Georgia-Pacific Gypsum

Building Reputations Together™

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TECHTALK Technical Insight from the Roof Board Experts

Sound Remediation Systems for Existing Roofs*

The Problem

Noise in our daily lives is becoming more and more intrusive, annoying and harmful. Sound Intrusion in a hospital or nursing home can be a health problem and affect healing, in a school it can affect concentration and learning and in apartments and homes, it can be annoying and disruptive. The sound may be from airplanes landing and taking off at an airport, traffic noise in urban areas or outdoor equipment in suburban areas.

As air traffic increases in volume and frequency and airports modify their landing patterns, existing buildings around airports, which previously had no problems, are now frequently faced with trying to deal with sound intrusion issues.

The typical apartment, school or assisted living facility is usually built using steel or wood frame construction, with a structural deck and insulation. These roofs are relatively transparent to sound penetration. To improve sound isolation, mass needs to be added to the assembly to help block the penetration of sound.

Defining Sound

Sound is a form of energy, produced when a source generates waves, which are rapid changes in pressure within a medium, such as air. The sound is heard when the waves reach the eardrum of the receiver. The number of waves radiated every second is described as the frequency or pitch, measured in Hertz (Hz). Doubling the frequency of the sound increases the pitch by one octave.

The loudness or intensity of the sound depends on the size of the pressure changes in the medium. The basic measure of loudness is the sound pressure level, which is recorded in decibels (dB). The sound pressure level is measured on a logarithmic scale, so a doubling of the sound pressure produces a 6dB increase in sound pressure level.

The human perception of loudness of sound depends on the pitch. The human ear is less responsive to very low and very high pitched sounds compared to those in the middle range (500 – 4000 Hz).

As the distance from a sound source increases, the intensity or loudness of the sound diminishes at a rate which is the square of the distance. The sound level in decibels, measured twice as far as the distance first measured will be ¼ the intensity. If it is four times as far away, it would be 1/16 the intensity.

When airborne sound hits a barrier such as a roof, wall or floor, some of it is reflected back, some of it is absorbed by the components in the barrier and if the sound intensity is high enough, some of it will be transmitted through the barrier to the other side. It is this transmitted sound we are trying to control.

* Information presented in this article concerning roofing systems and assemblies is presented as a general guide for illustration purposes only. Please consult the appropriate system manufacturer or design authority for system specifications and instructions for any specific system or assembly. Georgia-Pacific Gypsum does not provide roofing design services.

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Sound Control

To reduce the transmission of sound through a building element, a variety of components may be required. The key factors which affect the blocking of sound passing through a building component include:

- **Mass:** A greater amount of energy is required to set up vibrations in a dense material than a light one, making a massive structure less likely to transmit sound. Adding a dense layer of gypsum board separated from other layers will block more sound than insulation alone.
- **Stiffness:** when a building element consists of several different parts, the amount of sound transmission can be reduced by providing a resilient separation layer like insulation.
- **Absorption:** Components which absorb sound energy by friction (converting it to heat) will reduce the sound transmission through a structure.

Sound Transmission Classification (STC)

