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TECH TALK *from* Georgia-Pacific Gypsum

Technical Insight from the Roof Board Experts

Let's Have a Little Quiet in Here

Modern light-weight roof assemblies have one drawback: they don't keep noise out. DensDeck® Roof Boards can help.

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If you're running a factory, you probably don't worry about noise coming in through the roof. But in general, people like it quiet inside occupied buildings. Schools, hospitals, nursing homes, apartments: we look at these buildings as sanctuaries, and we try to keep out the obtrusive noise of the outside world. In these and other places where we need quiet, noise is disruptive to life.

Unfortunately, current trends in roof designs make it more difficult to ensure that needed quiet. Modern construction practices can make the roofs of buildings an entrance for noise from freeway traffic and airplanes, construction equipment and leaf blowers. Georgia-Pacific Gypsum's DensDeck® Roof Boards can help with that challenge.

Why has noise become a problem?

What has happened in roofing is that we are building lighter. A lightweight roofing assembly could consist of only a steel deck, a foam insulation layer and a membrane that keeps out water, ice and snow. These assemblies are efficient and cost-effective; they meet code standards and safety requirements—but they are also easily penetrated by sound.

Often the problem of noise entry through lightweight roofs shows up in low rise buildings—and buildings around airports being the poster children for the problem. In particular, when airports expand, existing buildings may need remediation to provide more sound isolation. Isolation in the sense that material selection and design considerations can benefit the amount of sound that is isolated from the exterior to the interior of the building.

Massively built buildings tend to be quieter, but even in massive structures with masonry walls and heavy vertical components, current roof structure practice is steel joists and decking—an invitation to noise intrusion.

STC ratings measure sound control.

Sound control is not a new science. It has been around for years. What we try to accomplish in sound control is to reduce the noise transmitted from outside sources to a threshold of a quiet indoor environment. That threshold is typically a sound level of 25-35 decibels. (For an explanation of decibels and sound measurements, see the sidebar on Sound Levels.)

A Sound Transmission Class (STC) rating is a measure of the effectiveness of air-borne sound transmission reduction in decibels. STC is a derived rating based on prescriptive ASTM test methods, including Sound Transmission Loss (STL) testing. STL calculates the difference of sound energy between an outside sound source separated by, in this case, a roof system and an inside receiving area.

A simple steel-deck roof assembly with foam insulation and a membrane on top—but no high-density components—will have an STC rating of about 28. With that roof, a loud airplane overhead would be heard inside the building at a high level of sound intensity and with very little sound reduction. At 20 decibels above the interior background, the airplane will be perceived as about four times louder than the ambient interior sound level. That's enough to be very distracting.

High-density layers attenuate sound.

To increase sound reduction in lightweight roofs based on wood or steel decks, material selection must introduce multiple layers of high-density components—such as DensDeck Roof Boards. DensDeck is actually one of the highest density roof components available for commercial roofing, and its high mass can make a unique contribution to sound reduction.

To attenuate sound from being conducted between high-density layers located in a roof, we separate them with other material such as foam insulation. Usually, the insulation layers have different thicknesses which assists with sound reduction.

Testing gives STC ratings for roofs with DensDeck.

Because sound isolation in roofs is an issue that designers and specifiers have to deal with, Georgia-Pacific Gypsum has conducted testing to establish proven STC values for steel-deck roofs using layers of DensDeck for sound reduction. (See Sound Testing table.) The STC ratings for roofs using layers of DensDeck give the designer tools to calculate the sound-reduction performance of roof assemblies. These ratings closely parallel similar layering in wall construction.

The tests showed an STC class of 41 for roofing assemblies using one layer of ⅝″ DensDeck® FireGuard® Type X Roof Board on top of the steel deck, then insulation, then a covering of two layers of ⅝″ DensDeck.

