CavityComplete®
Steel Stud Wall System

Technical Bulletin SS-10

Acoustical Performance
STC and OITC Classification

CavityComplete® Wall Systems Acoustical Performance
The CavityComplete® Wall System for Steel Stud with Masonry Veneer, with its mass, insulation components and continuous air space, is well suited to reduce sound transmission. Three mechanisms reduce sound energy transmitted through the CavityComplete® wall. The hard surface of the masonry veneer reflects a large portion of incident sound waves. The mass of the masonry absorbs another portion of sound energy. The limited sound energy that does transfer through the masonry wythe is dampened as it passes through the air space and impacts the FOAMULAR® and gypsum sheathed steel studs. The only solid connection from the masonry to the steel stud framing is the Pos-I-Tie® masonry veneer anchor. But, with the ThermalClip® head separating the barrel screw from the pintle wire tie, even the minimal amount of sound energy transferring though that connection is further dampened. With the CavityComplete® Wall Systems structural/thermal layering, the amount of sound energy transferred through to the interior gypsum board to the inside of the building is minimized.

These characteristics make the CavityComplete® Wall System effective at resisting the passage of noise commonly in the range of speech, typically measured by the Sound Transmission Class (STC), and lower frequency outdoor noise sources typically measured by the Outdoor-Indoor Transmission Class (OITC). The CavityComplete® Wall System for Steel Stud with Masonry Veneer is estimated to achieve STC and OITC ratings in the range of >45 to >60 depending on wall system details.

Environmental Noise Control
A common acoustic concern for virtually any building use is controlling sound transmission. Airborne sound can transmit through an exterior wall assembly. It can also pass under doorways, and through penetrations such as windows or mechanical ductwork. Unwanted sound reaching the building interior becomes noise. Exterior noise such as, automobiles, trains, airplanes and playgrounds can transmit through the exterior wall of a building and diminish the effectiveness of the activities taking place inside classrooms or offices for example. The International Building Code (IBC) and LEED v4 contain requirements regarding environmental noise control making the acoustic advantages of the CavityComplete® Wall System for Steel Stud with Masonry Veneer an important design consideration.

Sound Transmission Loss Tests
ASTM E 90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, is the procedure for measuring sound transmission loss (STL) in a laboratory. STL is the difference between the sound energy (sound pressure level) in a source room and a receiving room when the two rooms are separated by the wall system being tested. STL values are plotted on a sound pressure level graph and the resulting curve is compared to a standard reference contour. Acoustical engineers fit these values to the appropriate transmission loss curve to determine an STC rating. The sound transmission loss values from the ASTM E90 test are used to calculate the STC and OITC ratings in accordance with ASTM E413 and ASTM E1332 respectively.

Sound Transmission Class (STC)
Transmission Loss is a measurement of the wall systems ability to block sound at a given frequency. It is determined by test measuring the number of decibels that sound is reduced in passing through the wall system over a range of 16 different frequencies between 125-4000 Hz. 125-4000 Hz is consistent with the frequency range of speech. The Sound Transmission Class (STC, calculated in accordance with ASTM E413) is a single composite rating derived from the results of testing over those 16 frequency ranges. A higher STC rating blocks more noise from transmitting through a wall. The STC rating does not assess sound transfer at low frequencies. Special consideration must be given to exterior walls where the noise transfer concern is other than speech, such as outdoor environmental noise.

Outdoor–Indoor Transmission Class (OITC)
While STC is based on a noise spectrum targeting speech sounds, Outdoor-Indoor Transmission Class (OITC, calculated in accordance with ASTM E1332) utilizes a source noise spectrum that evaluates effectiveness against frequencies down to 80 Hz (aircraft/rail/traffic) and is weighted more toward lower frequencies better indicating the rate of transmission of sound between outdoor and indoor spaces. The OITC is calculated over the frequency range of 80 to 4000 hertz.

Effective Levels of STC and OITC
In general, loud speech can be understood fairly well through an STC 30 wall but should not be audible through an STC 60 wall. An STC of 50 is a common standard and blocks approximately 50 dB from transmitting through the wall

system. However, occupants could still be aware of, if not able to understand, loud speech. Wall assemblies, such as CavityComplete®, with a higher STC (as much as 10dB better, estimated STC >60) should be specified in sensitive areas where sound transmission is a concern.

