



Georgia-Pacific
Gypsum

Building Reputations Together®

Sound Isolation Solutions for Commercial Roofing Systems

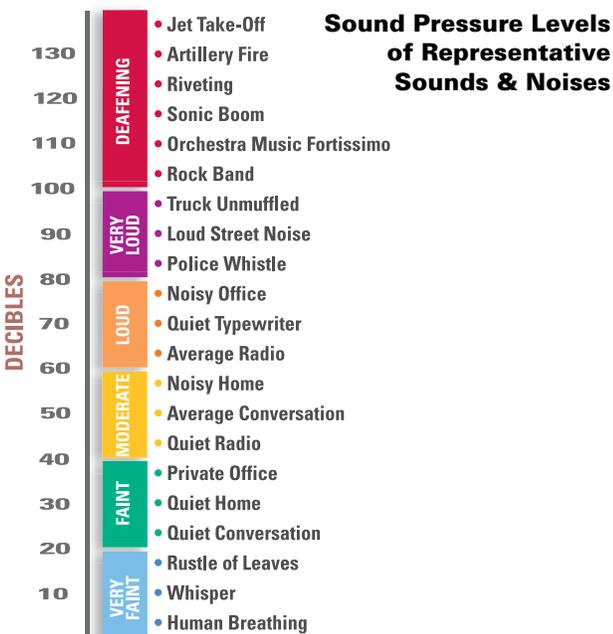
Test reports confirm dramatic improvement in STC and OITC ratings when using DensDeck® Roof Board.

Georgia-Pacific Gypsum's DensDeck® Roof Boards are the first gypsum roof boards tested to contribute to Sound Transmission Class (STC) ratings of up to 61 and Outdoor Indoor Transmission Class (OITC) ratings of up to 49 in roofing assemblies for commercial framed construction.

Enhancing the soundproofing of low-slope roofs for commercial steel or wood-framed construction* is quickly becoming a requirement or a way of gaining credits in programs such as the LEED® rating system of the U.S. Green Building Council (USGBC).

USGBC's LEED for Schools 2007 rating system mandated a minimum 50 STC rating for new school construction, and LEED for Schools 2009 provides extra credit for achieving enhanced sound levels.

LEED for Healthcare provides a credit when improved roofs are built in a manner consistent with the need in noisy areas. Additionally, the California Green Buildings Standards Code requires STC 50 roofs on all non-residential buildings, located in noisy areas, with certain exceptions.



There is no question that keeping unwanted noise from disrupting the daily life in a school, assisted living facility or apartment building makes life more livable and healthy. While most architects and roof designers are comfortable with the latest waterproofing and weatherproofing techniques of low slope roofs, the complexities of sound isolation of new buildings and sound remediation in existing buildings appear to present a variety of challenges.

"Excessive noise indoors can interfere with sleep and voice communication, including television and telephone, or simply be a distraction and annoyance, said Noral Stewart Ph.D., FASA, FASTM, INCE, of Stewart Acoustical Consultants and a consultant to Georgia-Pacific Gypsum. "Controlling sound inside and from the outside is an essential part of any plan to provide a more comfortable environment for building occupants."

Besides meeting code or similar requirements, sound isolation and remediation solutions for low-slope roofing need to consider good roofing practices and proper moisture control, as part of a simple, sustainable, new or retrofit roof solution.

DensDeck® makes it simple

The roofing and construction researchers at Georgia-Pacific Gypsum, the manufacturer of DensDeck Roof Boards, have been studying the problems of sound isolation and sound remediation for years. Numerous tests were conducted on assemblies using multiple layers of DensDeck panels over exposed steel decks, which have been successfully used in airports around the country for more than two decades.

* Testing of the new assemblies was completed at Riverbank Acoustical Laboratories in 2011.

Sound Isolation Solutions for Commercial Roofs

Recently-tested assemblies added a suspended 1/2" or 5/8" drywall ceiling, which make them suitable for apartments, hospitality and assisted living facilities and even schools when a suspended acoustical ceiling is added to meet absorption needs in the classroom.

"This system is quite versatile. It can be used with suspended drywall ceilings and steel frame construction, with vapor barrier, insulation and cover board," says CJ Sharp, DensDeck® Technical Manager of Georgia-Pacific Gypsum. "This eliminates the need to specify and purchase additional components and build the assembly in a non-standard fashion. It really saves a lot of headaches for the designer, installer and building owner."

