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SCHULTZ

REPORT NO.

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RECOMMENDED NOISE CONTROL  
AMENDMENT TO THE CITY OF  
CHICAGO BUILDING CODE

Second Draft  
Project No. 171742

Submitted to:

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A. INTRODUCTION

The City of Chicago, like many other cities and municipalities in the United States and abroad, has resolved to respond to the growing need for superior acoustical standards in her buildings. The purpose of this report is to discuss and define the meaning of acoustical performance in buildings, and to present a definitive proposal for inclusion in the City's existing Building Code.

The overriding purpose of the recommended ordinance is to prescribe standards of acoustical comfort and performance which are realistic, humanly relevant, and readily verified and enforced. In several respects, the stated goals stand in contrast to similar ordinances now in force elsewhere. Most of these adapt established concepts of acoustical testing and noise control, which place the emphasis on the performance of individual building elements. This ordinance breaks new ground by focussing on the total acoustical environment of urban man.

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The recommended ordinance does not seek to establish standards of unquestioned excellence, which would disrespect economic reality. Nor does it attempt to regulate acoustical situations covered by the City's recently enacted Noise Ordinance, the noise exposure standards of the Occupational Safety and Health Administration, or by other federal standards or guidelines. Instead, it seeks to exclude many cases of inferior acoustical comfort which, up to now, have not been regulated by law.

Based on the premise that man spends most of his time, including his time of rest and leisure when acoustical discomfort is least welcome, in his home, the provisions of this ordinance are intended to apply to the following building categories only:

- a) Apartments, flats, condominiums, and all other forms of multi-family dwelling where several units are located in a single building.
- b) Hotel and motel rooms and suites, and all other places of temporary residence where several units are located in a single building.

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Intentionally not subject to this ordinance would be hospitals and other places of health care, all public and commercial buildings, industrial buildings, and single-family dwellings.

In technical terms, this ordinance addresses itself to the following types of disturbance, each of which may affect the standard of acoustical comfort experienced within a dwelling or place of temporary residence:

- a) Airborne sound originating outdoors.
- b) Airborne sound originating in a vertically or horizontally adjacent dwelling.
- c) Impact sound originating in a vertically or horizontally adjacent dwelling.
- d) Noise generated by heating, ventilating and air-conditioning equipment.
- e) Noise generated by other built-in equipment, fixtures and appliances.

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Insofar as the strength of this ordinance lies in practicality and enforceability, and since it does represent a departure from component-oriented practices, all standards set at this time should be viewed as provisional. After a period of adaptation and field experience, as described in the following text, the numerical performance goals may be adjusted to better reflect the balance between man's expectation and practical reality.

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## B. BACKGROUND

To date, codes and ordinances with an intent similar to that described in this report have been or are about to be enacted in many localities throughout the world. As pointed out in the introduction, virtually all of these codes and ordinances are component-oriented, wherein the acoustical performance of individual constructions and pieces of equipment is specified in accordance with some established test procedure. Since the origin of the majority of these procedures can be traced to the laboratory, technical accuracy is high but adaptation to field situations is difficult and conducive to elaborate test procedures, which rule out routine testing to verify performance in completed buildings. Furthermore, the assembly of individually superior components may or may not result in superior overall acoustical performance.

For example, when considering isolation between two dwellings, it is one thing to use an "approved" partition, which in no way can guarantee satisfactory privacy, although it may help achieve that goal. It is another thing to know and to specify the goal (in terms of

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easily measurable performance) and to achieve it by a balanced combination of components. We are not interested in the excellence of a wall or any other part of a complex whole. Instead, we want that complex whole to perform. And we want to have the assurance that every dwelling covered by this ordinance will actually meet a minimum standard of performance. While knowledge of the acoustical potential of individual components remains an invaluable planning tool, it is the performance of the building as a whole that matters and that is the ultimate goal of this ordinance.

It is for these reasons -- total performance and quick measurement -- that we dispense with most of the standards and procedures used elsewhere. However, as described in the text of the ordinance, such procedures can be used in cases where the proposed techniques indicate failure and/or the exact cause of failure needs to be determined.

Following is a brief review of several existing codes and ordinances, their advantages and drawbacks, and their relationship to this ordinance.

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1. The Chicago Building Code

The present Building Code of the City of Chicago does not in any way regulate or prescribe acoustical performance, which is the sole subject of the ordinance described in this report. Our review of the Chicago Building Code has led us to believe that the recommended noise control provisions, including all standards, test procedures, enforcement etc., do not contradict or supersede any part of the existing Code.

This ordinance, therefore, is intended to stand as an independent amendment to the City's Building Code, and to complement any and all other provisions and requirements prescribed by the existing Code.

2. Other U. S. Codes and Ordinances

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3. Some Foreign Codes and Ordinances

4. HUD and FHA Noise Control Policies

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C. THE ORDINANCE

The Building Code of the City of Chicago is hereby amended by adding thereto the following Article.

ARTICLE X: ACOUSTICAL CONTROL

SECTION X 01: PURPOSE

The provisions of this Article shall control the design and construction of certain buildings and structures, as defined in Section X 04 hereunder, and any addition or alteration thereto hereafter erected to insure control of and protection from noise within buildings and to provide minimum standards of acoustical comfort and privacy.

*Comment: These provisions are not designed to apply to existing buildings, except with respect to additions and alterations which result in the creation of new dwellings. Major considerations in exempting existing buildings are the cost of structural modifications required to meet these standards, and the enormous task of field testing all existing dwellings which might be subject to these provisions.*

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SECTION X 02: LIMITATIONS

The provisions of this Article shall not require, or be construed to require, buildings to be designed or constructed contrary to provisions contained elsewhere in this Code.

SECTION X 03: ENACTMENT

The provisions of this Article shall apply to buildings, additions or alterations completed on or after [insert date] . One year after this date, and at future dates as and when the City may so desire, the performance standards, as defined in Sections X 06 and X 07 hereunder, shall be subject to review and revision.

*Comment: Insofar as this Article seeks to achieve a tenable balance between current construction practices and good acoustical performance, the suggested initial enforcement procedures are deliberately lenient. Given fair warning, it is expected that the construction industry will, in future years, be in a position to offer higher standards of acoustical performance which*

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*better satisfy human expectations, whereupon these  
(or suitably revised) standards can be strictly enforced.*

SECTION X 04: SCOPE

X 04.1: Building Types Covered

The provisions of this Article shall apply to all buildings and structures which, either initially or by virtue of addition or alteration, contain two or more dwellings, as defined in Section X 05 hereunder. These shall include, but shall not necessarily be limited to, apartments, flats, condominiums, townhouses, pensions, rooming houses, dormitories, and hotel-motel rooms and suites.

Exempt from these provisions are all buildings and structures which are not places of residence, either permanent or temporary, and all buildings and structures housing a single individual, family or comparable socio-logic unit.

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X 04.2: Rooms and Spaces Covered

The provisions of this Article shall apply to all habitable rooms and spaces, which are part of a dwelling located in a building or structure, as hereinbefore defined. However, performance standards governing isolation of airborne and impact sounds shall apply to pairs of adjacent dwellings only.

The rooms and spaces covered include, but are not necessarily limited to, all bedrooms, living and dining rooms, studies, family rooms, kitchens and bathrooms.

Exempt from these provisions are all storage rooms, closets and similar spaces not normally occupied by people, and, with respect to the isolation of airborne and impact sounds, all adjacencies where both spaces are part of the same dwelling.

*Comment: Man objects to sounds created by a neighbor, but not to his own. At least, he has some control over the latter, if generated by a member of his own family. Besides, intra-dwelling isolation standards would reverse*

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*the trend of architectural freedom which manifests itself in an expression of space rather than a separation into cells. This the present ordinance seeks to avoid.*

**X 04.3: Situations Covered**

The provisions of this Article shall include and shall be limited to the following acoustical situations, conditions, circumstances and relationships, the relevant test procedures and performance standards for each of which are defined in Sections X 06 and X 07 hereunder.

1. Attenuation of airborne sound offered by exterior constructions, such as exterior walls, windows, doors, and all elements and devices appurtenant thereto.
2. Attenuation of airborne sound offered by interior party constructions which shall include but shall not necessarily be limited to party walls, floors, ceilings, and all appurtenant connections, interruptions and penetrations.

