

Introducing the Brazilian standard NBR 15575 regarding the acoustical requirements, criteria and assessment methods for residential dwellings

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Introduction

For the first time in the Brazilian civil construction the standard NBR 15575 [1] establishes requirements, criteria and evaluation methods for determining performance of residential buildings in order to provide acoustical and thermal comfort and acoustical privacy to its occupants. This paper, aimed to share with German colleagues the most important information contained in the standard published in Portuguese only, presents a review of the parts of the standard that concern acoustics in terms of the requirements, the criteria and the methods of evaluation by measurements in the laboratory or the field.

The Brazilian standard NBR 15575 [1] should have been applied in May 2010 but its introduction was postponed due to several reasons, including the lack of technical preparation of the civil construction industry, architects, etc. to interpret the recommendations of this standard.

The standard has six parts which deal with the different systems of the residential dwellings up to five floors: structures, internal floors, internal e external walls (comprising also windows, doors, etc), terrace floors and hydrosanitary systems. Part 1, 3, 4, 5 and 6 are dealing with the acoustical performance as shown in Table 1.

Table 1: Acoustical requirements of standard NBR 15575.

Part	Requirement
1. General	1. Sound Insulation of external walls. 2. Sound insulation between adjacent rooms. 3. Impact noise and noise generated by equipment.
2. Structural systems	No acoustical performance adressed.
3. Internal floors	1. Impact noise on floors. 2. Airborne sound insulation of floors between residential units.
4. Internal and external walls	1. Maximum sound pressure level in the residence.
5. Terrace floors	1. Airborne sound insulation of terrace floors. 2. Impact noise sound insulation of terrace floors accessible to the public.
6. Hydrosanitary systems	1. Limitation of hydrosanitary noise.

The performance of a building is defined by requirements, criteria and evaluation methods for a certain aspects, e.g., for the acoustical comfort. Requirements are qualitative ones as showed in Table 1. In accordance with the acoustical

criteria, which are quantitative, are given in terms of the weighted values determined in accordance to ISO 140 [2] and ISO 717 [3].

Finally, for every requirement and criteria methods of assessment are established, being these laboratory or in situ measurements, prototype inspection or inspection at the construction site or even simulation or analysis of the project.

The most important requirements, criteria and methods for assessment will be introduced subsequently, following the division proposed by the NBR 15575 [1].

Part 1 - General Requirements

According to Table 1 three requirements are defined in part 1 of NBR 15575 [1]. Part 1 also states that the standards NBR 10151 [4] and NBR 10152 [5] must be considered, as well as the requirements given in the remaining parts of NBR 15575 [1].

Req. 1 - Sound Insulation of external walls establishes the “tolerable noise level inside the room” as the criteria to assess the sound insulation of external walls. It is considered that the dwelling is exposed to maximum SPLs in accordance with the standard NBR 10151 [4] and must guarantee maximum indoor SPLs in accordance with NBR 10152 [5].

Req. 2 - Sound insulation between adjacent rooms establishes two criteria: (1) Airborne sound insulation of internal floors and walls and (2) Airborne sound insulation of facades and roofs. Both criteria are addressed in deep in parts 3, 4 and 5 together with the methods of assessment.

Req. 3 - Impact noise and noise generated by equipment defines that the criteria to be used is the “impact noise level”, addressed in deep in parts 3, 4 and 5 together with the methods of assessment.

Part 3 - Requirement for internal floors systems

Regarding the requirements for the internal floors systems a large number of additional standards is referenced such as: NBR 10151 [4], NBR 10152 [5], ISO 140-3 [2], ISO 140-4 [2], ISO 140-7 [1], ISO 717-1 [3] and ISO 717-2 [3].

Req. 1 - Impact noise on internal floors defines as criteria the “Impact noise level in the field” $L'_{nT,w}$ in accordance with standards ISO 140-7 [1] or ISO 10052 [6] and ISO 717-2 [3] and with the values described in Table 2.

Assessment is to be done in accordance with ISO 140-7 or ISO 10052 [5], and single number values are to be determined according to ISO 717-2 [3].

Table 2: $L'_{nT,w}$ for field measurements.

Element	$L'_{nT,w}$ [dB]	Performance
Slab floor, or another element, with or without the floor covering, without acoustic insulation	< 80	<i>Minimum</i>
Slab floor, or another element, with or without the floor covering, with acoustic insulation	55 a 65	<i>Intermediate</i>
	< 55	<i>Superior</i>

Req. 2 – Airborne sound insulation of floors between residential units considers two criteria: (1) $D_{nT,w}$ according to ISO 140-4 [2] or ISO 10052 [6] for assessment in the field or (2) R_w according to ISO 140-3 [2], for measurement in the laboratory. The recommended weighted values of both criteria are shown in Table 3. If the floor is composed of different subsystems any subsystem can be assessed separately in laboratory and results can then be combined.

