Report from International INCE

The CAA was represented by Hugh Jones at the recent meeting of INCE in Munich, but no report was available.

15) Report of the Nominating Committee

The past president, Tom Northwood, presented the list of nominations (previously published in Canadian Acoustics Volume 13(4)). The following nominations of officers were made:

President:	Cameron Sherry (continuing)
Executive Secretary:	Deirdre Benwell (continuing)
Editor:	John Bradley (continuing)
Treasurer:	Tom Ho (continuing)

MOTION: That nominations be closed

CARRIED

The terms of 2 of the 8 Directors, Sharon Abel and Leslie Russell, expire this year. To replace them, the nomination committee proposed Nicole Lalande and Winston Sydenborgh to serve for 4 year terms. An additional nomination of Peter Terroux was presented.

MOTION: That nominations be closed.

CARRIED

Ballots were distributed, with Lola Cuddy and Harold Forrester as scrutineers; the elected directors are Nicole Lalande and Winston Sydenborgh.

A motion of thanks of thanks was made to the outgoing Directors, Sharon Abel and Leslie Russell.

CARRIED BY APPLAUSE

16) Appointment of Membership Chairman

MOTION: That the position of Membership Chairman and Honorary Officer be continued for the next year, and that Annabel Cohen continue in this capacity.

CARRIED BY APPLAUSE

17) Appointment of Auditor

The chairman will request Doug Whicker to audit the books of CAA for the year 1985-1986.

18) New Business

No items of new business were raised.

19) Adjournment

The meeting adjourned at 6:10 pm.

APPENDIX 1

Report by the Chairman of the 12ICA Executive Committee to the Canadian Acoustical Association for the Year Ending October 3, 1985

In June 1985, the "call for papers" for the Congress in Toronto and for the Associated Symposia (Circular 2) was mailed to 2100 people whose names were on file with the Secretariat. In addition each of the acoustical societies registered with the International Commission on Acoustics received a package containing approximately 100 copies of Circular 2. The members of the CAA were covered in a special mailing.

By October 1, the 12ICA Secretariat had received more than 700 preliminary abstracts from authors in 35 countries who are planning to present their work at the Congress. Approximately 40% of these contributions are from Europe, nearly 20% from Japan and China and 30% from North America including 90 from Canadian authors. So, the stage is set for a meeting that in scope, magnitude and character promises to meet the goals that we set for ourselves five years ago. The three specialized Symposia associated with 12ICA, also, are flourishing: "Underwater Acoustics" in Halifax with no less than 110 preliminary abstracts, "Units and their Representation in Speech Recognition" in Montreal with approximately 50 abstracts and "Acoustics and Theatre Planning for the Performing Arts" in Vancouver with 40 abstracts.

The 12ICA Executive Committee, the Technical Program Committee, the Local Planning Committee in Toronto and the various Sub-Committees have covered a great deal of ground during the past year. In May, the Executive Committee entered a period of intensive negotiations with the management of the Metro Toronto Convention Centre concerning space for the Congress. These negotiations were soon brought to a successful conclusion and a formal agreement with the MTCC for the rental of meeting rooms, Exhibition space and other facilities was duly signed by the Secretary General on our behalf early in August.

In 1984, formal applications for grants were prepared and submitted to the Ontario Ministry of the Environment, the Natural Sciences and Engineering Research Council of Canada and the International Union of Pure and Applied Physics. All three were approved and cheques for $25,000 from MOE and $10,000 from NSERC have already been received. Until these cheques arrived, the Executive Committee was primarily dependent on the CAA, American Express Canada, CP Air and Air Canada for funding and tangible support.

In Circular 2, the Technical Program Committee was able to announce the names of the seven distinguished plenary session speakers and the titles of the proposed structured sessions. The Committee is now mapping out a tentative Technical Program with approximately ten parallel sessions each morning and afternoon. In the meantime the instructions to authors are ready to be printed and should be mailed very soon. Authors are required to submit their four-column manuscripts and pay their registration fees by January 31, 1986. The subject coordinators will then meet with the Technical Program Committee to sort papers and prepare the way for the printing of

the Program and more than 2000 pages of Congress Proceedings. Finally, on July 23, 1986, all who are involved in the running of the Technical Program (approximately 150 people) will meet at dinner to receive a final briefing in preparation for the opening of the Congress the following day.