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3. Attenuation of impact sound offered by interior floor-ceiling constructions, which separate pairs of vertically or horizontally adjacent dwellings, and by the appurtenant, permanent floor finishes.
4. Control of noise within dwellings, generated by heating, ventilating, air-conditioning and other service systems or equipment, which are an integral and necessary part of the building, and which are in constant or frequent operation.
5. Control of noise within dwellings, generated by the following built-in conveniences, which are manually controlled and subject to intermittent or infrequent use: room air-conditioning units, kitchen and toilet exhaust fans, food waste, disposers, freezers and refrigerators, dishwashers, and washing machines.

Control of certain other noise sources, though regulated by Section X 07 of this Article, shall be enforced at the Inspector's discretion only.

*Comment: The above situations, if adequately provided for, will eliminate most of the acoustical discomfort*

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*and annoyance experienced in places of residence. As will be shown in subsequent sections of this report, each situation is handled in a manner which will permit quick testing in the field. The emphasis clearly lies on practicability (at the possible expense of minor inaccuracies) and on insuring acceptable long-term.*

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*environments -- not on protection against infrequent disturbances which, in terms of severity, far exceed those which are commonplace.*

SECTION X 05: DEFINITIONS

X 05.1: Acoustical Terms

1. Sound Level

More correctly, sound-pressure level, sound level is the quantity in decibels measured by a sound level meter. Throughout this Article, unless otherwise specified, sound levels shall be measured and expressed in terms of dBA, to the nearest integral number, using the A-weighting network and "slow" response of a Precision Sound Level Meter.

*Comment: The choice of dBA, in preference to other weighted or unweighted forms of the decibel, is strongly supported by the need for simplicity in testing, and by the significant advantages, in terms of correlation with human response, of A-levels over the other levels that can be measured with a standard sound level meter.*

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**2. Ambient Sound**

Also ambient noise and ambient level. An essentially steady sound (level) which prevails in the absence of other, distinguishable sounds of a more temporary nature. Synonymous with background noise, or background noise level.

**3. Airborne Sound**

Any and all sounds and noises which, upon generation by any source, first propagate through air, then impinge upon a partition, and then are re-radiated into air by the partition's opposite side.

**4. Impact Sound**

Any and all sounds and noises which are induced directly and by mechanical action into a floor structure, and then are re-radiated into a vertically or horizontally adjacent space by said floor or floor-ceiling combination.

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5. Attenuation

A lessening or reduction in the sound level due to distance or to barriers, mufflers or other obstacles or devices placed between a sound source and a receiver.

6. Noise Reduction (NR)

The attenuation offered by any and all building elements that control the transfer of airborne sound from one space into another. Throughout this Article, unless otherwise specified, noise reduction is measured and specified in terms of dBA and, hence, performance is described by the abbreviation NRA.

*Comment: Note that the term Transmission Loss (TL) and its derivative, the Sound Transmission Class (STC), are not defined or used in this ordinance, since neither describes total performance of a combination of structural elements; the term NRA is unique to the procedures described in this ordinance, and should not be compared with other, established rating systems.*

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7. Impact Isolation (II)

The degree of control offered by a floor-ceiling construction over impact sounds induced into said floor. Throughout this Article, unless otherwise specified, impact isolation is measured and specified in terms of dBA and, hence, performance is described by the abbreviation IIA.

*Comment: Neither II nor IIA are established acoustical terms; both were developed for this ordinance and modeled upon the concept of (NR), which is an established term.*

8. Effective Isolation (EI)

A measure of acoustic privacy, based on the relationship of intruding sound to the "masking" effect of ambient sound. For the purposes of this Article, EI shall be the sum of noise reduction (or impact isolation) and ambient sound.

*Comment: The term EI is unique to this ordinance, although the concept of quantifying acoustic privacy in terms of the signal-to-noise ratio is widely used.*

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9. "Hard" Room

A room or space that is completely unfurnished, and contains no carpet, no acoustical tile, nor any debris that may contribute acoustical absorption over and above that contributed by the bare floor, walls and ceiling.

10. "Medium" Room

A room or space that is sparsely furnished with hard pieces of furniture only, or one that contains moderate quantities of building materials or other forms of sound-absorbing debris.

11. "Soft" Room

A room or space that is fully furnished (with or without carpet), or fully carpeted or equipped with an acoustical tile ceiling, but otherwise unfurnished. It must contain major areas of carpet or of other soft furnishings.

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12. Source Room

A space or room within a building which, for acoustical test purposes, is deliberately insonified so that (attenuated) sound levels may be measured elsewhere in the building -- ref. Receiving Room.

13. Receiving Room

A space or room within a building which, for acoustical test purposes, receives sound originating elsewhere - ref. Source Room.

X 05.2: Architectural Terms

1. Building

Any and all contiguous structures, located under one roof (including roofs at diverse elevations) that contain two or more adjacent dwellings.

*Comment: The given definition of a building specifically relates to buildings covered by this ordinance only.*

2. Dwelling

A place of residence of an individual, a family, or a household, whether permanent or temporary, owned, leased or rented by the tenant, and comprising one or more habitable spaces. For the purposes of this Article, rentable rooms and suites in hotels, motels and other places of temporary residence shall be considered as dwellings.

3. Habitable

Used in combination with terms such as "room" or "space". A descriptor implying that the room or space (a) constitutes all or part of a dwelling, and (b) does not solely serve as a place of storage or of transit.

4. Partition

Any wall, floor, ceiling, or similar construction, singly or in combination, including doors, windows, and all elements and devices appurtenant thereto, that physically separates one room or space from another.

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5. Party Wall

Also party structure. A wall or structure that forms a separation between two dwellings, and not a separation between two spaces that are part of the same dwelling.

6. Adjacent

Any and all relationships between two or more dwellings that share, horizontally or vertically, one or more common partitions, however small and indirect these may be. Synonymous with adjoining, abutting, neighboring, etc.

*Comment: The purpose of this definition is to insure privacy between dwellings, even if these may not be adjacent in the literal sense. In such cases, as where mechanical shafts or stair towers are interposed and no actual party walls exist, field tests should be made at the Inspector's discretion.*

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X 05.3: Terms Related to Responsibility

1. Inspector

The City's lawful representative in any or all of the following matters related to this Article: review and approval of plans, acoustical field testing, and certification of compliance with the provisions of this Article.

1A. *Eng'g*

2. Owner

The cause and prime beneficiary of a building project, who funds, legally owns, but, upon completion of the project, does not necessarily reside in, the building, addition or alteration.

3. Developer

An Owner or Owner-Contractor who builds, or causes to be built, a building, addition or alteration for the explicit purpose of gainful sale, lease or rental. *for dwelling purposes*

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4. Architect

A licensed professional engaged by the Owner to design, detail, specify, and supervise the construction of, a new building, addition, or alteration.

5. Mechanical Engineer

A licensed Mechanical Engineer, not necessarily associated with the Architect, who is charged with the design and specification of all mechanical systems and devices that are part of a building, addition or alteration.

6. General Contractor

An executor of a building, addition or alteration, as prescribed by the contract documents (drawings and specifications) usually prepared by an Architect.

7. Subcontractor

An executor, usually engaged by the Contractor or Owner, of specific parts of a building, addition or alteration, as prescribed by the contract documents.

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8. Supplier

A purveyor and/or manufacturer of building systems and equipment, whose goods are incorporated in the design and construction of a building, addition or alteration.

9. Acoustical Consultant

A professional acoustician, <sup>who may be</sup> ~~usually~~ engaged by the Owner or Architect <sup>to</sup> ~~who~~ renders expert advice in matters pertaining to acoustics and noise control. The services of a Consultant, though generally available, are not mandatory. *His services are not mandatory.*

10. Realtor

An agent engaged by the Owner or Developer to administer and manage the sale, lease or rental of a completed building, addition or alteration.

11. Tenant

The ultimate resident, irrespective of his legal status with respect to ownership or other forms of tenure, of a new dwelling that is subject to the provisions of this Article.

