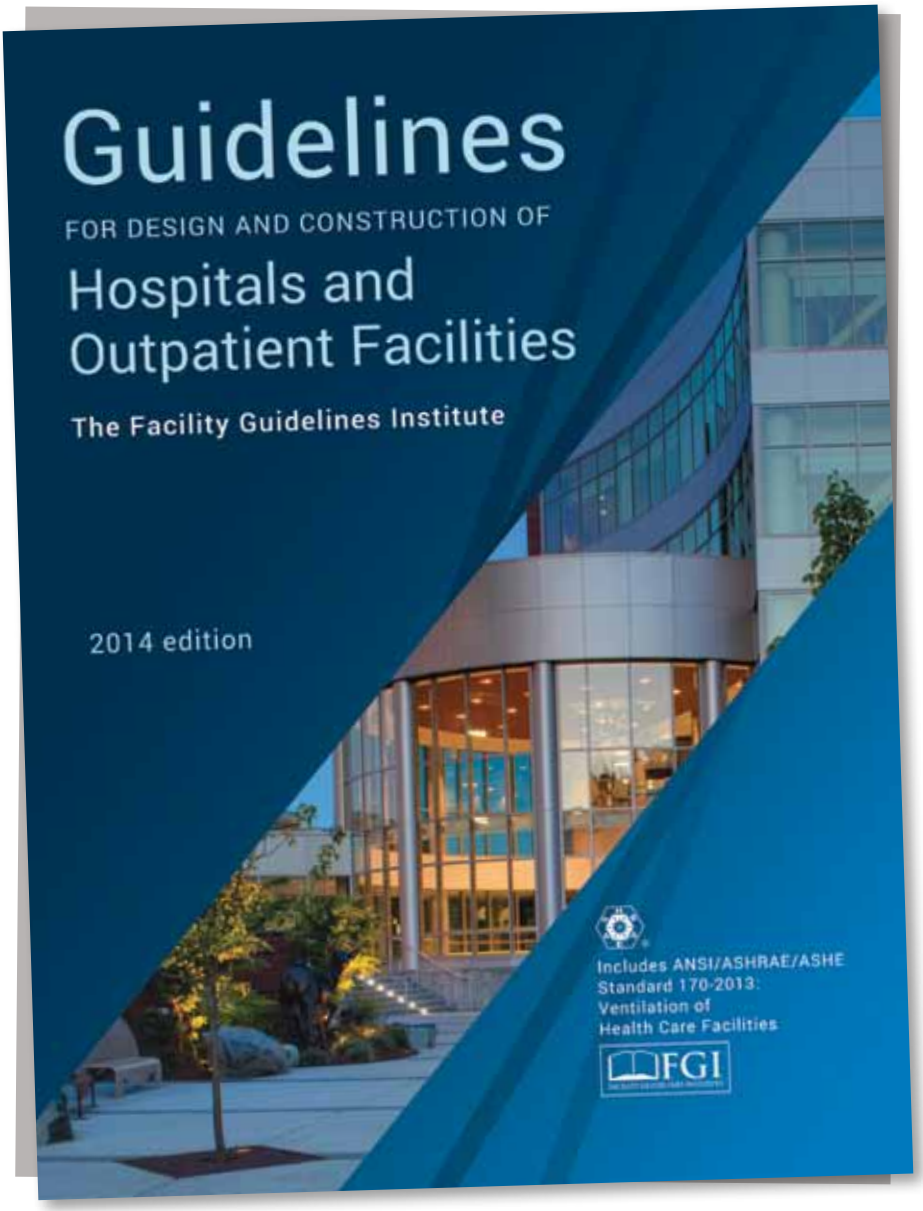
A Guide on the Four Categories for Acoustics Criteria in Building Standards and Guidelines



BY GARY MADARAS

The acoustics section in a building standard or guideline could leave anyone but acousticians confused. Most acoustics criteria fall into one of four categories. Knowing about all of the categories can help CISCA members quickly find the relevant information.

1. PREVENT EXCESSIVE REVERBERATION AND LOUDNESS INSIDE OCCUPIED SPACES.

Provide the appropriate amount of sound-absorbing surface materials inside occupied rooms on the ceilings, walls or floors.

