

EVOLUTION OF THE ACOUSTICAL PROVISIONS WITHIN THE MODEL NATIONAL BUILDING CODE OF CANADA

Todd Busch *^{1,2}

¹Soft dB Acoustical Consulting, Etobicoke, Ontario, Canada

²Invited Committee Member, Canadian Commission of Building and Fire Codes, Sound and Vibration Task Force

1 Introduction

This paper explores the evolution of the model National Building Code of Canada (NBCC). Starting in 1941, the NBCC required a sound transmission loss between dwelling units of 45 dB or higher. There were prohibitions on the attachment of fixtures. Refuse chute construction was described. In 1954, references to compromising air leaks were introduced. In 1965, sound transmission class (STC) 45 performance was added including a variety of service rooms. ASTM E90-61T was introduced. In 1970, a table was added showing “sound ratings” of assemblies. Minor changes occurred in the 1975, 1977, and 1985 versions. In 1980, STC 50 was adopted for elevator shafts. In 1990, STC 50 between dwellings was adopted along with an STC 55 provision for elevator shafts and refuse chutes. In 1995, a larger table of expected laboratory STC ratings was included. No significant changes occurred for the 1995 or 2005 versions. The 2010 edition saw language added for secondary suites where an STC 43 rating was stipulated. The 2015 version added in the option of demonstrating either an apparent STC (ASTC) performance of 47 or STC 50. Additional reference was made to ISO standards in regards to flanking paths. Future changes are being considered for impact insulation class (IIC), exterior noise control, and low-frequency sources.

2 NBCC 1941

Starting in 1941, the NBCC required walls and floors between dwellings to be sound transmission loss of 45 dB or higher and transmission loss (TL) was defined. There were prohibitions on the attachment of fixtures to walls separating dwelling units including plumbing, water-supply pipe, drainage pipe or mechanical equipment. Refuse chute construction was described by specifying a minimum 2.156 lb/ft² (No. 18 Gauge) surface weight.

3 NBCC 1954

In 1954 references to compromising air leaks were introduced. Specifically, “The required sound insulation can not be obtained if air leaks exist in any layer of the intervening construction.” The 45 dB rating requirement between dwelling units was retained unchanged.

4 NBCC 1965

In 1965, STC 45 performance was added for a variety of

service rooms to the effect that, “Every service room or space such as storage room, laundry, workshop or building maintenance room and garages ... when not located in a dwelling unit, shall be separated from the dwelling units by a construction providing ... [an STC rating of 45 or greater].” ASTM E90-61T, “Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements,” was introduced as an acceptable methodology for measuring the TL and obtaining STC ratings.

5 NBCC 1970

In 1970, a table was added for the first time showing “sound ratings” of acceptable assemblies, classified as either I or II, and distinct from the stipulated STC 45 rating between dwellings. ASTM E-90-66T was introduced.

6 NBCC 1975

Minor changes occurred in the 1975 version. ASTM E90-70 was introduced.

7 NBCC 1977

Minor changes occurred in the 1977 version. ASTM E90-75 was introduced.

8 NBCC 1980

More change occurred in the 1980 version. Now in addition to STC 45 between dwellings, “Where a dwelling unit is adjacent to an elevator shaft or a refuse chute, the separating construction shall have [an STC] rating of at least 50, or shall have a “sound rating” of I or II as described [in the accompanying table].” ASTM E90-75 was retained and ASTM E336-77, “Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings,” was introduced. The table of acceptable assemblies had no fewer than twenty-eight fire and “sound ratings” indicated for various wall constructions and no fewer than eleven for floors, ceilings, and roofs.

9 NBCC 1985

Minor changes occurred in the 1985 version. Newly introduced language stated that, “Building services located in an assembly required to have [an STC] rating shall be installed in a manner that will not decrease the required rating of the assembly.” ASTM E90 and ASTM E336 were now referenced to their most-recent versions in different sections of the NBCC document.