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Comment: The ~~explicit~~ intent of the above definitions is to describe the role of each individual or group of individuals, ~~who in any way may be related~~ <sup>with respect</sup> to the enforceability or enforcement of this ordinance. Consequently, duties other than those related to this ordinance, are not described.

SECTION X 06: MANDATORY TEST PROCEDURES AND PERFORMANCE STANDARDS

X 06.1: Performance of Exterior Constructions with Respect to Airborne Sounds Originating

Outdoors

The inspector shall <sup>perform</sup> ~~follow~~ the following procedures; ~~to all but~~ ~~at~~ ~~the~~ ~~site~~ ~~of~~ ~~the~~ ~~test~~

1. Instrumentation

- ANSI
- a) A precision sound level meter, operated so as to read A-weighted sound levels with high ~~high~~ ← ? damping -- results read in dBA on "slow" meter setting.
  - b) The sound level meter shall be hand-held, away from the observer's body, approximately the

one-third point of one of the room's major diagonals, closest to the exterior construction tested but away from absorptive surfaces.

*copying*

*Comment: The recommended location of the sound level meter appears to offer, with a single reading, the best approximation to the average sound-pressure level of the room's reverberant field.*

## 2. Procedure

- a) Inspect the construction to be tested. Open and close all windows, doors, and other apertures that may be part thereof. Thereupon, leave all such elements and devices closed, unless they are designed to remain open during normal occupancy, in which case they shall remain open.
  
- b) Deactivate all interior mechanical and similar service systems that may govern or affect the ambient noise level in the dwelling tested. Return to the receiving room and close its door(s).

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- c) Measure the sound level in the receiving room due to normal street traffic and to any other <sup>exterior</sup> sound source that typifies the prevailing acoustical environment of the dwelling's site or exposure. Record the result as Item 1 on the data sheet.
- d) Correct the result in accordance with the following table, and record the corrected result as Item 2 on the data sheet.

<u>Acoustical Status of Receiving Room</u>	<u>Correction</u>
Hard	-2 dBA
Medium	-1 dBA
Soft	0 dBA

*why these figures -*

- e) Open any window or door that may be part of the exterior construction tested, and measure the prevailing sound level at this opening, in the plane of the exterior wall. Record the result as Item 3 on the data sheet.

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*Comment: The recommended test procedure is necessarily crude but it is both quick and simple to perform. It gives an immediate indication of how much exterior noise enters the dwelling. At the Inspector's discretion, the test may be performed on one or more exterior constructions of a dwelling, depending on the uniformity of exposure. It is the explicit intent of this procedure to exclude consideration of sounds which contravene the City's Noise Ordinance, sirens, aircraft flyovers, and other high-level intrusions, unless, in the Inspector's opinion, these are frequent and typical of the site under consideration.*

### 3. Evaluation

- a) As a first step, the acoustical adequacy of the exterior construction tested shall be judged directly from the corrected sound level measured in the receiving room (Item 2 on data sheet).

AN EXTERIOR CONSTRUCTION SHALL BE DEEMED TO HAVE SATISFIED THE PROVISIONS OF THIS ARTICLE, IF THE CORRECTED AMBIENT LEVEL, MEASURED WITH ALL SYSTEMS IDLE (ITEM 2 ON DATA SHEET) IS NO HIGHER THAN 30 dBA.

b) If the preceding result exceeds 30 dBA, the difference between the open-window sound level (Item 3) and the corrected closed-window sound level (Item 2) shall be calculated and the resultant attenuation recorded as Item 5 on the data sheet.

THEREUPON, THE PROVISIONS OF THIS ARTICLE SHALL BE DEEMED TO HAVE BEEN SATISFIED SUBJECT TO COMPLIANCE WITH THE FOLLOWING TABLE, OR IF ATTENUATION (ITEM 5) EQUALS OR EXCEEDS 35.

*where is item 2*  
?

<u>Exterior Noise Level</u> (Item 3)	<u>Min. Required Attenuation</u> (Item 5)	
41 or 42 dBA	11	30
43 " 44 "	12	31
45 " 46 "	13	32
47 " 48 "	14	33
49 " 50 "	15	34
51 or 52 dBA	16	35
53 " 54 "	17	36
55 " 56 "	18	37
57 " 58 "	19	38
59 " 60 "	20	39

*(dBA interior) due to exterior sources?*

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<u>Exterior Noise Level</u>	<u>Min. Required Attenuation</u>
<u>(Item 3)</u>	<u>(Item 5)</u>
61 or 62 dBA	21 40
RWY for San Diego: 63 " 64 "	22 41
65 " 66 "	23 42
65-70 ⇒ 25 dB 67 " 68 "	24 43
69 " 70 "	25 44
71 or 72 dBA	26 45
70-75 ⇒ 30 dB 73 " 74 "	27 46
75 " 76 "	28 47
75-80 ⇒ 35 dB 77 " 78 "	29 48
79 " 80 "	30 49
81 or 82 dBA	31 50
not permitted 83 " 84 "	32 51
85 " 86 "	33 52
87 " 88 "	34 53
Goal is for interior annual CNEL ≤ 45 dB 89 " 90 "	35 54

*Comment: In keeping with the spirit of this ordinance, which first seeks to insure acceptable acoustical environments, and relegates attenuation to a position of secondary*

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importance, the latter is determined only if intrusive sounds exceed a certain limit. Even then, the performance requirements are intended to be realistic and not necessarily such as to insure compliance with the first limit. They are based on a sliding scale of values and ask little, if the site is quiet. Under extreme circumstances, even permanently open windows (subject to weather) may pass the test. However, the performance requirements increase with increasing acoustic activity on or near the site up to a standard which can be achieved with high-quality double glazing.

X 06.2: Performance of Interior Party Structures with Respect to Airborne Sounds Originating in an Adjacent Dwelling

*Comment: All currently used measurement procedures, whether employed in the laboratory or in the field, are predicated upon established standards such as ISO R 140, ASTM E 90, or ASTM E 336. In each case, it is required that separate measurements be made in several octave or one-third octave bands, and, if Transmission Loss (TL) or Sound Transmission Class (STC) are to be determined, that all results be normalised to exclude variations*

due to partition area and receiving room absorption. Worse still, to determine similar data for a field condition (FTL and FSTC), the current standard prescribes an elaborate series of secondary tests to prove and to assure the absence of flanking transmission.

The usual objective of these thoroughly valid but cumbersome procedures is to determine the performance of a particular partition, and not the performance of a structure as a whole. The resultant ratings, such as STC, conveniently describe the test partition's performance, but merely hint at the actual isolation enjoyed between a pair of spaces.

If our choice were limited to existing procedures and ratings, then the Normalized Noise Isolation Class (NNIC) would be the most meaningful and reliable rating for the purpose of this ordinance. But it requires 48 pieces of measurement data for each pair of spaces tested! We are confident that the much simpler procedure recommended here will, besides yielding numbers comparable to the NNIC ratings, be just as sensitive to narrow-band deficiencies, and will produce a result which describes attenuation, irrespective of the constructions involved, on a humanly tangible scale.

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*The built-in accuracy and responsiveness of the recommended rating (NRA) is dependent upon the accuracy and reliability of the sound source, as specified, and upon the exclusive use of the meter's A-weighted network. In place of further measurements, normalization is handled by applying pre-determined corrections, derived from a study of room absorption data for residential spaces under varying conditions of furnishing.*

*Acoustical comfort and privacy, as experienced by people, cannot be described on a scale of attenuation (such as NRA) alone. Invariably, acceptability or non-acceptability of a particular state of privacy depends both on the attenuation offered by the partition(s) and on the level of steady ambient noise, which helps obscure other intruding sounds. Decibel for decibel, the two are of equal value, for which reason Effective Isolation (EI) is equally (but within limits) affected by both.*

1. Instrumentation

- a) An electronic pink noise generator/amplifier/  
loudspeaker combination with flat power output  
from the one-third octave band centered at 100 Hz

through the one-third octave band centered at 5000 Hz, and a roll-off of at least 12 dB/octave beyond these frequencies. The sound power level in each one-third octave band from 100 to 5000 Hz of this source shall be determined in accordance with ANSI [TJS please complete], shall average at least 100 dB re  $10^{-12}$  watt, and the scatter of the individual power levels shall not exceed  $\pm$  [enter smallest reasonable guess] dB.