Key sound absorption metrics in the standards and guidelines:

- NRC (Noise Reduction Coefficient) – Percent of the noise absorbed by the material
- T60 (Reverberation Time) – Time required for the sound level to decrease 60 decibels

When NRC values are specified in the standards and guidelines, they generally apply to ceilings in conference rooms and open offices, and are in the mid to high range of 0.80 to 0.90. T60 is the more common criterion and values of 0.60 seconds or shorter are typical.

The main acoustic purpose and strength of suspended ceilings is sound absorption. Additional absorption on the walls and floor may only be required if the ceiling does not provide enough sound absorption; for example, when the NRC is less than 0.70, or when parts of the ceiling are intentionally left sound reflective to project sound.

The equation below can be used to convert T60 into ceiling NRC. This equation may be conservative if other absorption on the floor or walls is present.

$$NRC = \frac{0.05 * \text{Room Volume}}{T60 * \text{Ceiling Area}}$$

2. LIMIT OCCUPANT NOISE TRANSMISSION BETWEEN INTERIOR ROOMS.

Construct rooms, including slabs, walls, windows, doors and penetrations so that they limit the amount of occupant noise that transmits between rooms.

Key interior sound blocking metrics in the standards and guidelines:

- STC (Sound Transmission Class) – The sound blocking capacity of a wall or other assembly.
- NIC (Noise Isolation Class) – The total sound blocking capacity between two rooms as measured in the field after construction is complete.

Most standards and guidelines require sound isolation levels of STC/NIC 40, 45 or 50+.

The use of STC indicates that demising walls extend vertically from slab to slab and all penetrations are sealed airtight. Relying on a modular acoustic ceiling alone – for example, when the wall stops at the ceiling and does not completely block off the plenum – cannot provide the levels of isolation required by the standards and guidelines. A modular, acoustic ceiling does not have enough mass to block sound. The lights, air devices and other elements also result in noise leaks, worsening performance. For these reasons, CAC (Ceiling Attenuation Class) is not a part of most standards and guidelines.

Glass wall systems and windows should be limited in size and insulated and/or laminated to increase their sound blocking capacity. Doors should swing, not slide, and have full perimeter seals.

3. LIMIT EXTERIOR ENVIRONMENTAL NOISE TRANSMISSION INTO THE BUILDING.

Construct the building's envelope, including the roof, façade, windows and doors, so that they limit the amount of exterior environmental noise that transmits into occupied rooms.

Key exterior sound blocking metrics in the standards and guidelines:

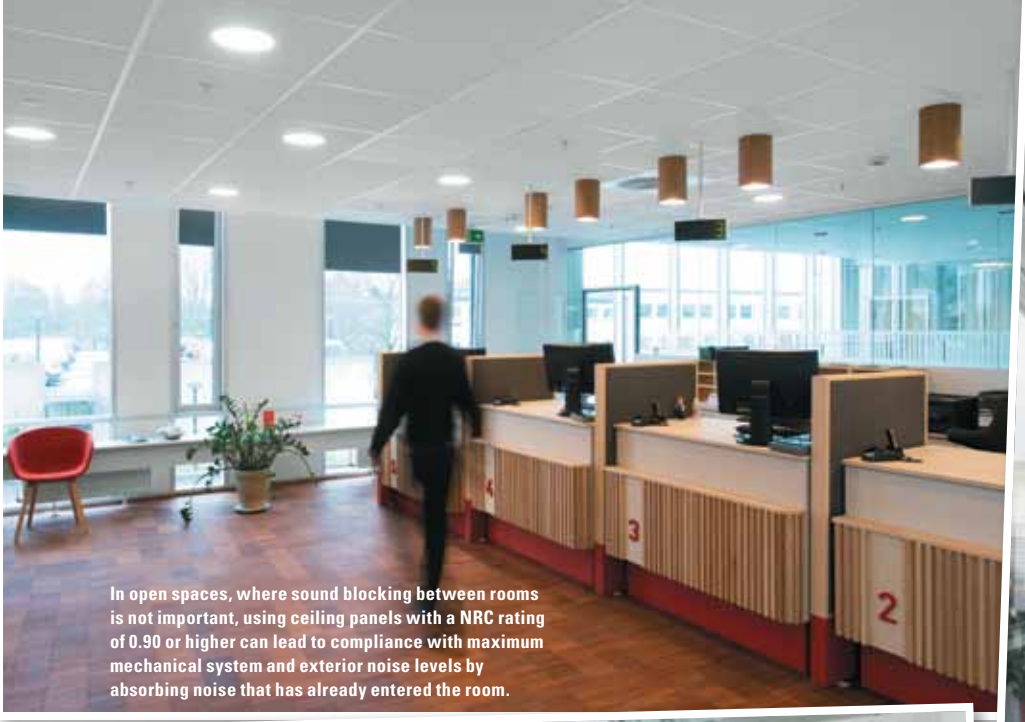
OITC (Outdoor Indoor Transmission Class) – The sound blocking capacity of a roof, window, building façade or façade component.