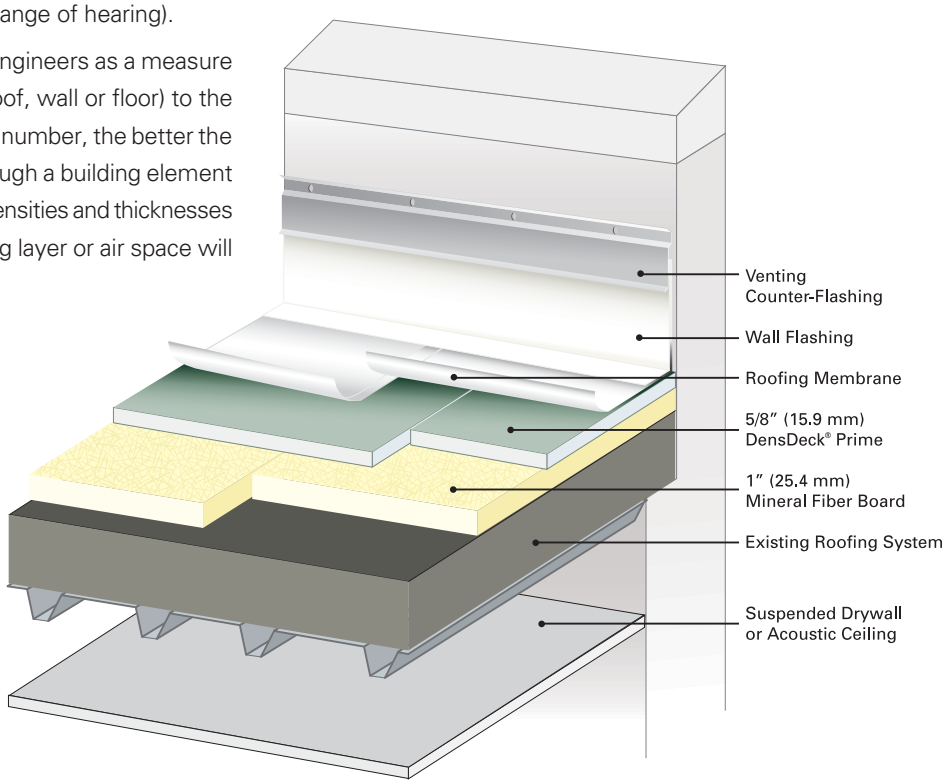
Sound Transmission Classification is the overall rating of the amount of transmission loss through a roof, wall or floor composed of several layers, through a frequency range from 100 Hertz to 5000 Hertz (the normal range of hearing).

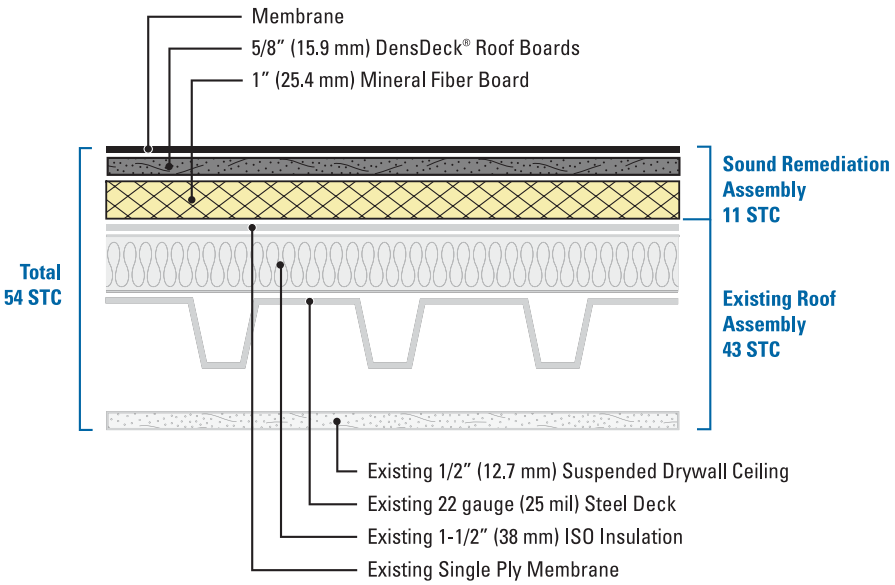
STC numbers are used by acoustics engineers as a measure of resistance of a building element (roof, wall or floor) to the passage of sound. The higher the STC number, the better the resistance of sound transmission through a building element such as a roof, wall or floor. Dissimilar densities and thicknesses of materials separated by a dampening layer or air space will usually produce the greatest results.

The Solution

Most existing commercial buildings in need of sound remediation have an existing asphaltic, modified asphalt or single ply membrane roof system. These systems lend themselves to sound remediation by installing a high mass layer of 5/8″ (15.9 mm) DensDeck® Prime Roof Board on top of the existing surface and gaining a significant improvement in the roofing system's ability to block exterior sound.

This solution has some inherent problems. If the existing membrane is left in place, a condition is created where moisture can build up between the old membrane and the new roof membrane above the DensDeck Prime Roof Board. To overcome any potential problems, a rigid layer of mineral fiber board like fiberglass or rock wool is first placed on top of the existing membrane under the DensDeck Prime Roof Board and vented to the perimeter of the roof. The fiberglass serves a couple of purposes. It allows vapor pressure between the roof membranes to dissipate and also provides a dampening layer to isolate the DensDeck Prime Roof Board from the existing roof to improve the sound isolation.