- b) A precision sound level meter, operated so as to read A-weighted sound levels with high-damping -- results read in dBA on "slow" meter setting.
- c) The sound source (loudspeaker) shall be placed on the floor of the source room, but supported by a resilient pad to minimize direct induction of acoustic energy into the floor structure. It shall be located away from the party structure tested and, preferably, aimed toward a hard-surfaced corner of the source room. For vertical measurements, the lower space shall be the source room and shall contain the loudspeaker.

- d) The sound level meter shall be hand-held, away from the observer's body, at approximately the one-third point of one of the (source or receiving) room's major diagonals, closest to the partition tested but away from absorptive surfaces.

*Comment: Correct and reliable performance of the sound source is critical. There is nothing to suggest that today's technology cannot cope with the performance requirements spelled out above. It is suggested that, in addition to an initial acceptance test by a suitably qualified acoustical laboratory, each sound source be re-tested at least twice annually to assure conformance with the given performance requirements. Sound level meters should be calibrated prior to each use, and the calibration device should be checked semi-annually.*

## 2. Procedure

- a) Inspect the pair of spaces to be tested. Close all doors, windows and other apertures which are kept closed during normal occupancy of the spaces. Select one of the spaces as the source room (always the lower space in case of vertical

tests between floors). Move any furniture which may interfere with the recommended location of the loudspeaker. Define and record the acoustical status of each space - hard, medium, or soft. ( )

- b) Measure the level of continuous ambient noise in the receiving room. Make sure that the level is representative of the ambient noise level that will prevail throughout the test. If necessary, deactivate the ventilation system, unless it operates quietly and continuously. Record the result as Item 8 on the data sheet.
- c) Proceed to the source room and activate the loudspeaker. Adjust the gain so that the sound level in the source room reads exactly 100 dBA. Subject to a possible repeat test (see e), record the level measured as Item 9 on the data sheet.
- d) Leave the loudspeaker on and proceed to the receiving room. Measure the sound level (~~now governed by the test source~~) and record the result as Item 10 on the data sheet.

*8/1* If the received level (Item 10) lies less than 10 dBA above the ambient level (Item 8), return to the source room, increase the gain of the sound source to maximum, and again measure the sound levels in both the source and receiving rooms. Revise the source and received sound levels (Items 9 and 10) accordingly.

f) If the received level (Item 10) still lies less than 10 dBA above the ambient level (Item 8), correct the former in accordance with the following table, and enter the result as Item 11 on the data sheet.

Excess of Item 10 over Item 8    Reduce Item 10 by

6-9 dBA

1 dBA

4-5 dBA

2 dBA

1-3

3 dBA

g) If the received level (Item 10) exceeds the ambient level (Item 8) by less than 4 dBA, an accurate measurement cannot be made nor reported. However, compliance with the performance standards of this Article can be established upon making

*Wait for lower ambient?*

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the maximum permissible correction of 2 dBA,  
with the understanding that actual performance  
may be superior to that measured.

*Comment: Again, the recommended test procedure is quick  
and simple to perform. There is good reason to believe  
that the results, determined as described below under  
"Evaluation", are both meaningful and reliable with  
respect to the intent of this ordinance -- to insure  
acoustical comfort for the occupant. It is suggested  
that the above procedure be applied to all pairs of  
adjacent habitable spaces that may exist in a pair of  
adjacent dwellings.*

### 3. Evaluation

- a) To determine noise reduction as measured by  
the A-level technique (NRA), subtract the received  
level (Item 10 or, if present, Item 11) from  
the source level (Item 9). Enter the resultant  
"raw" NRA as Item 12 on the data sheet.

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- b) Correct the "raw" NRA in accordance with the following table, and enter the final, corrected NRA as Item 13 on the data sheet.

Acoustical Status of

<u>Source Room</u>	<u>Receiving Room</u>	<u>Correction</u>
Hard	Hard	+2
Hard	Medium	0
Hard	Soft	-2
Medium	Hard	+3
Medium	Medium	+1
Medium	Soft	-1
Soft	Hard	+4
Soft	Medium	+2
Soft	Soft	0

- c) To determine the level of steady ambient noise that can be counted upon for "masking" purposes, activate any mechanical, electronic or pneumatic system that may have been designed and provided for guaranteed continuous operation at all times

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and during all seasons, and measure the sound level in all habitable rooms of the dwelling tested. Enter the lowest value, but not less than 30 dBA nor more than 40 dBA, as Item 14 on the data sheet.

In the absence of such a system, use the lowest of the following, but not less than 30 dBA nor more than 40 dBA:

Either, the corrected ambient level (Item 2) measured in the dwelling tested with all mechanical systems idle;

Or, the ambient level (Item 8) measured in a receiving room that is part of the dwelling tested, and further corrected by -4, -2, or 0 dBA, in case of a hard, medium, or soft receiving room, respectively;

Or use, the applicable value from the following table, which is based on the environmental criteria described in the Federal Housing Administration's publication FT/TS-24, dated January 1968:

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"Quiet" suburban areas	30 dBA
"Average" urban and suburban areas	35 dBA
"Noisy" urban areas	40 dBA

Enter the ambient noise level thus determined as Item 14 on the data sheet, and record the manner in which it was determined. This value shall be determined once only for each dwelling tested. ( )

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- d) To determine Effective Isolation (EI) between each pair of adjacent spaces tested, arithmetically add the final NRA (Item 13) and the ambient level determined for "masking" purposes (Item 14). Record the sum as Item 16 on the data sheet.

AN INTERIOR PARTY STRUCTURE SHALL BE DEEMED TO HAVE SATISFIED THE PROVISIONS OF THIS ARTICLE, IF EI (ITEM 16 ON DATA SHEET) EQUALS OR EXCEEDS 85. THIS SHALL BE A MINIMUM STANDARD APPLICABLE TO ALL DWELLINGS COVERED BY THIS ARTICLE.

FOR PURPOSES OF GRADING PARTY STRUCTURES THAT MEET THE MINIMUM STANDARD, THE FOLLOWING DISTINCTIONS SHALL BE MADE:

GRADE III: EI EXCEEDS 84 BUT IS LESS THAN 90  
GRADE II: EI EXCEEDS 89 BUT IS LESS THAN 95  
GRADE I: EI EXCEEDS 94

HOWEVER, ANY ONE DWELLING SHALL BE GRADED IN ACCORDANCE WITH THE LOWEST EI VALUE OBTAINED FOR ANY PARTY STRUCTURE APPURTENANT THERETO.

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*Comment: The recommended minimum standard (EI=85) correlates well with the expectations and experience of most residents living in multi-family dwellings, but only with respect to everyday sounds, such as conversational voice, radio and TV. Privacy with respect to occasional, louder sounds can be achieved with higher EI ratings only. Really good performance with respect to parties, loud altercations and live music may be achieved with EI ratings that exceed 100, which, with rare exceptions, is clearly beyond the realm of practical (and economic) construction techniques. The proposed grades of performance recognize the relative inadequacy of the minimum standard, and offer a choice both for the Owner and for the prospective Tenant.*

*In contrast to many other ordinances and policy guidelines, no differentiation is made between the types of rooms involved. Instead, reasonable approximations of the expected and expectable differences are automatically provided for in the corrections prescribed in Section X 06.2.3.b, which require superior performance in cases involving "soft" receiving rooms (as are bedrooms, when furnished), and are more lenient in cases involving "hard" receiving rooms (as are most finished bathrooms).*

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*Since all measurements recommended for the determination of EI involve a room's "reverberant field", it must be understood that "near field" situations may offer somewhat less isolation. Some examples are: beds, chairs and other places of rest that are within a foot or two of a party structure; neighbor's sound sources, such as radios and TV sets, that are comparably close (or attached to) a party structure. If possible, such conditions are to be avoided in the design stage.*

X 06.3: Performance of Interior Party Structures with Respect to Impact Sounds Originating in an Adjacent Dwelling

1. Instrumentation

- a) An ISO standard tapping machine, comprising five 500-gram drop hammers, each dropping twice per second from a height of 4 cm, with an overall impact repetition rate of ten blows per second.
- b) A precision sound level meter, operated so as to read A-weighted sound levels with high damping -- results read in dBA on "slow" meter setting.

