



**LEED Rating System  
2<sup>nd</sup> Public Comment Draft  
July 2011**

# **BUILDING DESIGN & CONSTRUCTION**

***Includes:***  
***New Construction***  
***Core & Shell***  
***Schools***  
***Retail***  
***Data Centers***  
***Warehouse & Distribution Centers***  
***Hospitality***  
***Healthcare***

## **EQ PREREQUISITE: MINIMUM ACOUSTIC PERFORMANCE Required**

BD&C

This prerequisite applies to:

- Schools

### **Intent**

To provide classrooms that facilitate teacher-to-student and student-to-student communications through effective acoustic design.

### **Requirements**

#### **SCHOOLS**

Achieve a maximum background noise level<sup>62</sup> of 40dBA from heating, ventilating and air conditioning (HVAC) systems in classrooms and other core learning spaces.

Design classrooms and other core learning spaces to include sufficient sound-absorptive finishes for compliance with reverberation time requirements as specified in ANSI Standard S12.60-2010 part 1, Acoustical Performance Criteria, Design Requirements and Guidelines for Schools.

Implement measures to minimize noise intrusion from exterior sources into and control sound transmission between classrooms and other core learning spaces. For high-noise sites (peak hour Leq above 60 dBA during school hours), include acoustic treatment for exterior noise control. Projects are exempt from the exterior noise control requirement if the project is at least one-half mile from any significant noise source such as (but not limited to) aircraft over-flights, highways, trains, and industry.

Adhere to the following reverberation time requirements.

#### **CASE 1. Classrooms and Core Learning Spaces < 20,000 Cubic Feet**

##### **OPTION 1**

Finish 100% of all ceiling areas (excluding lights, diffusers and grilles) in all classrooms and core learning spaces with a material that has a Noise Reduction Coefficient (NRC) of 0.70 or higher.

OR

##### **OPTION 2**

Confirm that the total area of acoustic wall panels, ceiling finishes, and other sound-absorbent finishes equals or exceeds the total ceiling area of the room (excluding lights, diffusers and grilles) Materials must have an NRC of 0.70 or higher to be included in the calculation.

#### **CASE 2. Classrooms and Core Learning Spaces ≥ 20,000 Cubic Feet**

Meet the recommended reverberation times for classrooms as described in the NRC-CNRC Construction Technology Update No. 51 entitled, "Acoustical Design of Rooms for Speech" (2002).

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<sup>62</sup> Recommended methodologies and best practices for mechanical system noise control are described in Annex B of ANSI Standard S12.60-2010 and the 2011 HVAC Applications ASHRAE Handbook, Chapter 48 on Sound and Vibration Control (with errata but without addenda).

Projects that cannot meet the requirements due to limited scope of work must submit a detailed description justifying their design decisions. Projects required to observe historic preservation requirements may document special circumstances in a report justifying their design decisions.

## EQ CREDIT: ACOUSTIC PERFORMANCE

[This credit is available in the Pilot Credit Library](#)

BD&C

### 1-2 points

This credit applies to:

- New Construction (1 point)
- Schools (1 point)
- Data Centers (1 point)
- Warehouses & Distribution Centers (1 point)
- Hospitality (1 point)
- Healthcare (1-2 points)

### Intent

To provide workspaces and classrooms that promote occupants' well-being, productivity, and communications through effective acoustic design.

### Requirements

#### NC, DATA CENTERS, WAREHOUSE & DISTRIBUTION CENTERS, HOSPITALITY

For all occupied spaces, meet the following requirements for room noise levels, speech privacy and sound isolation performance of constructions, limiting reverberation time and reverberant noise buildup, paging, masking and sound reinforcement systems, as applicable to the space.

Projects that cannot meet the requirements due to limited scope of work must submit a detailed description justifying their design decisions. Projects required to observe historic preservation requirements may document special circumstances in a report justifying their design decisions.