As a counterpoint to the Technical Program, the Local Committee is planning a series of receptions and special events commencing with a reception at lunchtime on Thursday July 24 in Roy Thomson Hall following the offical opening and concluding with a farewell reception on July 31. Other events planned or under discussion include a reception at City Hall, an informal supper at the Ontario Science Centre, a banquet at the Royal York Hotel, a recital featuring the octet of instruments based on the violin, and a symphony concert at Roy Thomson Hall. The Local Committee is also responsible for accommodation (in nine hotels and in university residences), the 12ICA Exhibition, Congress facilities, tour information and publicity. The provision of professional management for some of these activities is now under consideration.

In September 1985, an ad hoc Committee met to prepare realistic projections of income and expenses through July 1986. Assuming that 1200 delegates pay registration fees totalling $238,000 the total income will be in the vicinity of $420,000 which is 10% greater than the projected expenses. This approximate balance is, however, precarious since the income from registration fees, the size of the Exhibition and the level of financial support from industry cannot at present be accurately estimated. As a consequence, the Executive Committee will need to keep the balance sheet under constant review during the coming months and be prepared to make rapid adjustments from time to time. During the fiscal year which ended on August 31, 1985, approximately $3000 was spent on the distribution of Circular 2, $6000 on the printing and distribution of the Exhibition prospectus, $3000 on advertising and $11,000 in prepayment for space at the MTCC. The MOE grant was more than sufficient to cover these front end expenses. The formal financial statement for the fiscal year is not yet available.

When we decided to invite the international acoustical community to come to Canada in 1986, we believed that the presence of the Congress would enhance our own activities in this field. With this in mind, the Executive Committee has put together the 12ICA Student Prize scheme the purpose of which "is to encourage graduate students in Canadian universities whose thesis topics lie within the broad field of acoustics to participate in the Congress and present contributed papers on their work in an international setting" (see Canadian Acoustics, July 1985). The Committee also approved a letter prepared in collaboration with Annabel Cohen seeking support for the Congress and for the Canadian Acoustical Association. Approximately 350 copies of the letters were sent out in June.

Our annual progress report was duly presented to the Commission on Acoustics in Oslo in June and was received with unbounded enthusiasm and appreciation. Let us all redouble our efforts during this final year to ensure that 12ICA is indeed an unqualified success, remembering that such an event is unlikely to come our way again.

Edgar A.G. Shaw
Chairman, 12ICA Executive Committee
3 October 1985

APPENDIX 2

CANADIAN ACOUSTICAL ASSOCIATION

Statement of Receipts and Disbursements for Period 1 September 1984 - 31 August 1985

Receipts:

Membership	$ 5,834.67
I.C.A. Single Contribution	225.00
I.C.A. Annual Contribution	542.14
Sustaining Subscription	2,093.91
Reprints	1,950.00
Industrial Noise Manuals	1,576.00
Proceeds from 1984 Acoustics Week in Canada	2,997.25
From C.A.A. account sent by Jean Nicolas	3,000.00
From Génie mécanique	19,020.57
Ontario Grant for I.C.A.	25,000.00
Interest received from bank account 152-508977	1,157.74
	$63,397.28

Disbursements:

C.A.A. Printing	$ 4,336.24
Printing of Noise Control Manuals	2,970.22
12 I.C.A. Toronto	30,000.00
1985 Contribution: I-Ince	164.17
86 Acoustic Conferences	1,000.00
Postage	165.43
Miscellaneous	191.68
	$38,827.74

Excess receipts over disbursements $24,569.54

Balance Sheet

Assets:

Cash on hand	$24,569.54

Surplus:

Receipts	$24,569.54

Membership Report 1985

There were 382 members in September 1985, including 25 student members. This represents an increase of 3% over the number recorded for October 1984 and a 79% increase in the student membership. These figures do not include 15 free memberships and 42 library subscribers. Neither do they include an additional 65 applications, many of which were delayed in processing as a result of software development for a new data base format. When all members but those in the free category are included, the total is 489 as compared to 411 last year. This increase represents the addition of 150 new members, the loss of 72 and a net gain of 78 members or 19%.

Geographically, the membership (including libraries) was stable with small increases in Alberta, Nova Scotia, Saskatchewan and Newfoundland. This accounts for a 3% gain in Canadian relative to non-Canadian membership, from 88 to 91%. The largest percentage of members is in Ontario (49, 0% change over last year), followed by Quebec (17, 0), British Columbia (9, 0), Alberta (7, +1), Nova Scotia (4, +1), Manitoba (2, 0), and Saskatchewan (1, +.08). As before, there are no members in Prince Edward Island, but this year two members for Newfoundland. The United States represents 6% as before, Britain and France have 1% with the remainder distributed in Sweden, West Germany, Norway, Australia, New Zealand, Iran, China and Hong Kong.