- c) The tapping machine shall be placed directly on the finished (carpeted, if carpet is an integral part of the dwelling's design) floor of the source room, directly over the receiving room, with respect to which the test is conducted. The upper space shall always be the source room, and the lower space shall be the receiving room.

Horizontally adjacent spaces are subject to the same test procedures at the Inspector's discretion. In such cases, the tapping machine shall be located in the center of the source room, irrespective of its relationship to the room below.

- d) The sound level meter shall be hand-held, away from the observer's body, at approximately the one-third point of one of the receiving room's major diagonals, away from the ceiling (in case of vertical measurements).

*Comment: Despite widespread criticism of the ISO tapping machine in that its signal bears no resemblance to the typical impact sounds that occur in residential buildings*

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*(footsteps, dropping of objects, moving of furniture, children tumbling, etc.), it is the only device of its kind available today. Thus, the recommended test procedure, which shares a measure of questionable human relevance with all similar procedures now in effect or contemplated, is subject to change pending the development of more meaningful procedures.*

## 2. Procedure

- a) Inspect the pair of spaces to be tested. Close all doors, windows and other apertures that may transmit airborne sound (generated by the tapping machine) into the receiving room. Define and record the acoustical status of the receiving room -- hard, medium, or soft.
- b) Measure the level of continuous ambient noise in the receiving room, as described in Section X 06.2.2.b of this Article. Record the result (or, if such measurement already was made in the room in question, transfer Item 8) as Item 19 on the data sheet.

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- c) Proceed to the source room and activate the tapping machine. Observe and record the generic type of floor finish used in the source room (carpet, wood, resilient tile, terrazzo, etc.).
- d) Return to the receiving room, measure the sound level (due to the tapping machine), and record the result as Item 20 on the data sheet.
- e) If the received level (Item 20) lies less than 10 dBA above the ambient level (Item 19), proceed as described in Sections X 06.2.2.f and g of this Article, substituting Item 20 for Item 10, and Item 19 for Item 8. Enter the resultant corrected received levels as Item 21 on the data sheet.

↑?

*Comment: With the exception that no measurements are to be made in the source room, the procedure parallels that prescribed in Section X 06.2.2 for the measurement of airborne sound isolation between adjacent dwellings. It is suggested that the above procedure be applied once only to each generic type of floor finish that may be present in the upper of two vertically adjacent dwellings.*

*70/BA*

3. Evaluation

- a) To determine impact isolation as measured by the A-level technique (IIA), proceed as follows:

If the received level (Item 20 or, if present, Item 21) exceeds 55 dBA, subtract the excess from 55; if it equals 55 dBA, make no correction; if it is less than 55 dBA, add the difference to 55. Enter the resultant "raw" IIA as Item 22 on the data sheet.

- b) Correct the "raw" IIA in accordance with the following table, and enter the final, corrected IIA as Item 23 on the data sheet.

<u>Acoustical Status of Receiving Room</u>	<u>Correction</u>
Hard	+2
Medium	0
Soft	-2

- c) Enter the level of steady ambient noise that can be counted upon for "masking" purposes as

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Item 24 on the data sheet. Do this simply by transferring Item 14, which previously was determined in accordance with Section X 06.2.3.c of this Article.

- d) To determine Effective Isolation (EI) between each pair of adjacent spaces tested, arithmetically add the final IIA (Item 23) and the ambient level determined for "masking" purposes (Item 24). Record the sum as Item 25 on the data sheet.

*Comment: The principle applied in developing the above rating is very much the same as used earlier in establishing EI for comfort and privacy with respect to airborne sounds. Again, the procedure is quick and simple in relation to other procedures now in use. It might be pointed out that, just as NRA yields numerical results which compare well with NNIC, the values of IIA tend to be comparable with the more familiar IIC values, but correlation with IIC is not as good -- discrepancies of as many as 10 dB seem possible. However, we believe that the recommended evaluation technique does not offer any less reliability, with respect to human response, than any other technique that is predicated upon the use of a tapping machine.*

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AN INTERIOR PARTY STRUCTURE SHALL BE DEEMED TO HAVE SATISFIED THE PROVISIONS OF THIS ARTICLE, IF EI (ITEM 25 ON DATA SHEET) EQUALS OR EXCEEDS THE FOLLOWING MINIMUM VALUES:

<u>FUNCTION OF RECEIVING ROOM</u>	<u>MINIMUM EI</u>
BEDROOM	90
LIVING AND/OR DINING ROOM	85
OTHER HABITABLE ROOMS	80

FOR THE PURPOSES OF GRADING PARTY STRUCTURES THAT MEET THE MINIMUM STANDARD, THE FOLLOWING DISTINCTIONS SHALL BE MADE:

GRADE III: EI EXCEEDS THE MINIMUM BY LESS THAN 5  
GRADE II: EI EXCEEDS THE MINIMUM BY 5 TO 9  
GRADE I: EI EXCEEDS THE MINIMUM BY 10 OR MORE

HOWEVER, ANY ONE DWELLING SHALL BE GRADED IN ACCORDANCE WITH THE LOWEST EI VALUE (RELATIVE TO THE APPLICABLE MINIMUM STANDARD) OBTAINED FOR ANY PARTY STRUCTURE THAT SEPARATES IT FROM AN ADJACENT DWELLING.

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*Comment: Since the objectives are similar to those considered in regulating comfort and privacy with respect to airborne sounds, and since the recommended test procedures are largely the same, it seems only reasonable to use similar terms in defining the performance standards applicable to impact sounds. There is no evidence to suggest that the numerical values of the recommended standards are out of line with residents' expectations or with practicability. On the other hand, it is possible that Effective Isolation, determined as recommended above, represents a better measure of subjective impact isolation than the more "sophisticated" procedures now in use elsewhere. Some field experience with this standard is essential before its place in this ordinance can be affirmed.*

*Concerning grading, it is suggested that a single isolation grade, covering both airborne and impact sounds, but limited to isolation from adjacent dwellings, be assigned to each dwelling. Or, at least, both grades should be established and stated. This would avert occupant disillusionment in cases where superior performance is attained with respect to either airborne or impact sounds only.*

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X 06.4: Performance of Heating, Ventilating, Air-  
Conditioning and Other Service Systems or  
Equipment

1. Systems and Equipment Covered

These test procedures shall govern, and shall be limited to, the measurement of noise generated during normal and regular operation of the following systems and equipment, all of which, irrespective of their location in the building, shall be integral parts of the building, shall serve directly or indirectly the dwelling tested, and shall be in constant or frequent (all-year or seasonal) operation:

Heating, ventilating, and air-conditioning systems (excluding room air-conditioning units of the "window" type), and all ductwork, grilles, registers, diffusers, and spaces or shafts associated therewith; humidifiers and dehumidifiers; transformers; cooling towers; and all rotating, reciprocating and vibrating equipment (except emergency equipment *Why?* that normally lies idle) located in the building's mechanical room(s).

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## 2. Instrumentation

- a) A precision sound level meter, operated so as to read A-weighted sound levels with high damping -- results read in dBA on "slow" meter setting.
- b) The sound level meter shall be hand-held, away from the observer's body, at approximately the one-third point of one of the room's major diagonals, away from absorptive surfaces and away from the immediate vicinity of an obvious noise source.

## 3. Procedure

- a) Inspect each habitable room that is part of the dwelling tested. Record the acoustical status of each -- hard, medium, or soft. Make sure that all systems and equipment covered by this test procedure (but no other systems or equipment) are in a normal mode of operation.

( )

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- b) Measure the noise level in each habitable room of the dwelling tested. Record the results as Item 27 on the data sheet.

4. Evaluation

Correct each of the preceding results in accordance with the following table, and enter the final, corrected mechanical ambient noise levels as Item 28 on the data sheet.