If the building has a metal roof edge, a retrofit venting metal roof edge system can be installed. If the building has a parapet wall, the fiberglass board can be installed vertically, under the 5/8" (15.9 mm) DensDeck® Prime Roof Board and a venting parapet wall cap or venting counter-flashing system needs to be used.

This Sound Remediation System has been tested for STC ratings and over a typical metal deck roofing system with a finished drywall ceiling, which starts with an STC rating of (43), has a final STC rating of (54), a significant 11dB improvement. This improvement means that an exterior sound can be reduced by enough to bring the sound intensity below the background sound level of the space. By doing this, the exterior sound will not be heard inside the building.

Description of the SRS, Sound Remediation System

SRS, Sound Remediation System:

- Single ply roof membrane, adhered
- 5/8" (15.9 mm) DensDeck Prime roof board joints butted tightly
- 1" (25.4 mm) Mineral fiber board, ventilate to the roof perimeter

Existing Roofing System:

- Smooth surface single ply roofing system
- 1 1/2" (38 mm) isocyanurate (ISO) rigid foam insulation
- 22 gauge (25 mil) structural roof deck
- 1/2" (12.7 mm) suspended drywall ceiling

Additional Benefits

Now that we have addressed the intrusion of noise into our building, energy conservation can be an additional benefit of this sound remediation system. Any thickness of rigid foam insulation may be placed under the fiberglass and 5/8" (15.9 mm) DensDeck Prime without detracting from the STC improvement. The venting characteristic of the SRS will address the concerns of potential moisture accumulation in an insulated assembly as well.

In addition, this assembly will provide a stronger hail and foot traffic resistant assembly, which will stand up to forces trying to tear the system apart.

The building owner will not only benefit from the significant sound reduction, but also create a more durable, sustainable roofing system, which will save energy in the operation of the building. This may also qualify the assembly to receive tax breaks or stimulus funding.

So, if all you need to accomplish is to block out the noise of that airplane, you can now accomplish that while saving energy and creating a sustainable roofing system.

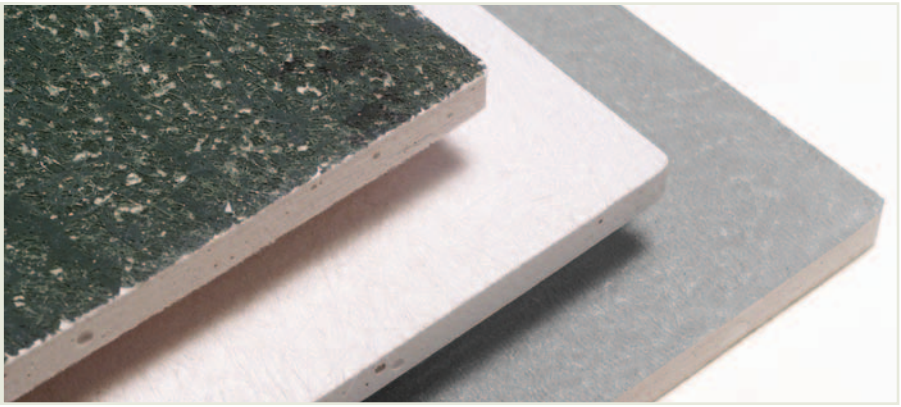
U.S.A.– Georgia-Pacific Gypsum LLC
Canada – Georgia-Pacific Canada LP

Sales Information & 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 www.gp.com/safetyinfo or call 1-800-225-6119.

HANDLING AND USE–CAUTION This product contains fiberglass facings which may cause skin irritation. Dust and fibers produced during the handling and installation of the product may cause skin, eye and respiratory tract irritation. Avoid breathing dust and minimize contact with skin and eyes. Wear long sleeve shirts, long pants and eye protection. Always maintain adequate ventilation. Use a dust mask or NIOSH/MSHA approved respirator as appropriate in dusty or poorly ventilated areas.

FIRE SAFETY CAUTION Passing a fire test in a controlled laboratory setting and/or certifying or labeling a product as having a one-hour, two-hour, or any other fire resistance or protection rating and, therefore, as acceptable for use in certain fire rated assemblies/systems, does not mean that either a particular assembly/system incorporating the product, or any given piece of the product itself, will necessarily provide one-hour fire resistance, two-hour fire resistance, or any other specified fire resistance or protection in an actual fire. In the event of an actual fire, you should immediately take any and all actions necessary for your safety and the safety of others without regard for any fire rating of any product or assembly/system.

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