

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

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### 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"<sup>1</sup> (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).<sup>2</sup> 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<sup>3</sup> 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 5½ 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 disruptive 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<sup>1</sup> 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 RESIDENTIAL 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,<sup>4</sup> 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,<sup>4</sup> 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:

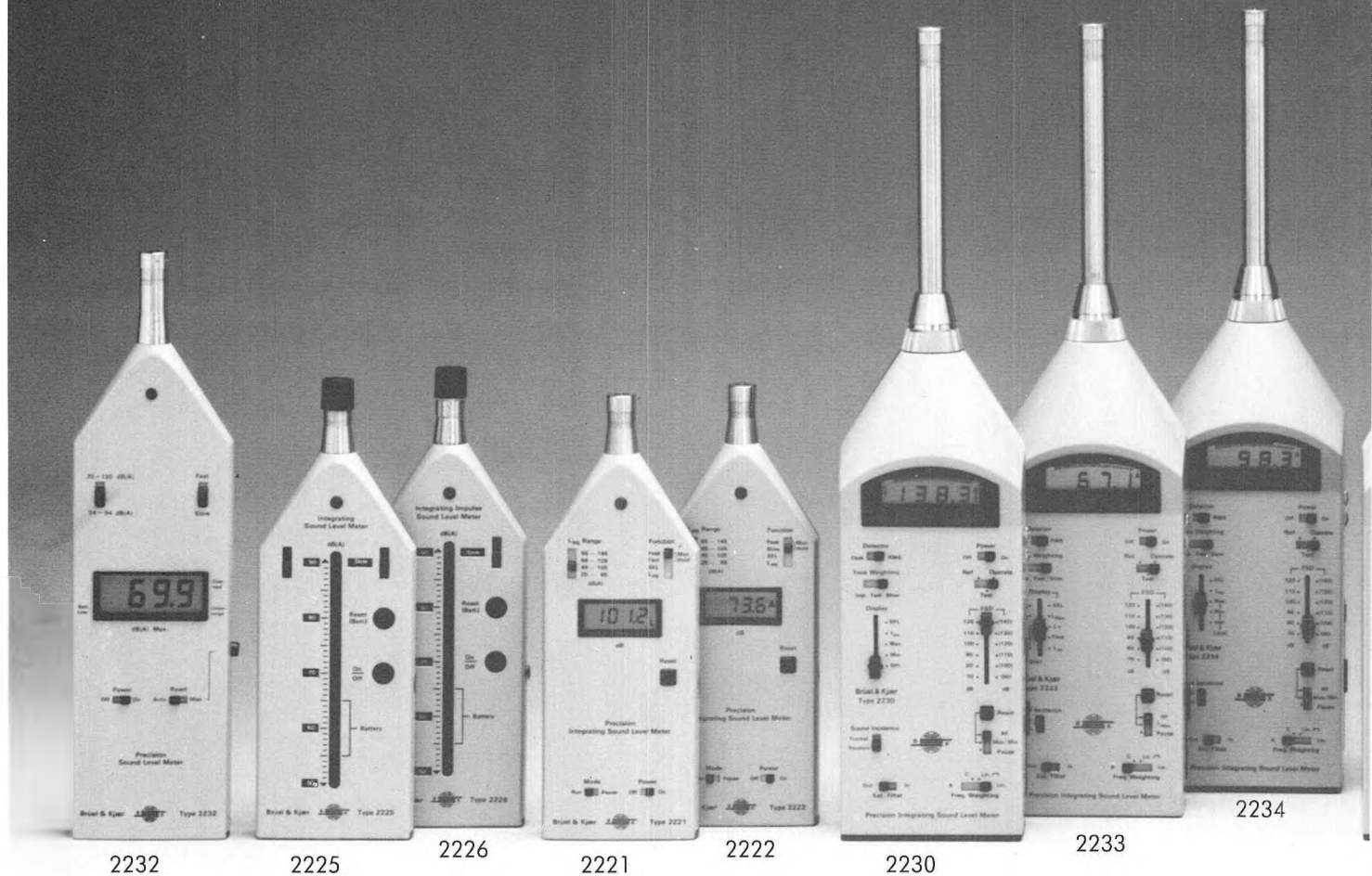
- (i) the proposal is considered to be feasible, practical and economical;
- (ii) its adoption and implementation, should not require the hiring of 'any' additional qualified and/or specialized personnel (or anyone else), on a 'casual' or 'contract' or 'permanent' basis, by any Permits and Licences Departments 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.