<u>Acoustical Status of Habitable Room</u>	<u>Correction</u>
Hard	-4 dBA
Medium	-2 dBA
Soft	0 dBA

THE PROVISIONS OF THIS ARTICLE SHALL BE DEEMED SATISFIED, IF THE NOISE LEVELS DUE TO CONSTANTLY OR FREQUENTLY OPERATING SYSTEMS AND EQUIPMENT (ITEM 28) DO NOT EXCEED THE FOLLOWING CRITERIA:

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<u>FUNCTION OF ROOM OR SPACE</u>	<u>MAXIMUM NOISE LEVEL</u>
BEDROOM (PERMANENT, AS IN AN APARTMENT ETC.)	40 dBA
BEDROOM (TEMPORARY, AS IN A HOTEL ETC.)	45 dBA
LIVING/DINING ROOM OR STUDY	45 dBA
OTHER HABITABLE ROOMS	50 dBA

*Comment: Once again, the test and evaluation procedure is predicated upon speed and convenience in the field, which techniques requiring measurement in octave or other frequency bands cannot offer. The results, including approximate corrections for room absorption, are thoroughly relevant (even if not the most accurate) with respect to human hearing and response. It should be pointed out that no further correction for other ambient sounds, such as site noise, is recommended, even though such sounds may "support" or affect the results.*

*The more detailed procedures required to resolve cases of doubt as to the cause of excessive noise are discussed in Section...*

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X 06.5: Performance of Miscellaneous Systems, Equipment  
and Conveniences

1. Systems and Equipment Covered

These test procedures shall govern, and shall be limited to, the measurement of noise due to the following systems, equipment and conveniences, all of which shall be located in the dwelling tested, shall be integral parts of the building, shall serve the dwelling tested, and shall be ~~manually controlled and subject to intermittent or infrequent use~~

Room air-conditioning units ("window" type); kitchen and toilet exhaust fans, and all associated ductwork, grilles, registers and diffusers; food waste disposers; built-in freezers and refrigerators; and built-in dishwashers and washing machines (if located in the dwelling).

Measurements of noise associated with plumbing, elevators, and trash chutes shall be made at the Inspector's discretion and, if made, shall conform with Section X 07.5.3 of this Article.

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## 2. Instrumentation

- a) A precision sound level meter, operated so as to read A-weighted sound levels with high damping -- results read in dBA on "slow" meter setting.
- b) The sound level meter shall be hand-held, away from the observer's body, at a distance of approximately 3 feet from the equipment tested.

## 3. Procedure and Evaluation

- a) Inspect each system, piece of equipment or built-in convenience that is covered by the provisions of this Subsection. Prepare to subject each to a normal cycle of operation. Operation under no-load conditions is permitted, except that some material equivalent to food waste must be processed during the food waste disposer's test cycle.
- b) While operating one system, piece of equipment or other built-in convenience at a time, measure the highest noise level encountered during its operating cycle. Record the results as Item 30 on the data sheet.

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THE PROVISIONS OF THIS ARTICLE SHALL BE DEEMED SATISFIED, IF THE NOISE LEVELS DUE TO INTERMITTENTLY OR INFREQUENTLY OPERATING, ~~MANUALLY CONTROLLED~~ SYSTEMS, EQUIPMENT AND CONVENIENCES (ITEM 30) DO NOT EXCEED THE FOLLOWING CRITERIA:

<u>SYSTEM, EQUIPMENT OR CONVENIENCE</u>	<u>MAXIMUM NOISE LEVEL</u>
DISHWASHERS	70 dBA
EXHAUST FANS (KITCHEN AND TOILET)	60 dBA
FOOD WASTE DISPOSERS	80 dBA
REFRIGERATORS AND FREEZERS	45 dBA
ROOM AIR-CONDITIONERS	60 dBA
WASHING MACHINES	65 dBA

*Comment: It is the explicit intent of this ordinance to exclude domestic equipment and appliances that are not a permanent and integral part of the building, or the selection and installation of which is made by the tenant after occupying the dwelling. Since noise associated with the equipment covered by this Subsection tends to be local, measurements need be made near the source only, as specified, and not necessarily in all spaces that*

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*The recommended performance standards are based solely upon available acoustical data. The given criteria are intended to exclude uncommonly noisy equipment, and do not necessarily imply that all acoustical situations will be automatically acceptable to the Tenant.*

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SECTION X 07: OPTIONAL TEST PROCEDURES AND PERFORMANCE  
STANDARDS

X 07.1: Performance of Exterior Constructions with  
Respect to Airborne Sounds Originating Outdoors

1. In case of non-compliance, as determined by the mandatory procedures described in Section X 06 of this Article, the Owner may request and may cause the exterior construction to be re-tested in accordance with Appendix 2.2 of ASTM E 336.
2. Upon such test, the provisions of this Article shall be deemed met if the Field Sound Transmission Class (FSTC) of the exterior construction tested exceeds at least by 5 the minimum required attenuation prescribed in Section X 06.1.3.b of this Article. However, in no case shall FSTC be required to exceed 40.

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X 07.2: Performance of Interior Party Structures with  
Respect to Airborne Sounds Originating in an  
Adjacent Dwelling

1. In case of non-compliance, as determined by the mandatory test procedures described in Section X 06 of this Article, or in case a superior grading is <sup>by whom?</sup> sought, the Owner may request and may cause any party structure to be re-tested in accordance with Appendix 1.1 of ASTM E 336, whereupon the results shall be normalized to a 0.5-second reverberation time in the receiving room, and reported as Normalized Noise Isolation Class (NNIC).
2. In addition, he may request and may cause the dwelling's ambient noise level to be monitored during a 4-hour period, starting at 8 p.m. and ending at midnight, whereupon the  $L_{90}$  level in dBA shall be determined.
3. Thereupon, EI shall be calculated ~~as before~~ using NNIC in place of NRA, and using the late-evening  $L_{90}$  <sup>A</sup> ambient level in place of the original ambient level; ~~determined in accordance with Section X~~ <sup>This new value of EI shall be compared with required values of</sup> 06.2.3c of this Article.



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X 07.4: Performance of Heating, Ventilating, Air-  
Conditioning, and Other Service Systems or  
Equipment

1. In case of non-compliance, as determined by the mandatory test procedures described in Section X 06 of this Article, the Owner may request and may cause corresponding octave-band sound level measurements to be made, whereupon the results shall be normalized to a 0.5-second reverberation time in the room tested, and reported in terms of Noise Criterion (NC) ratings, as defined in the ASHRAE Guide and Data Book, 1963 et seq.
2. Upon such test, the provisions of this Article shall be deemed met if the results satisfy the following criteria:

<u>Function of Room or Space</u>	<u>Maximum NC Rating</u>
Bedroom (permanent, as in an apartment etc.)	33
Bedroom (temporary, as in a hotel etc.)	38
Living/Dining Room or study	38
Other habitable rooms	44

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*Comment: The NC-based performance standards, recommended for verification in case of non-compliance with the first set of standards, correlate well with the dBA-based standards, if the spectrum shape of the noise is typical of that measured in many existing dwellings. If the dBA level is dominated by low-frequency rumble, and indicates non-compliance, the situation most likely will not pass the NC test either. The same is probable in cases of extreme high-frequency dominance. In all such cases, it is suggested that possible non-mechanical causes of noise (such as street traffic) be determined and eliminated before a final acceptance test is performed.*

X 07.5: Performance of Miscellaneous Systems, Equipment and Conveniences

1. In case of non-compliance, as determined by the mandatory test procedures described in Section X 06 of this Article, the Owner may request and may cause similar measurements to be repeated. During such repeat test, the Inspector shall monitor one or more full operating cycles of the equipment in question. Thereupon, the provisions of this Article shall be deemed met, if the applicable criterion is exceeded by no more than 5 dBA and this for periods not exceeding 1 minute during any one operating cycle.

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2. The above repeat test provision shall apply only to the following: dishwashers, food waste disposers, and washing machines. Since exhaust fans, refrigerators and freezers, and room air-conditioners are characterized by a relatively constant acoustic output, and not by distinct fluctuations during an operating cycle, any repeat test performed with respect to these shall be identical to the original, mandatory test, and the previous performance criteria shall apply.