The Membership Committee, formed in July 1984, continued its work throughout the year. Committee members were Alberto Behar, Bannu Hurtig, Chris Krajewski, Ron Newman, Ramani Ramakrishnan and Winston Sydenborg with Mustafa Osman and Hugh Jones assisting in an advisory capacity. Meetings were held 29 January, 7 March, 4 April, 15 August and 19 September. The following were major agenda items: results of the recommendations made to the Board of Directors October 1984, campaign plans and liaison with other organizations, and the audiovisual presentation. The Committee was advised that international liaison was not within its jurisdiction. The Committee focused on Canada in accordance with its other objectives established by the Membership Chair one year before and as stated in the Duties of the CAA Officers.

The flier design was finalized, typeset and 2,000 copies were produced and distributed as follows: Audio Engineering Society Workshop (200 approximately), ICA mailing to AES members (600), Canadian members of the Acoustical Society of America who are not CAA members (100), teachers, research associates and graduate students working in acoustics at Canadian universities (350), physics departments (70), IEEE student groups (100), CAA Annual Meeting and NRC cross-Canada seminars (100), Ontario Speech and Hearing Association (70). Much special assistance in the writing of cover letters and piggyback mailing was provided by Hugh Jones, John Manuel, Chris Krajewski, Ramani Ramakrishnan, Edgar Shaw, and Floyd Toole. Phil Giddings and Marshall Chasin also assisted in arranging cooperation with other organizations. The Committee telephoned members of the Industrial Hygiene Association inviting them to a Toronto Chapter Meeting on noise level standards. There was also a CAA booth at the Canadian Music Show in Toronto. As a result of these efforts, the expanded membership was more widely distributed among professions.

New members this year were sent a letter of welcome from the President, a call for papers from CANADIAN ACOUSTICS with information also about advertising and information about 12ICA, and new members were welcomed in CANADIAN ACOUSTICS.

A 20-minute audiovisual presentation on acoustics in Canada was developed to aid promotion of the CAA. Slides were donated by 18 members and Canadian acoustics was represented from underwater to satellites, music to noise, icebergs to power plants,

and coast to coast. The sound track included environmental sound effects and the announcer, David Helwig, who volunteered his professional assistance. The first official presentation took place at the Annual Meeting as part of the technical program and comments from a large audience were encouraging and constructive.

The conveners of the Annual Symposium assisted membership in other ways as well; for example, reducing the registration fee to membes. Organized technical sessions such as on speech and musical acoustics attracted newcomers. With the President's cooperation, three guests were invited to speak briefly about their related organizations at the beginning of the Annual Business Meeting. They were Mrs. Betty Dion from the Canadian Hearing Society, Mr. Havercroft, founding member of the Society for Nondestructive Testing, and Dr. Jeffrey Crelinsten, Executive Director of the Association for the Advancement of Science in Canada.

The listing of the Association by Deirdre Benwell in the Directory of Canadian Associations provided additional exposure. Less immediate in its effect but potentially significant is our correspondence with the Canada Employment and Immigration Commission, National Occupational Analysis and Classification Systems in regard to development for Jobscan of a category of occupations related to acoustics. Such information is provided for students who are making career and educational choices.

Items relevant to membership at the Board of Directors Meeting were: the decision to typeset and print a revised pamphlet in both English and French; discussion about the relevance of local chapters to membership expansion and strength of the Association; development of a CAA exhibit for 12ICA and other similar opportunities; and a request for a budget for future development of the audiovisual presentation.

Two reports have been prepared: An Overview on Membership Policy, An Audiovisual Overview on Canadian Acoustics (script), and also a List of Teachers, Graduate Students and Researchers Working in Fields of Acoustics in Canadian Universities.

Many other activities conducted by Society members, not directly associated with activities of the Membership Committee, stimulated membership growth such as the promotion of the 12ICA, the promotion of CANADIAN ACOUSTICS, NRC seminars on acoustics and individual initiatives through personal contact. Alf Warnock's development of an efficient and complete data base, capable of supporting a useful membership directory, highlights the start of this year. The support of membership recruitment by the Executive, Directors and members is gratefully acknowledged. Special thanks goes to the members of the Membership Committee for their time, standards, imagination and seriousness with which they took last year's challenge of acquiring 100 to 200 new members. This achievement is very promising for the continuing growth of the Association.