#### Room Noise Levels

Evaluate noise from building mechanical systems. Room noise levels shall fall within the sound level ranges shown in either the 2011 ASHRAE Handbook, HVAC Applications, Chapter 48, Table 1, or the AHRI Standard 885-2008, Table 15. Conformance measurements for room sound levels shall be measured using a sound level meter that conforms to ANSI S1.4 for type 1 (precision) or type 2 (general purpose) sound measurement instrumentation

Comply with design criteria for HVAC noise levels in occupied spaces resulting from the sound transmission paths listed in Table 6 in the ASHRAE 2011 Applications Handbook.

#### Speech Privacy and Sound Isolation

Speech privacy shall be measured in terms of the Articulation Index (AI), Privacy Index (PI), or Speech Transmission Index (STI). Meet the following speech privacy goals for enclosed rooms. Normal speech privacy shall generally be provided between all enclosed, private spaces. Confidential speech privacy shall be achieved between spaces occupied by different tenants, and for all other spaces deemed "confidential" by building occupants.

Speech Privacy Goal	AI	PI	STI
Normal	≤0.15	≥85%	≤0.19

Confidential <sup>88</sup>	<0.05	≥95%	≤0.12
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Where building codes include STC ratings, meet or exceed requirements where they are applicable. In lieu of a building code, meet the following STC<sub>C</sub> ratings:

<b>Adjacency Combinations<sup>89</sup></b>		<b>STC<sub>C</sub></b>
Residence (within a multi-family residence) or Hotel/Motel Room	Residence or Hotel/Motel Room	55
Residence or Hotel/Motel Room	Common Hallway/Stairway	50
Residence or Hotel/Motel Room	Retail	60
Retail	Retail	50
Standard Office	Standard Office	45
Executive Office	Executive Office	50
Conference Room	Conference Room	50
Office/Conference Room	Hallway/Stairway	50
Mechanical Equipment Room	Occupied Area	60

As applicable, use the following table to estimate the composite STC rating (STC<sub>C</sub>) of interior partitions.

Weaker element (% wall area)	STC of door or window	(1) layer 5/8" GWB each side, metal stud (STC 40)	(1) layer 5/8" GWB each side, metal stud with insulation (STC 45)	(2) layers 5/8" GWB each side, metal stud with insulation (STC 50)
Open door (10%)	0	10	10	10
Open door (20%)	0	7	7	7
Un-gasketed door (10%)	20	30	30	30
Un-gasketed door (20%)	20	27	27	27
1/8" glazing (10%)	26	35	36	36
1/8" glazing (20%)	26	33	33	33
Gasketed door or 1/4" glazing (20%)	30	37	39	40
Gasketed door or 1/4" glazing (10%)	30	35	36	37
1/4" laminated glazing (10%)	35	39	42	44
1/4" laminated glazing (20%)	35	39	40	41
Acoustically rated STC-45 door or insulating glazing with 4" airspace (10%)	45	40	45	50
Acoustically rated STC-45 door or insulating glazing with 4" airspace (20%)	45	40	45	49

### Limiting Reverberation Time and Reverberant Noise Buildup

<sup>88</sup> To achieve confidential speech privacy, the sum of the composite STC and the A-weighted background noise level shall be at least 75. This assumes a "conversational" voice level of 60 dBA at three feet. For "raised" and "loud" voice levels, add 5 to 10 dBA to the total, respectively.

<sup>89</sup> The sound isolation ratings are considered the composite sound isolation performance values associated with the demising constructions, whether they are the floor/ceiling or wall partitions. Details such as the ceiling plenum conditions, windows, doors, penetrations through the constructions, etc. shall be addressed to provide this composite sound isolation rating. The values will provide Normal speech privacy (except at corridor walls with doors), assuming a background sound level of at least 30 dBA.