3. The following additional measurements and evaluations shall be made, at the Inspector's discretion, either initially or during a subsequent visit to the building.

DIN 52 219 <sup>field?</sup> & 52 218 <sup>lab?</sup>

a) Noise associated with plumbing: -- While operating one fixture at a time, sound levels shall be measured in an adjacent dwelling, in a space nearest to the active fixture, and the results shall be recorded in terms of dBA. Thereupon, these results shall be corrected by -4, -2, or 0 dBA, in case of a hard, medium, or soft receiving room, respectively.

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The provisions of this Article shall be deemed met, if the corrected sound level in an adjacent dwelling, due to operation of any water closet, faucet or shower does not exceed 40 dBA.

? *was factor*

*Comment: While it is clear that intrusive plumbing noise is a frequent source of complaint in multi-family dwellings, strict regulation as well as precise field measurement are difficult to invoke. Unlike in Germany, for example, we have no laboratory test standards which can be referred to in the design stage. Consequently, results in the field are largely unpredictable. However, by choosing "quiet" fixtures and by employing acoustically advantageous installation details (which are not normal practice), a high degree of plumbing noise control can be achieved. The suggested performance standard of 40 dBA is 10 dBA more lenient than the standard prescribed by DIN 4109, which is acknowledged as being a tough standard to achieve.*

- b) Noise associated with elevators and trash chutes. --  
During passages of an elevator cab and counter-weight, and during the passage of a standard paper shopping bag filled with typical domestic

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waste, sound levels shall be measured in the dwelling, 3 feet from the wall beyond which there is an elevator shaft or trash chute, respectively. The results shall be recorded in terms of dBA, without further correction.

The provisions of this Article shall be deemed met, if the maximum sound level encountered during the above tests does not exceed 45 dBA.

*Comment: Again, we are speaking of acoustic situations which are not easily quantified. A more precise way of handling these would include consideration of ambient noise as well as the time history of the acoustic event. Moreover, it is difficult to standardize a trash bag and the manner (and place) in which it is inserted into the chute. We therefore suggest that the recommended standard be viewed as a "good intent", but we hesitate to make it a binding requirement until more reliable procedures are developed.*

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SECTION X 08: ENFORCEMENT

X 08.1: General

~~Insofar as actual~~ Compliance with the provisions of this Article cannot be determined until the building, including all appurtenant fixtures, systems and services, are complete and ready for occupancy; <sup>accordingly</sup> enforcement shall be handled as specified in Section X 08.2 hereunder.

X 08.2: Actions and Procedures

1. Procedures Preceding Construction

- a) Upon completion of the contract drawings and specifications of a new building, addition or alteration, but prior to issuance of a building permit, the Inspector shall review said drawings and specifications, and shall make a preliminary determination of the acoustical qualities such structure is likely to offer.
- b) To facilitate such review, the Inspector may request from the party to whom the permit is

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to be issued any supplementary information, including acoustical test data pertaining to the constructions, systems and equipment used in the proposed structure.

For purposes of estimating Effective Isolation in the completed building, he shall assume a continuous indoor ambient noise level of 30 dBA, unless predictions of higher ambient levels are supported by documentation from a qualified Acoustical Consultant.

Furthermore, he may refer to publications such as the Federal Housing Administration's "Guide to Airborne, Impact, and Structure-Borne Noise Control in Multifamily Dwellings" (FT/TS-24, January 1968).

- c) The Inspector shall issue a building permit only upon first determining that the proposed structure, with or without changes with respect to the original submittal, will reasonably meet the intent of the provisions of this Article.

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- d) The issuance of a building permit shall not constitute, nor shall be construed to constitute, approval with respect to any and all acoustical considerations that may be subject to the provisions of this Article.

*Comment: The recommended pre-construction procedures constitute a vital step in the complicated process of creating acoustically satisfactory dwellings. It is unreasonable to leave Owners and their Architects to their own devices and, upon completion, to reject the structure, or to require extensive changes to be made. But since the very purpose of this ordinance is to secure adequate performance which, in a final analysis, is the only thing that matters, there is no way of determining compliance before the whole structure is completed.*

*Thus, the pre-permit and pre-construction review is essential, but the resultant approval cannot be binding <sup>final</sup> and must be regarded strictly as advisory and provisional.*

*(insert)*

2. Procedures Preceding Occupancy

- a) Upon completion of the building, addition or alteration, but prior to issuance of a certificate of compliance with the provisions of

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this Article, the Inspector shall perform each and every test prescribed in Section X 06 of this Article.

- b) In the event that all test results meet or exceed the performance standards prescribed in Section X 06 of this Article, the Inspector shall issue a certificate of compliance. Upon such certificate, he shall indicate the grade of performance achieved with respect to airborne and impact sound isolation from adjacent dwellings. A separate certificate shall be issued for each and every dwelling tested.
- c) In the event that the dwelling fails to meet all or some of the performance standards prescribed in Section X 06 of this Article, the Inspector may, at his discretion, issue a conditional certificate of compliance, and advise the Owner of any and all deficiencies with respect to the minimum performance standards.
- d) In cases of initial failure, an unconditional certificate of compliance shall be issued only

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upon completion of additional tests, as prescribed either in Section X 06 or X 07 of this Article, and provided such additional tests prove compliance with the provisions of this Article.

- e) The cost of any and all repeat tests performed on a dwelling, previously tested in accordance with Section X 06 of this Article, shall be borne by the Owner.
  
- f) No dwelling that is subject to the provisions of this Article shall be sold, leased, rented, or otherwise disposed of, or declared fit for occupancy, unless and until an unconditional certificate of compliance has been issued. However, the Inspector may, at his discretion, waive this requirement, if and when a conditional certificate has been issued, and if and when failure is limited to items that are covered under the optional procedures and standards of Section X 07 only.

*Comment: These procedures make it abundantly clear that every single dwelling, as defined earlier, should be*

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*subject to the performance standards of this ordinance. By merely keeping such standards "on the books", without regular and uniform enforcement, we would defeat the very purpose of this ordinance. Herein, once more, lies the overwhelming argument for quick test procedures and easy evaluation. Consistent application of these procedures will assure a new standard (even if it is a minimum standard) of acoustical comfort and privacy for all occupants of new dwellings.*

*Insofar as in several respects the provisions and procedures described in this ordinance are new and "experimental", it is strongly recommended that strict enforcement be delayed until the validity and relevance of the procedures and standards is proven in the field. There are two alternatives: either, the enactment date (ref. Section X 03) should be set back by about one year; or, provisional certificates of compliance should be issued for a period of about one year, without requiring that non-complying conditions be corrected. In either case, extensive field testing of newly completed buildings should commence at the earliest possible time.*

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SECTION X 09: RESPONSIBILITIES

X 09.1: Inspector

1. The Inspector shall, prior to the issuance of a building permit, subject all relevant drawings and specifications to a competent acoustical review.
2. The Inspector shall, upon completion of the project, be responsible for the accurate and impartial determination, recording and reporting of acoustical performance, as prescribed by the provisions of this Article.
3. The Inspector shall direct that a certificate of compliance with the provisions of this Article, either conditional or unconditional, be or be not issued, whichever the case may be. *Ref. §*
4. The Inspector shall not, unless hired by the Owner for this purpose and is competent to do so, investigate causes of non-compliance and develop corrective recommendations.

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*Comment: The Inspector, or whoever is delegated to act as Inspector, must determine compliance with the provisions of this ordinance. As pointed out earlier in Section X 08, his pre-construction duties are advisory, but his post-construction duties and determinations are final and binding. He and he alone will issue or recommend the issuance of a ~~mandatory~~ certificate of compliance. He is in no way responsible for compliance with the provisions of this ordinance.*

X 09.2: Owner

1. The Owner shall assume full responsibility for the compliance of his building with the provisions of this Article.
2. He may, if he so wishes, and by mutual consent, <sup>formal contract</sup> delegate this responsibility to his Architect, who then shall act as his agent in all matters pertaining to the provisions of this Article.
3. If he acts in the dual role of Owner-Developer, and does not employ the full services of an Architect, he may not delegate this responsibility.

