CON SPEC TUS

CREATING VALUE. REDUCING RISK.
WHERE DESIGN AND CONSTRUCTION MEET.

TECH TIPS

www.conspectusinc.com
Vol12.10.01 ©2012 Conspectus Inc.

Providing compete construction specifications documentation, systems and performance descriptions, and risk and quality advisory services.

CSI Award Winning Publication
Conspectus's Tech Tips received the national Communications Award from CSI.

ABSTRACT:
Improving acoustic ratings for partitions and floors depends on increasing sound transmission losses to minimize unwanted air-borne and structure-borne sounds between adjacent spaces. Effective noise control improves functionality of building spaces.

FILING:
UniFormat™
B1010 Floor Construction
C1010 Interior Partitions
MasterFormat™
09 21 00 Plaster and Gypsum Board Assemblies
09 50 00 Ceilings
09 60 00 Flooring

KEYWORDS:
Sound transmission class, noise isolation class, noise reduction class, impact isolation class, acoustics, absorption, sound control, noise control

REFERENCES:

ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E413 - Classification for Rating Sound Insulation
ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
ASTM E989 - Standard Classification for Determination of Impact Insulation Class (IIC)

Acoustic Ratings For Partitions and Floors

By Jay Bethel CSI and David Stutzman, AIA, CSI, CCS, SCIP, LEED AP

Acoustic Control

There are two basic approaches to acoustic design: Sound Control and Noise Control. Sound control, provides favorable conditions for the perception of desirable sounds within a space. Noise control, excludes or reduces unwanted sounds and vibrations, especially sounds transmitted between adjacent spaces.

Sound control is accomplished by the finishes and furnishings installed in each space. A combination of sound control devices are used to reflect, absorb, diffuse, or diffract sound to improve the sound perception within the space.

Noise control is accomplished, principally, by the partition, floor, and ceiling construction separating adjacent spaces. Noise control assemblies increase the transmission loss of air-borne and structure-borne sound between spaces attempting to make unwanted sound imperceptible in the receiving room.

This article will concentrate on noise control measures for acoustic privacy between spaces.

Sound Ratings

Humans hear sound at frequencies ranging from 20 to 20,000 Hz. The acoustic ratings for selecting materials and assemblies are normally evaluated at 6 octaves (125, 250, 500, 1,000, 2,000, and 4,000 Hz) associated with speech. The common laboratory tested ratings include the following.

For all these ratings, a greater number indicates superior acoustic performance.

Sound Transmission Class (STC) is a reliable single-number rating for partitions' air-borne sound transmission loss without regard for the acoustic properties of the rooms separated by the partition. STC is derived by comparing the ASTM E90 tested transmission loss over 16 frequencies to a standard reference contour according to ASTM E413. STC ratings are used to compare acoustic performance of partitions.

Noise Isolation Class (NIC) is a single-number rating that measures air-borne noise reduction between two rooms taking into account the partition, transmission paths, and the acoustic properties of the source and receiving rooms. NIC is usually a field test to assess actual installed conditions. Noise reduction is measured according to ASTM E336 and compared to the standard contour according to ASTM E413 to derive the NIC rating.

Noise Reduction Coefficient (NRC) is a single number rating for a building material to absorb air-borne vocal range sound (250- 2,000 Hz). The rating is determined by lab testing according to ASTM C423. Because NRC ratings are an average for vocal frequencies, a material may have very poor sound absorption at low or high frequencies, and at certain vocal range frequencies.

Impact Insulation Class (IIC) is a single number rating for structure-borne impact sound transmission loss. Impact sound pressure is measured according to ASTM E492 using a standard tapping machine and compared to a standard contour according to ASTM E989. The IIC ratings are roughly equivalent to STC ratings.

Required Ratings

The International Building Code (IBC) regulates noise control for residential occupancies, only Section 1207 requires dwelling unit separation assemblies to have air-borne (STC) and structure-borne (IIC) ratings of not less than 50 if lab tested, and not less that 45 if field tested. Other building and use types require noise control designs to make the spaces useable. The Gypsum Association GA-600 Fire Resistance Design Manual, available as a free download, includes fire resistance, STC, and IIC ratings for more than 230 wall and floor assemblies. Multiple IIC ratings are reported for various finishes applied to each floor assembly.

Acoustical Design

Every building and interior space has different acoustic requirements. The requirements for a Medical Intensive Care Unit would be quite different from those of a kindergarten or a concert venue. Because the various sound ratings generally address only speech frequencies, the ratings may be ineffective in evaluating materials and assemblies used to isolate sounds outside the speech frequency range such as music and low frequency mechanical equipment.
The sound transmission between spaces is dependent on the acoustical properties of source and receiving space including each material within the spaces, the size of the spaces, and construction of the enclosing assemblies. A comprehensive design that addresses particular sound transmission requirements is a complicated affair, most effectively completed by an acoustical consultant.

Common Approach

Minimize flanking paths. Any penetration, air gap, or other way for sound to travel over, under, or around a wall is called a "flanking path." Flanking paths can include ductworkpiping, other partitions, doors, windows, receptacles, fixtures, other penetrations and connecting construction. The initial effort to achieve greater acoustic performance is to control these weak points in the assembly.
Here are strategies that may be useful for improving STC and IIC performance.
Improving Wall STC Ratings:

- Extend walls to structural decks.
- Seal penetrations, openings, and perimeter to eliminate air paths using acoustical sealants.
- Increase wall mass.
- Use unbalanced faces (e.g. 2 layers of gypsum board on one side and 1 layer on the other).
- Increase wall insulation for exterior walls, and include insulation for interior walls.
- Use resilient furring channels.
- Use dual, staggered stud layouts.
- Select doors, windows, and other opening with an STC rating matching the wall assembly.
- Increase air space within the wall.
- Use metal instead of wood studs.
- Improving Floor IIC Ratings:
- Install a soft, resilient surface.
- Use a floating floor system with a resilient cushion.
- Install a solid suspended ceiling below the floor.
- Include insulation within the ceiling cavity.

Conclusion

Achieving improved STC and IIC ratings, while challenging, is not impossible. Careful design will ensure the best possible performance in rated assemblies.
An acoustical design consultant may be the best investment to ensure code compliance and satisfactory building performance after occupancy.

Additional Resources

www.stcratings.com - Offers descriptions of rating systems, links to other rating systems, and suggestions on enhancing performance of wall systems.
www.nrcratings.com - similar website for NRC ratings.

Add Your Comments

We invite your comments. Visit our blog and add your comments.

Like it? Share it!

Tweet or Email your friends

The information contained in this document is offered for educational purposes, only, and not as technical advice suitable for any particular project or specific condition. Technical consulting is unique to the facts of a particular condition, and Conspectus recommends that a specialist be consulted to determine solutions for each specific condition.