Table 3: $D_{nT,w}$ for field- and R_w for laboratory measurements.

Element	$D_{nT,w}$ [dB]	R_w [dB]	Performance
Floor of residential unit, positioned under common area (corridors)	35	40	<i>Minimum</i>
	40 a 45	45 a 50	<i>Intermediate</i>
	> 45	> 50	<i>Superior</i>
Floor separating independent residential units	40	45	<i>Minimum</i>
	45 a 50	50 a 55	<i>Intermediate</i>
	> 50	> 55	<i>Superior</i>

Parte 4 - Requirements for the vertical internal and external systems

Req. 1 - Maximum sound pressure level in the residence defines four criteria and also requires fulfillment of NBR 10151 [4] and NBR 10152 [5]. Other standards to be observed are: ISO 140-3 [2], ISO 140-4 [2], ISO 140-5 [2], ISO 717-1 [3] and ISO 10052 [6]. The criteria to guarantee the maximum sound pressure level in the residence can be determined as: (1) weighted standardized level difference for the external wall (field measurements), (2) weighted sound reduction index of the facade elements (laboratory measurements), (3) weighted standardized level difference between dwellings of internal walls (field measurements) and (4) weighted sound reduction index between dwellings (laboratory measurements). Table 4 describes the weighted values of the constructive elements between dwellings for field and laboratory measurements.

Part 5 – Requirements for terrace floors

The requirements of the part 5 consider terrace floors at the top of a building that are accessible to all users of the building, comprising a very typical situation in Brazil. Two requirements are recommended in accordance with Table 1:

- (1) $D_{2m,nT,w}$ for external walls and upper floor of the residential unit just below the terrace (field measurement); R_w of the terrace floor (laboratory measurement) and (2) $L'_{nT,w}$ of the terrace floor (field measurement).

Part 6 - Limitation of hydrosanitary noise

Regarding hydrosanitary systems of the building these should be not “provoke unpleasant noise to its users”, but no quantitative criteria are given and no references to any other standards are given.

Table 4: Weighted values of the elements between dwellings, $D_{nT,w}$ for field measurements and R_w for laboratory measurements.

Wall between	$D_{nT,w}$ [dB]	R_w [dB]	Performance
wall separating rooms/ kitchens from areas of common non- continuous use (floors, halls etc)	30 a 34	35 a 39	<i>Minimum</i>
	35 a 39	40 a 44	<i>Intermediate</i>
	≥ 40	≥ 45	<i>Superior</i>
wall separating rooms/ kitchens from areas of common non- continuous use (floors, halls etc)	40 a 44	45 a 49	<i>Minimum</i>
	45 a 49	50 a 54	<i>Intermediate</i>
	≥ 50	≥ 55	<i>Superior</i>
wall separating res. units and areas of common use (gym, pool, ..)	45 a 49	50 a 54	<i>Minimum</i>
	50 a 54	55 a 59	<i>Intermediate</i>
	≥ 55	≥ 60	<i>Superior</i>
wall separating different residential units	40 a 44	45 a 49	<i>Minimum</i>
	45 a 49	50 a 54	<i>Intermediate</i>
	≥ 50	≥ 55	<i>Superior</i>

Conclusions

The introduction of the new standard is certainly a big step for the Brazilian market. In order to be successful the Standard will require that adequately trained professionals are at hand and involved not only for in-situ or laboratory measurements but also in research and in activities that can transmit this knowledge to the Civil Engineering sector.

References

- [1] ABNT NBR 15575: 2008: Residential dwellings up to five floors – Performance. Brazilian Association of Technical Standard. All parts.
- [2] ISO 140: Acoustics - Measurement of sound insulation in buildings and of building elements, International Organization for Standardization. All parts.
- [3] ISO 717: 1996: Acoustics – Rating of sound insulation in buildings and of building elements, International Organization for Standardization. All parts.
- [4] NBR 10151: 2000: Acústica – Avaliação do ruído em áreas habitadas, visando o conforto da comunidade – Procedimento, Associação Brasileira de Normas Técnicas.
- [5] NBR 10152: 1987: Acústica – Níveis de ruído para conforto acústico, Associação Brasileira de Normas Técnicas.
- [6] ISO 10052: 2004: Acoustics – Field measurements of airborne and impact sound insulation and of equipment sound - Survey method, International Organization for Standardization.