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4. The Owner may seek and use the advice of an Acoustical Consultant, as and if he so wishes, to assist him in making acoustically satisfactory decisions.
5. The Owner shall not sell, lease or rent his building, unless and until he is granted a certificate of compliance with the provisions of this Article.

*Comment: The Owner is responsible for the funding of a project, which has a direct bearing on its quality (as well as its size). His natural objective is to get "the most for his money". Financially, he stands to gain an advantage if his building barely satisfies the requirements prescribed by this ordinance. If it does not, he would be the first to be blamed -- for imposing a cheap and acoustically inadequate solution. But, as a rule, he is no expert. He must rely on the advice of others. The ultimate responsibility is his, but he must be in a position to delegate the responsibility.*

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X 09.3: Developer

1. The Developer shall assume full responsibility for the compliance of his building with the provisions of this Article.
2. He may not delegate this responsibility, unless he employs the full services of an Architect to design, specify and supervise the construction of his building, and then only by mutual agreement with the Architect.
3. He may seek and use the advice of an Acoustical Consultant, as and if he so wishes, to assist him in making acoustically satisfactory decisions.
4. The Developer shall not sell, lease or rent his building, unless and until he is granted a certificate of compliance with the provisions of this Article.

*Comment: As a speculative Owner or Owner-Contractor, the Developer often contracts an Architect for limited services only. He wields supreme power over the project, which makes him an obvious candidate for assuming full and final responsibility for compliance with the provisions*

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*of this ordinance. He may seek the advice of others, but hardly can delegate his responsibilities, except to his Architect, provided the latter has full control over the project.*

X 09.4: Architect

1. The Architect may, at the discretion and on behalf of the Owner, assume full responsibility for compliance with the provisions of this Article.
2. In his role as coordinator for and on behalf of the Owner, the Architect shall advise the Owner of any provisions necessary for compliance with the performance standards prescribed in this Article. Such advice shall be binding <sup>on whom</sup> only if the Owner delegates full responsibility to the Architect.
3. As part of the assumed responsibility (if delegated by the Owner and accepted by the Architect), he shall, with or without expert assistance, obtain and interpret acoustical data supplied by manufacturers of building components, systems and equipment.

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4. The Architect, in turn, may delegate responsibility to Suppliers only, and then, only insofar<sup>as</sup> the performance of the Supplier's goods are concerned.

*Comment: The Architect, provided his contract with the Owner is for full services, is the mastermind and chief coordinator of a building project. By definition, he must be sensitive to all aspects of the human environment, and he must have a working knowledge of how environment is created and controlled. But he serves the Owner. While ultimate responsibility is not his, he is best equipped to assume the responsibility on the Owner's behalf.*

*Does the architect  
have his  
responsibility*

X 09.5: Mechanical Engineer

1. The Mechanical Engineer may, at the discretion and on behalf of the Owner, and jointly with the Architect, assume responsibility for the mechanical noise control provisions, but no other provisions, of this Article.
2. Given this responsibility, the Mechanical Engineer shall advise the Owner of any provisions necessary for compliance with the performance standards prescribed in this Article.

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3. As a further part of this responsibility, he shall, with or without expert assistance, obtain and interpret all necessary and relevant manufacturer's test data.
4. The Mechanical Engineer, like the Architect, may delegate responsibility to Suppliers only, and then, only insofar the performance of the Supplier's equipment is concerned.

*Comment: The Mechanical Engineer is best qualified and wholly responsible for translating a set of functional requirements into a complete, working design. Mechanical system noise depends largely on the manner in which the design has been executed. But, like the Architect, he serves the Owner and, therefore, can only assume those aspects of the Owner's responsibility which are related to his profession.*

X 09.6: General Contractor

1. The General Contractor shall perform or cause to be performed all work, as directed by the Architect for and on behalf of the Owner.

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2. The Contractor shall assume no direct responsibility for compliance with the provisions of this Article, unless he is the Owner and/or Developer, in which case he shall do so.
3. The Contractor shall advise the Owner or Architect, whoever carries the responsibility for compliance with the provisions of this Article, of any condition which, based on his experience, may cause non-compliance.

*Comment: The Contractor bears the overall responsibility for the erection and completion (on time and within budget) of a building. But he is bound by the Architect's drawings and specifications, which may or may not lead to compliance with this ordinance. His advice (based on experience) can be helpful but, if his duties are merely those of a general contractor, he cannot be held responsible for compliance with this ordinance.*

X.09.7: Subcontractor

1. Each Subcontractor, whether employed by the Contractor or directly by the Owner, shall perform all work as prescribed by his contract documents.

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2. He shall not be responsible for compliance with the provisions of this Article, but he may be called upon to demonstrate the acoustical performance of his installations.
3. Like the General Contractor, he shall advise his employer on the project of any condition which, based on his experience, may cause non-compliance.

*Comment: Though he may have some control over the performance of his specialty, the Subcontractor (drywall, mechanical, etc.) must, above all, perform as directed by the contract documents. At least to some extent, performance is subject to the design and specifications prepared by others. His advice is welcome but, unless his installations are subject to acoustical performance specifications, he cannot be held responsible for compliance with this ordinance.*

X 09.8: Supplier

1. Each Supplier of acoustically relevant building systems or equipment shall, upon request by the Owner or his agent, submit and make available whatever acoustical performance data he may have.

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2. Such data shall describe the guaranteed minimum performance of the product in question, or shall be clearly marked, if no guarantee is made or implied.
3. The Supplier's responsibility is limited to non-compliance which, upon appropriate tests, <sup>E336</sup> can be traced to performance below the guaranteed minimum of his product.

*Comment: The Supplier may be called upon to demonstrate the acoustical performance of his goods, for which he must be prepared. His data can be very useful to the Architect, Engineer, Consultant, etc., but there his responsibility ends, unless failure can be traced directly to a malfunction of his goods.*

X 09.9: Acoustical Consultant

1. The Acoustical Consultant shall, upon engagement by the Owner, Developer, Architect, or Mechanical Engineer, advise his client on all matters within his competence that are related to the provisions of this Article.

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2. The Acoustical Consultant's recommendations are not binding and shall not be construed as a guarantee of compliance with the provisions of this Article.
3. The Acoustical Consultant shall, if called upon by his client, perform any necessary field tests to verify acoustical performance of a building, its components or equipment.
4. In case of non-compliance with the provisions of this Article, the Acoustical Consultant's client may call upon him to determine the cause(s) of non-compliance, and to develop corrective recommendations

*Comment: The Acoustical Consultant is an expert adviser. He is also an expert determinator of results in a finished building. But he has no control over the quality of workmanship and installations, which so often determine performance. His advice to the Owner or his agents may be invaluable, but his recommendations are never mandatory. Besides, his services are used selectively and on some projects only.*

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X 09.10: Realtor

1. The Realtor shall hold and, upon request, produce a certificate of compliance with the provisions of this Article, issued with respect to any dwelling that he may administer or manage for and on behalf of the Owner.
2. The Realtor shall not be responsible for the procurement of such certificates, nor for the building's performance upon which such certificates are issued.

*Comment: The Realtor is an administrative middle-man. On behalf of the Owner, he sells and administers the sale of a product (space in a building) to the consumer (tenant or new owner). He must be in a position to claim compliance with the provisions of this ordinance, but he cannot be held responsible for compliance.*

X 09.11: Tenant

1. Every prospective Tenant or subsequent Owner of a new dwelling shall have the right to see a certificate of compliance with the provisions of this Article, issued by the City with respect to the dwelling in question.

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2. The responsibilities of the original Owner with regard to this Article are transferable to subsequent Owners, but never to Tenants who legally do not own the dwelling.
  
3. Any Tenant or subsequent Owner of a dwelling subject to the provisions of this Article may, at his expense, request a re-determination of the dwelling's acoustical performance.

*Comment: The Tenant, including prospective Owner of an apartment, condominium or townhouse, is the one and only party for whose benefit this ordinance is enacted. He cannot be responsible for compliance, unless he is involved in the initial process of design and construction of the building. It is his prerogative to reap the rewards of compliance -- a place of residence that offers a known and, for all intents and purposes, adequate standard of acoustical privacy and comfort.*