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

Conspectus's Tech Tips received the national Communications Award from the Construction Specifications Institute.

ABSTRACT:
You are designing a residential facility near an airport or a busy highway with large expanses of glass. How do you prevent the noise from nearby sources adversely impacting its tenants? How is sound measured? Which glazing configurations best reduce sound transmission?

FILING:
UniFormat™
B2010 - Exterior Walls
B2020 - Exterior Windows

MasterFormat®
08 44 00 - Curtain Wall and Glazed Assemblies
08 50 00 - Windows
08 80 00 - Glazing

KEYWORDS:
STC, OITC, sound transmission, glazing, noise, decibel

REFERENCES:
ASTM International
ASTM E1332 - Standard Classification for Rating Outdoor-Indoor Sound Attenuation
DDC High Performance Building Guidelines, 1999 edition.
International Building Code, 2009 edition.
International Residential Code, 2009 edition.

Sound Transmission through Glass

By Clifford Marvin, AIA, CSI, CCS, SCIP, LEED AP

Background

According to City of New York's DDC High Performance Building Guidelines, the transmission of noise from the outside of a facility to its interior should be prevented "…by ensuring appropriate fabrication and assembly of walls, floors and ceilings." Where there is no fenestration, this task is relatively easy to accomplish, but how is this accomplished when the bulk of the facility is glass curtain wall?

Codes and Standards

The International Building Code (IBC) Section 1207 "Sound Transmission" addresses sound transmission in terms of Sound Transmission Class, or STC, and Impact Isolation Class, or IIC; OITC is not addressed. In 2008, at the height of the housing boom, I began to hear more and more about OITC, especially for low-income housing projects in the public sector. While the code only addresses STC, measuring OITC makes more sense, particularly for hospitals, hotels and residential construction where outside noise interrupting sleep can be a greater concern. NCMA TEK 13-4 addresses OITC of concrete masonry walls, but does not address windows.
Sound Transmission Class (STC): Measurement of a partition's ability to limit airborne sound through the partition.
Impact Isolation Class (IIC): Measurement of a floor assembly's ability to limit structure borne impact sound through the floor.
Outdoor Indoor Transmission Class (OITC): Measurement of an exterior wall and glazed opening's ability to limit airborne sound from the exterior to the interior.
These ratings are all single numbers used for comparison of various assemblies. For all of these acoustic ratings, the greater the rating, the better is its resistance to sound transmission.
Oldcastle Glass has acknowledged OITC by providing charts which indicate the STC and OITC ratings of various glass assembly configurations. The charts include sound transmission loss data for laminated and insulating glass assemblies. The ratings would be similar for the given configurations regardless of the glass source.
The current standard by which OITC is measured is ASTM E1332-10a. The test is intended to measure the effectiveness of test specimens to reduce the penetration of outdoor ground and air transportation noise. Presumably, as OITC gains acceptance, guidelines for specifying it will eventually appear in the IBC.
We'll look at the various ways in which sound transmission through glass can be mitigated, but first, some background information on sound.

How Is Sound Measured?

Sound pressure is measured in decibels (dB); a difference of 10dB indicates a difference of 10 times the sound pressure level. Since the scale is logarithmic, a difference of 20dB indicates a 100 times difference in

sound pressure level. The rule of thumb is that the sound pressure level drops by about 6dB every time the distance is doubled. When measuring sound transmission through a given material, the greater the rating, STC, IIC, or OITC, the more able the material is to resist the transmission of sound. The problem is that “noise” exists in both low and high frequency ranges, and sometimes in both for a given location, for example, at airports. Examples of low frequency noise are road noise, rail and air traffic, pumps and boilers. High frequency noise sources include fluorescent lights, alternators and radio transmitters; high frequency noise is typically conducted through power lines. It can cause the "snow" that you see on a television when someone nearby operates an electric hair dryer or vacuum cleaner.
An acoustics engineer should be consulted to analyze noise at different wavelengths from varying sources.

Lamination

The interlayer of a laminated glass makeup by itself dampens sound transmission considerably. Sound transmittance occurs at different wavelengths for each different thickness of glass, because each has a different mass. Combining different thicknesses of glass can greatly reduce the perceived noise level, by nearly 50% at certain frequencies. If faced with existing framing that cannot be removed and replaced, choosing laminated glass for a renovation project might be a viable alternative to insulating glass.

Multiple and Unbalanced Lights

The air space in an insulating glass unit contributes to reducing sound transmission through the opening, but using different thicknesses for each light will significantly reduce transmission. Again, it is the different masses of each light that will reduce sound transmission at different frequencies; even a slight difference is effective.

Increased Air Space

Increasing the air space in an insulating glass unit will reduce sound transmission, but obviously this is undesirable given the premium cost of floor area, especially in a dense metropolis like New York City. Also, most curtain wall and window framing manufacturers fabricate their assemblies to receive 1 inch thick glazing assemblies. Increasing the air space could result in additional costs to frame the glass.

Suspended Film and Triple Glazing

A suspended film in the air space of an insulating glass unit can work to reduce sound transmission. Adding lights, as in a triple-glazed insulating glass unit, will block a wider range of noise at different frequencies. Unfortunately, owners seldom agree to the additional costs associated with them. The additional lights in a triple glazed unit add mass that could result in increased structural costs, and the performance of operable units could be adversely affected by the increased weight.

OITC is Airborne Sound

Direct paths through open exterior wall joints, joints around the perimeter of the glazed opening, joints in the framing surrounding glazing, and joints at operable sashes will allow unwanted sound to pass through the exterior wall, unimpeded.

The OITC rating of the glazed opening will not matter if the details do not address the potential of flanking sound paths through the assembly.

Conclusion

In curtain wall construction, providing unbalanced insulating glass units goes a long way towards reducing sound through the envelope. In buildings with punched openings, sound transmission must be measured through the complete assembly including the solid infill. Window or curtain wall frames should be well made and have a mass capable of dampening sound transmission. Seal all perimeter joints and the space between the opening and the window.

Add Your Comments

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

Like it? Share it!

Tweet or Email your friends