Meet the reverberation time requirements in the following table, adapted from Table 9.1 in the Performance Measurement Protocols for Commercial Buildings<sup>90</sup>:

Room Types	Applications	T60 (sec)
Apartments and condominiums		< 0.6
Hotels/Motels	Individual rooms or suites	< 0.6
	Meeting/banquets rooms	< 0.8
Office Buildings	Executive and private offices	< 0.6
	Conference rooms	< 0.6
	Teleconference rooms ≤ 25	< 0.6
		≤ 40
	Open-plan offices without sound masking	< 0.8
	Open-plan offices with sound masking	0.8
Courtrooms	Unamplified speech	< 0.7
	Amplified speech	< 1.0
Performing Arts Spaces	Drama theaters, concert and recital halls	varies by application
Laboratories	Testing/research with minimal speech communication	< 1.0
	Extensive phone use and speech communication	< 0.6
Churches, Mosque, Synagogue	General assembly with critical music programs	varies by application
Libraries		< 1.0
Indoor Stadiums, Gymnasiums	Gymnasiums and natatoriums	< 2.0
	Large seating-capacity spaces with speech amplification	< 1.5

### Paging, Masking and Sound Reinforcement Systems

#### Sound Reinforcement

1. All large conference rooms and auditoria seating more than 50 persons shall consider sound reinforcement and AV playback capabilities, depending on their use. If it is determined that these systems are not required, the design team must submit a detailed description justifying their design decisions.
2. Sound reinforcement system shall achieve a minimum Speech Transmission Index (STI) of 0.60 or a Common Intelligibility Scale (CIS) rating 0.77 at representative points within the area of coverage to provide acceptable intelligibility from the system.
3. Performance of the system shall achieve:
  - 70 dBA minimum sound level
  - Maintain sound level coverage within +/- 3 dB at the 2000 Hz octave band throughout the space.
4. Upgraded sound isolation shall be considered for acoustically-sensitive spaces that are adjacent to spaces with sound reinforcement systems.

#### Masking Systems

For projects that use masking systems, meet the following:

1. Systems shall be designed for levels that do not exceed 48 dBA.
2. Loudspeaker coverage shall provide uniformity of +/- 2 dBA
3. Suitable spectra shall be designed to effectively mask speech spectra<sup>91</sup>.

<sup>90</sup> Adapted from ASHRAE (2007d), ASA (2008), ANSI (2002), and CEN (2007)

## **SCHOOLS**

Reduce background noise level<sup>92</sup> to 35 dBA or less from heating, ventilating and air conditioning (HVAC) systems in classrooms and other core learning spaces. Recommended methodologies and best practices for mechanical system noise control are described in ANSI Standard S12.60-2010 part 1 Annex B and the 2011 HVAC Applications ASHRAE Handbook, Chapter 48, Sound and Vibration Control (with errata but without addenda).

Design classrooms and other core learning spaces to meet the Sound Transmission Class (STC) requirements of ANSI S12.60-2010 part 1, excepting windows, which must meet an STC rating of at least 35.

## **HEALTHCARE**

Design the facility to meet or exceed the sound and vibration criteria outlined below adapted from the *2010 FGI Guidelines for Design and Construction of Health Care Facilities* (aka *2010 FGI Guidelines*) and the reference document on which it is based, *Sound and Vibration Design Guidelines for Health Care Facilities* (aka *2010 SV Guidelines*).

### **OPTION 1. (1 point)**

#### *Speech Privacy and Sound Isolation*

Design sound isolation to achieve speech privacy, acoustical comfort and minimal annoyance from noise-producing sources. Consider sound levels at both the source and receiver locations, the background sound at the receiver locations, and the occupant's acoustical privacy and acoustical comfort needs. Speech privacy is defined as "Techniques... to render speech unintelligible to casual listeners" by ANSI T1.523-2001, Telecom Glossary 2007.

Design the facility to meet the criteria outlined in the sections of the *2010 FGI Guidelines* Table 1.2-3: Design Criteria for Minimum Sound Isolation Performance between Enclosed Rooms and Table 1.2-4 Speech Privacy for Enclosed Room and Open-Plan Spaces (*2010 FGI Guidelines* and *2010 SV Guidelines*).