OITC values required for the building shell vary greatly based on the use of the building and the noise levels on and around the site. OITC values range from 35-40 for a relatively quiet site up to 60 for a very noisy site.

ACOUSTIC PERFORMANCE METRICS IN BUILDING STANDARDS AND GUIDELINES

Standard/Guideline	Room Type	Absorption	Blocking (Interior)[1]	Blocking (Exterior)	Background Noise
WELL Building Standard	Open Office	NRC 0.90[2] T60 0.50	Not Applicable	50 dBA inside	NC 40
	Closed Office	-	NIC 40	50 dBA inside	NC 35
	Conference	NRC 0.80[2] T60 0.60	NIC 53	50 dBA inside	NC 30
LEED (version 4)	Open Office	T60 <0.80	Not Applicable	-	-
	Closed Office	T60 0.60	STC 45-50	-	-
	Conference	T60 0.60	STC 50	-	-
The Facility Guidelines Institute (FGI)[3]	Healthcare - Patient Room	Room Average NRC[4] 0.15	STC 45	OITC 25-40	NC 40 or 45 dBA
ANSI/ASA S12.60	Schools - Classrooms	T60 0.60-0.70	STC 50	OITC 36-56	35 dBA 55 dBC
Collaborative for High Performance Schools (CHPS) (US-CHPS Criteria)[5]	Schools - Classrooms	T60 0.60-0.70	STC 45	40 dBA inside 60 dBC inside	35 dBA 55 dBC
Most Common Metric		**T60 0.60**	**STC 45-50**	**OITC[6] 35-40**	**NC 30-40 35-45 dBA**

1. Having an STC rating for wall construction typically indicates that the wall is full height from slab to slab. Note that CAC (Ceiling Attenuation Class), a measure of a ceiling panel's blocking capacity is not typically in acoustic standards and guidelines. Using a suspended, modular, acoustic ceiling alone to block sound does not meet the expected level of sound privacy performance between rooms.
2. Values are for ceilings and are minimums. Additional absorption on walls also may be required.
3. Guidelines for Design and Construction of Hospitals and Outpatient Facilities, 2014 edition.
4. NRCs of all surfaces are used to calculate a minimum room average absorption coefficient.
5. Core CHPS metrics. Regional versions of the CHPS criteria, e.g. NE-CHPS v3, may be more stringent.
6. Assumes a relatively quiet project site.



In open spaces, where sound blocking between rooms is not important, using ceiling panels with a NRC rating of 0.90 or higher can lead to compliance with maximum mechanical system and exterior noise levels by absorbing noise that has already entered the room.

Using high-performance ceiling panels with NRC ratings of at least 0.90 can lead to compliance with the required maximum reverberation times even when there is no other sound-absorbing surfaces in the room.

Using modular, acoustic ceilings alone to block sound does not comply with isolation requirements. To comply with both sound absorption and sound blocking requirements, use full height walls or plenum barriers in combination with high NRC ceiling panels.

Higher OITC values can result from more massive exterior wall and roof construction and selecting acoustically rated window or curtainwall systems.

4. LIMIT NOISE LEVELS GENERATED BY BUILDING MECHANICAL, ELECTRICAL AND PLUMBING SYSTEMS INSIDE OCCUPIED ROOMS.

Design the building systems appropriately, select quiet equipment and include noise and vibration control measures to limit the background noise levels.

Key system noise control metrics in the standards and guidelines:

- NC (Noise Criterion) – Building system background noise level classification.
- dBA or dBC (weighted decibels) – broadband sound level that is either A-weighted or C-weighted to better represent how people hear sound.

NC values for most rooms vary between NC-25 (quiet) to NC-35 (normal). Some open offices, corridors, waiting rooms and lobbies may have higher values (NC-40).

Complying with the background noise levels in the standards and guidelines relates mostly to the design of the building system themselves. However, having sound absorption inside occupied rooms can help to decrease perceived background noise.

The summary table on the opposite page should assist with understanding these four categories for acoustics criteria in building standards and guidelines. ■

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