Changes in Wall system STC or OITC Rating	Changes in Apparent Loudness
+/- 1 (change from 50 to 51)	Almost imperceptible
+/- 3 (change from 50 to 53)	Just perceptible
+/- 5 (change from 50 to 55)	Clearly noticeable
+/- 10 (change from 50 to >60)	Half as loud

Wall System STC or OITC	What is Heard
25	Normal speech can be understood easily and distinctly through wall
30	Loud speech can be understood, normal speech heard but not understood
35	Loud speech audible but not understood
40	Threshold of "Privacy"
42	Loud speech audible as a murmur
45	Loud speech not audible; 90% of statistical population not disturbed
50	Very loud sounds (musical instrument, stereo) faintly heard; 99% of population not disturbed
>60	Superior sound resistance; most sounds inaudible

Noise Control in Codes and Standards

LEED v4 has acoustic requirements for all New Construction including credits for room acoustics, background noise, acoustical finishes, speech privacy, sound isolation, and reverberation time. Schools are particularly targeted in LEED with the goal to provide classrooms that facilitate teacher-to-student and student-to-student communication through effective acoustic design. For high-noise school sites, meaning projects within one-half mile of any significant noise source (aircraft over flights, highways, trains, industry), and that exhibit peak-hour Equivalent Continuous Noise Levels (Leq) above 60 dBA during school hours, LEED has the goal to implement acoustic treatment and other measures to minimize noise intrusion from such exterior sources. The CavityComplete® Wall System for Steel Stud with Masonry Veneer depending on design details is estimated to contribute a superior OITC ratings in the range of >40 >50 making its acoustic advantages an important design consideration.

International Building Code (IBC)

The 2012 IBC does not contain requirements for exterior wall STC or OITC. Section 1207 requires that partitions and floor/ceiling assemblies separating dwelling units from each other or from public or service areas have an STC of not less than 50 for air-borne noise.

STC and OITC Ratings for CavityComplete® Wall System for Steel Stud with Masonry Veneer

The CavityComplete® wall system for steel stud/masonry veneer has estimated STC and OITC classifications in the sound resistance ranges shown in the table. STC and OITC system ratings vary depending on steel stud gauge and other construction variables as shown in the table.

CavityComplete® Wall System Acoustical Performance*

Steel Studs, 18 ga.						
Depth	**3-5/8"**				**6"**	
Spacing, o.c.	16"	24"	16"	24"	16"	24"
Cavity Fill	No Insulation		EcoTouch® FIBERGLAS™ or FireSpan® Mineral Wool		EcoTouch® FIBERGLAS™ or FireSpan® Mineral Wool	
STC Range	**>45**	**>50**	**>55**	**>60**	**>55**	**>60**
Add Interior Resilient Channel	>50	>55	>60	>60	>60	>60
OITC Range	**>35**	**>40**	**>40**	**>45**	**>40**	**>45**
Add Interior Resilient Channel	>40	>45	>45	>50	>45	>45

STC, Sound Tranmission Class
OITC, Outdoor-Indoor Transmission Class

*STC and OITC performance levels are estimated through an engineering analysis of similar tested assemblies that included steel studs of various depth and spacing, interior and exterior gypsum sheathing, various insulation configurations, resilient channels and brick veener.

Design Notes

- Designs with stud cavity insulation have a better STC/OITC than without. (Without considering the influence of brick veneer, 3-5/8" steel studs 16" o.c., with 5/8" gyp both sides, STC 38-40 uninsulated, STC 43-44 insulated).
- Metal studs achieve higher STC/OITC classification than wood studs. (16" o.c. Insulated with 5/8" gyp both sides, STC 34-39 2x4 wood; STC 43-44 3-5/8" steel)
- According to Brick Industry Association (BIA) Tech Note 28, testing has established that a nominal 4" wythe of brick alone can achieve an STC rating of 40 or higher.
- STC/OITC ratings and the overall sound isolation quality of the wall system will be greatly diminished by any penetrations, air-gaps, or other "flanking" paths over, under, or around a wall system including through ductwork and plumbing runs.

The CavityComplete® Wall System excludes the masonry veneer, steel studs and interior and exterior gypsum board. A detailed list of the components is available at www.CavityComplete.com.