Calculate or measure sound isolation and speech privacy descriptors achieved for representative adjacencies as necessary to confirm compliance with criteria as identified in Sections 1.2-6.1.5 and 1.2-6.1.6 (including associated sections of the Appendix) of the *2010 FGI Guidelines* and the reference standard on which it is based: the *SV Guidelines*.

#### *Room Noise Levels*

Consider background sound levels generated by all building mechanical-electrical-plumbing systems, air distribution systems and other facility noise sources under the purview of the project building design-construction team.

Design the facility to meet the *2010 FGI Guidelines* Table 1.2-2 Minimum-Maximum Design Criteria for Noise in representative interior rooms and spaces.

Calculate or measure sound levels in representative rooms and spaces of each type as necessary to confirm compliance with criteria in the above referenced table using a sound level meter that conforms to ANSI S1.4 for type 1 (precision) or type 2 (general purpose) sound measurement instrumentation. For

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<sup>91</sup> "Masking speech in open-plan offices with simulated ventilation Noise: Noise level and spectral composition Effects on Acoustical Satisfaction", Veitch, J.A. Bradley, J.S.; Legault, L.M. Norcross, S., and Svec, J.M. IRC – IR – 846, National Resource Council Canada, April 2002.

<sup>92</sup> Recommended methodologies and best practices for mechanical system noise control are described in Annex B of ANSI Standard S12.60-2002, and the 2011 HVAC Applications ASHRAE Handbook, Chapter 48 on Sound and Vibration Control (with errata but without addenda).

spaces not listed in Table 1.2-2, refer to the *ASHRAE 2011 Handbook*, Chapter 48, Sound and Vibration Control, Table 1.

## **OPTION 2. (2 points)**

Achieve Option 1

AND

### *Acoustical Finishes*

Specify materials, products systems installation details, and other design features to meet the *2010 FGI Guidelines* Table 1.2-1 Design Room Sound Absorption Coefficients.(including associated sections of the Appendix) and its reference the 2010 SV Guidelines.

Calculate or measure the room average sound absorption coefficients for representative unoccupied rooms of each type in the building, as necessary, to confirm conformance with requirements for this credit.

### *Site Exterior Noise*

Minimize the impact of site exterior noise on building facility occupants produced by all exterior noise sources—road traffic, aircraft flyovers, railroads, on-site heliports, emergency power generators during maintenance testing, outdoor facility MEP and building services equipment. Also minimize impacts on the surrounding community produced by all facility MEP equipment and activities as required to meet the lower of the local applicable codes or Table 1.2-1 of the *2010 FGI Guidelines* and the supporting Table 1.3-1 of the *2010 SV Guidelines*.

Comply with the appropriate sections of the 2010 FGI Guidelines for each category:

- Heliports – A1.3-3.6.2.2
- Generators – 2.1-8.3.3.1
- Mechanical Equipment – 2.1-8.2.1.1
- Building Services – A2.2-5.3

Measure and analyze data to determine the Exterior Noise Classification (A, B, C, or D) of the facility site. See Table A1.2a: Categorization of Health Care Facility Sites by Exterior Ambient Sound in the *2010 FGI Guidelines* and Table 1.3-1 in its reference standard, the *2010 SV Guidelines*.

Design the building envelope composite STC rating based on the *2010 FGI Guidelines* for the Categorization of Health Care Facility Sites by Exterior Ambient Sound and analyze contract documents to show conformance with requirements for this credit.

For Exterior Site Exposure Categories B, C or D calculate or measure the sound isolation performance of representative elements of the exterior building envelope to determine the composite sound transmission class (STCc) rating for representative façade sections as necessary. Measurements shall generally conform to the current edition of ASTM E966 Standard Guide for Field Measurements of Airborne Sound Insulation of Building Façades and Façade Elements.