The tests conducted at an accredited NVLAP acoustical laboratory complied with ASTM standards E 90, E 413 and E 1332. Some tests did not include, deliberately, a roofing membrane above the assembly or a finished ceiling below it. Those components would normally contribute only about one to three decibels of additional sound rating. So a test assembly with an STC rating of 41 would give an actual installed STC closer to 45 with a ceiling below it and a roof membrane on top.

DensDeck delivers sound control at airports.

Minimizing the penetration of sound is one of the goals in public airport buildings, and airport designers have recognized the role of DensDeck in providing a quiet indoor environment by controlling sound intrusion. DensDeck is used in roof assemblies at airports around the world including South Korea and Dubai. In many cases, DensDeck is chosen specifically for its high-density and sound-reduction capabilities.

Whatever the application, DensDeck can enhance sound reduction of the roof assembly. DensDeck can also add fire resistance, strength, moisture resistance and superior testing for mold resistance. Specify DensDeck in your next roofing job.

For more information on DensDeck in roofing systems, visit our website at www.gpgypsum.com, or contact any Georgia-Pacific Gypsum sales agents or independent sales representative.

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Sound levels and relative loudness

Sound levels are measured in decibels, which is a logarithmic scale that approximately matches the response curve of the human ear. The human perception of change in loudness of sound is roughly proportional to the logarithm of the physical sound energy.

Starting with the lower threshold of hearing at the 20-decibel level, a one-decibel change in sound intensity is the smallest difference the average human ear can perceive.

- A five-decibel change is clearly noticeable.
- A 10 decibel increase is an increase in sound energy of 10, and a doubling of perceived loudness.
- A 20 decibel increase is an increase in sound energy of 100 and a four-times increase in perceived loudness.
- A 30 decibel increase is an increase in sound energy of 1,000 and an eight-times increase in perceived loudness.

Typical Sound Levels

Noise Source	Decibels
Jet take-off, artillery fire	120
Loud street noise, loud band	100-120
Overhead airplane, unmuffled truck	80-100
Average radio or TV	70-90
Human voice at 1 meter	55-60
Background noise in office	35-40
Quiet home	24-30
Threshold of hearing	20

Sound Transmission Class (STC) Ratings of Steel-deck Roof Assemblies Using DensDeck® Roof Boards

STC[1]	Underlayment	Insulation	Cover Board	Membrane	System Attachment
28	None	6″ ISO	None	None	Mechanical[2]
29	None	6″ EPS	None	None	Mechanical
36	⅝″ DensDeck®	3″ ISO	½″ DensDeck® Prime	EPDM	Mechanical/EPDM-Adh.
38	⅝″ DensDeck	3″ ISO	¼″ DensDeck Prime	EPDM	All components adhered[3]
39	⅝″ DensDeck	4″ ISO	⅝″ DensDeck Prime	SBS Mod Bit	Mechanical/Mod Bit-Torched
41	⅝″ DensDeck	6″ EPS (Extruded)	Two: ⅝″ DensDeck, ⅝″ DensDeck Prime	None	Mechanical

[1] STC rating is calculated in accordance with ASTM E 413.
[2] Typically 9 fasteners: 3″ Round steel plates with screw penetrating deck.
[3] Olybond™ 500 Adhesive: ¼″ DensDeck Roof Board Down/EPDM Adhesive for Membrane Application.

Georgia-Pacific Gypsum

SALES INFORMATION AND ORDER PLACEMENT

U.S.A. Midwest: **1-800-876-4746** West: **1-800-824-7503**
South: **1-800-327-2344** Northeast: **1-800-947-4497**

CANADA Canada Toll Free: **1-800-387-6823**
Quebec Toll Free: **1-800-361-0486**

TECHNICAL INFORMATION

Georgia-Pacific Gypsum Technical Hotline
U.S.A. and Canada: **1-800-225-6119**
www.gpgypsum.com

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CAUTION: For product fire, safety and use information, go to gp.com/safetyinfo.

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