Annabel J. Cohen
Membership

Numbers of Members by Geographical Area, 1985

LOCATION

British Columbia	43	(38)*	Canada	444	(363)
Alberta	36	(26)	U.S.A.	26	(26)
Saskatchewan	5	(2)	Britain	6	(6)
Manitoba	9	(8)	Europe	8	(11)
Ontario	240	(202)	Australia	1	(2)
Quebec	83	(70)	New Zealand	1	(1)
New Brunswick	5	(3)	Hong Kong	1	(1)
Nova Scotia	21	(13)	China	1	(0)
Prince Edward Island	0	(0)	Iran	1	(0)
Newfoundland	2	(0)	U.S.S.R.	0	(1)
Northwest Territories	0	(1)			
			Total	489	(411)

*Number in brackets is last year.

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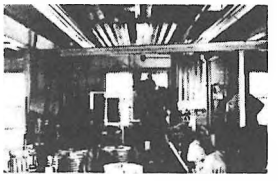

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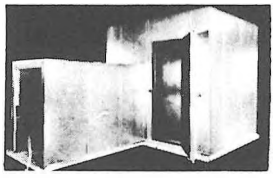

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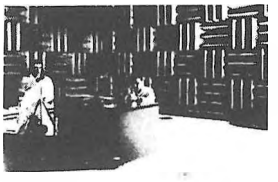

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Type	Prestige Elite preferred.
Title	All caps, centred, large type if available.
Author	Name and full mailing address, centred.
Abstract	Short summary, indent left and right margins.
Sommaire	French translation of Abstract.
Text	Single spaced, leave one blank line between paragraphs.
Page Size	8 1/2" x 11"
Margins	Fill the page! Leave only small margins, typically 3/4".
References	Any consistent format, list at end of article.
Figures and Tables	Not too large, insert in text. Include title for each figure and table.
Page Numbers	In light pencil at bottom of each page.
Equations	Minimize. Number them.
Originals	Submit original or very good dark copy.
Photographs	Only if essential or if they add interest. Submit glossy black and white prints only.

INFORMATION AUX AUTEURS

Général	Le manuscrit doit inclure le collage des figures et être prêt à photographier.
Charactère	Prestige Elite préférée.
Titre	Entièrement en majuscule. Centrer.
Auteur	Nom et adresse postale. Centrer.
Sommaire	Elargir la marge de chaque côtè.
Abstract	Traduction anglaise du sommaire.
Texte	Simple interligne. Séparer chaque paragraph.
Pages	8 1/2" x 11".
Marge	Réduire à 3/4".
Références	A la fin de l'article dans un format uniforme.
Figures et Tables	Petites tailles. Insérer dans le texte et titrer.
Pagination	En crayon, en bas de chaque page.
Equations	Minimiser. Numéroter.
Original	A remettre ou une très bonne copie.
Photos	Seulement si essentiel ou d'un intérêt particulier. Remettre une photo glacé en blanc et noir.

THE CANADIAN ACOUSTICAL ASSOCIATION

L'ASSOCIATION CANADIENNE DE L'ACOUSTIQUE

INVOICE

RENEWAL DUE 1 JANUARY 1986

Check Applicable Items

Subscription and/or CAA membership	$15	☐
CAA student membership	$5	☐
Sustaining subscription	$100	☐
Annual donation to 12th ICA	$20	☐
Single donation to 12th ICA	$75	☐

Total remitted $_____

FACTURE

ABONNEMENT DÛ 1 JANVIER 1986

Cocher Cases Appropriées

Abbonnement et/ou adhesion a l'ACA	
Membre étudiant de l'ACA	
Abonnés de soutien	
Don annuel au 12e ICA	
Don unique au 12e ICA	

Versement total

INFORMATION FOR MEMBERSHIP DIRECTORY

If you do not want to be listed, mark here ☐

RENSEIGNEMENTS POUR DIRECTOIRE DES MEMBRES

Cocher ici pour ne pas être enregistrer

Check areas of interest (max. 3)

Cocher les aires d'intérêt (max. 3)

Architectural Acoustics	Acoustique architecturale
Electroacoustics	Électroacoustiques
Ultrasonics	Ultrasons
Musical Acoustics	Acoustique musicale
Noise	Bruit
Psycho- and Physiological Acoustics	Physio-psycho-acoustique
Shock and Vibration	Choc-vibrations
Speech Communication	Communication parlée
Underwater Acoustics	Acoustique sous-marine
Other	Autre

Telephone Number ( ) _____ Numéro de téléphone

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