*t.busch@softdb.com

†toddbusch@hotmail.com

10 NBCC 1990

In 1990, the increased performance of STC 50 between dwellings was introduced for separations between dwelling units along with an STC 55 provision for elevator shafts and refuse chutes. ASTM E413, "Classification for Rating Sound Insulation," was introduced to accompany ASTM E90 and ASTM E336. More performance specificity was added by stipulating compliance with measurements that were conducted in terms of the relevant ASTM standards or as could be found in the table of fire and STC ratings. So-called "sound ratings" were dropped.

11 NBCC 1995

No significant changes occurred for the 1995 version although reference was now clearly made to ASTM E492-90, "Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine," and E1007-97, "Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures," as they pertain to impact insulation class (IIC) testing which was heretofore not included. Despite references to these standards, neither design nor performance testing for IIC was required in this version of the NBCC. The overall number of tabulated assemblies for walls along with floors, ceilings and roofs was greatly increased from prior versions of the NBCC and the associated information modified to include fire-resistance ratings, STC ratings, and IIC performance ratings.

12 NBCC 2005

No significant changes occurred for the 2005 version.

13 NBCC 2010

The 2010 edition saw language added for secondary suites where either an STC 43 rating was stipulated or specific construction utilized, to the effect that "Where a house contains a secondary suite, each dwelling unit shall be separated from every other space in the house in which noise may be transmitted by construction:

- 1) whose joist spaces are filled with sound-absorbing material of not less than 150 mm nominal thickness,
- 2) whose stud spaces are filled with sound-absorbing material,
- 3) having a resilient channel on one side spaced 400 or 600 mm o.c., and
- 4) having 12.7 mm thick gyms having 12.7 mm thick gypsum board on ceilings and on both sides of walls."

14 NBCC 2015

The 2015 version added in the option of demonstrating either an apparent STC (ASTC) performance of 47 or laboratory tested STC 50 for dwellings (or greater when flanking is also

considered). It was noted that, "An ASTC measurement or calculation will always yield a value equal to or lower than the STC for the same configuration, as the ASTC includes flanking transmission." The National Research Council of Canada (NRCC) software soundPATHS® was referenced as an acceptable tool for analyzing future performance when flanking is considered as required. Additional reference was made to ISO standards in regards to flanking paths, including ISO 15712-1, "Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 1: Airborne sound insulation between rooms," and ISO 10848 which is comprised of five separate standards. Supplemental tabulations were incorporated providing, "Options for Design and Construction of Junctions and Flanking Surfaces to Address Horizontal and/or Vertical Sound Transmission Paths." Furthermore, limitations on sound ratings of fans in terms of "sones" was incorporated through reference to CAN/CSA-C260-M, "Rating the Performance of Residential Mechanical Ventilating Equipment," and HVI publication 915, "Loudness Rating and Testing Procedure."

15 Discussion

The Canadian Commission of Building and Fire Codes (CCBFC) is the organization reviewing further changes to the NBCC. At this time, there are a number of topics of interest. Future changes are being considered for impact insulation class (IIC) in terms of making performance testing mandatory, for making controls over the construction of exterior facades a topic area that would allow for greater control of exterior noise intrusion, and other methods of design and construction that would limit problematic experience of dwelling residents due to the low-frequency sources that are typically found within service rooms such as mechanical rooms. An additional possibility involves the extension of the STC provisions to both educational and healthcare facilities nationwide which would greatly expand the scope of application of the acoustical provisions of the NBCC to a wider range of buildings.

16 Conclusion

The progression of the NBCC from 1941 through to the most recently adopted version in 2015 contains a steady progression of the acoustical requirements for residential dwellings. From the earliest point in time, a minimum of sound transmission performance was stipulated as a means to limit intrusive noise between dwellings. Further investigation is underway to determine if and when further additions and refinements of the NBCC are favoured which could occur within the next publication expected in the year 2025.

Acknowledgments

The author would like to thank Morched Zeghal of Codes Canada for sharing the historical information about the past versions of the model NBCC that are the basis for this paper, and for ongoing coordination of CCBFC activity pertaining to the NBCC 2025 code cycle.