#### REFERENCES

1. ASTM Standard E597-81, "Standard Practice for Determining a Single-Number Rating of Airborne Sound Isolation for Use in Multi-Unit Building Specifications," 1985 Annual Book of ASTM Standards, Section 4 - Construction.
2. Warnock, A.C.C. "How to Reduce Noise Transmission Between Homes (Apartments)." BPN 44, Division of Building Research, National Research Council, 1983.
3. "Noise: A Health Problem," Office of Noise Abatement and Control, Washington, DC, 20460, 1978.
4. Bradley, J.S. "Subjective Rating of Party Walls." Canadian Acoustics, Vol. 11, No. 4, pp. 37-45, 1983.

# WHAT'S ALL THE



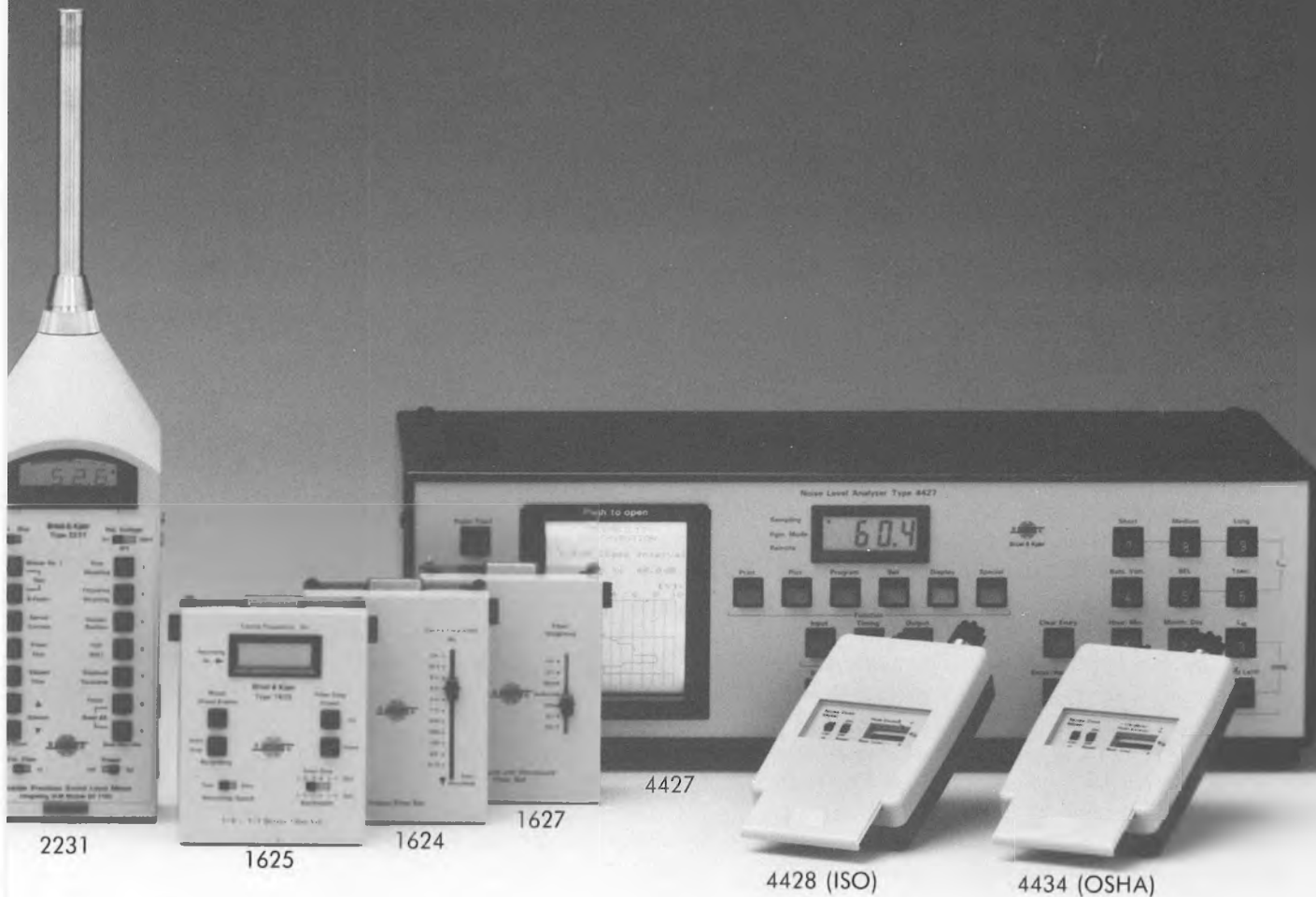
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