Testing on these assemblies was conducted and passed at the Riverbank Acoustics Laboratories in Geneva, IL, one of the oldest and most respected sound testing laboratories in the nation.

Using standard construction materials and methods in steel frame commercial buildings, the first of the test results showed an STC rating of 56 and an OITC rating of 42, both measures of sound resistance of specific building elements (see full definitions below).

What is a Sound Transmission Class (STC) rating?

An STC rating is a single-number rating calculated in accordance with standard ASTM E413 using the Transmission Loss measured at 16 one-third octave bands from 125 Hz to 4000 Hz. This rating is most appropriate for comparing performance of interior partitions to be used between rooms where there is not strong low-frequency sound.

What is an Outdoor Indoor Transmission Class (OITC) rating?

An OITC rating is a single number rating calculated in accordance with standard ASTM E1332 using the Transmission Loss measured at 18 one-third octave bands from 80 Hz to 4000 Hz. The rating is most appropriate for comparing the performance of exterior façade elements, including roofs, exposed to typical transportation noise sources.

What is Transmission Loss (TL)?

TL is a measure in decibels (dB) of the sound energy per unit area transmitted through a partition measured in one-third octave bands in a laboratory in accordance with the standard ASTM E90.

Solving sound, durability and energy problems

Because current lightweight construction techniques are relatively transparent to sound, the roofing system needs a high mass barrier like DensDeck Roof Boards to reduce the transmission of sound.

In addition to keeping unwanted sound from penetrating the building, these assemblies using DensDeck Roof Boards also address the persistent challenges of all commercial roofing systems. Durability and sustainability are enhanced by using DensDeck as a strong, high density cover board and the fire resistance of the entire assembly is improved as well with the use of the boards as a fire barrier. There is no question that the useful life of any roofing system can be extended by using these strong, moisture-resistant roof boards.

A reasonable approach to noise reduction is important, in part, because new noise certification and abatement procedures have in many instances been extremely successful in reducing noise impacts at airports across the country.

The Aviation Safety and Noise Abatement Act considers the soundproofing of public buildings a key step in most noise compatibility programs. In this regard, commercial roofing systems have proven to be worthwhile targets for sound isolation in existing buildings and for new construction when excessive noise is a concern.

Federal and state agencies now have an independently-tested solution to offer those who are complaining about sound intrusion levels at or around airports. Whether the remedial work is subsidized by the Federal Aviation Administration or not, the agency can suggest the system to building owners as a solution to sound, moisture, energy and sustainability challenges. These same solutions are now also compatible with the latest LEED® and IGCC (International Green Construction Code) sound isolation requirements or credits.



Diagram 1: STC=56**
RAL#TL11-006

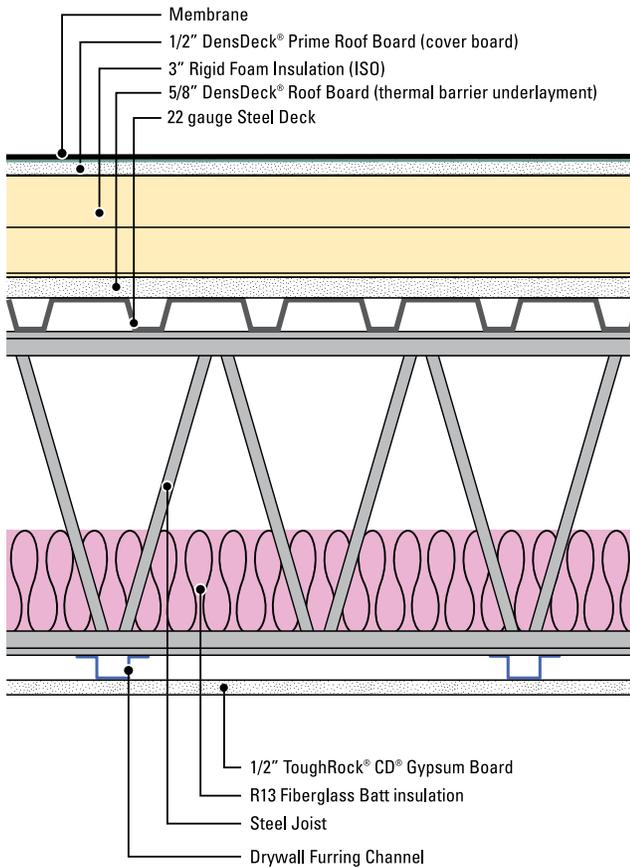
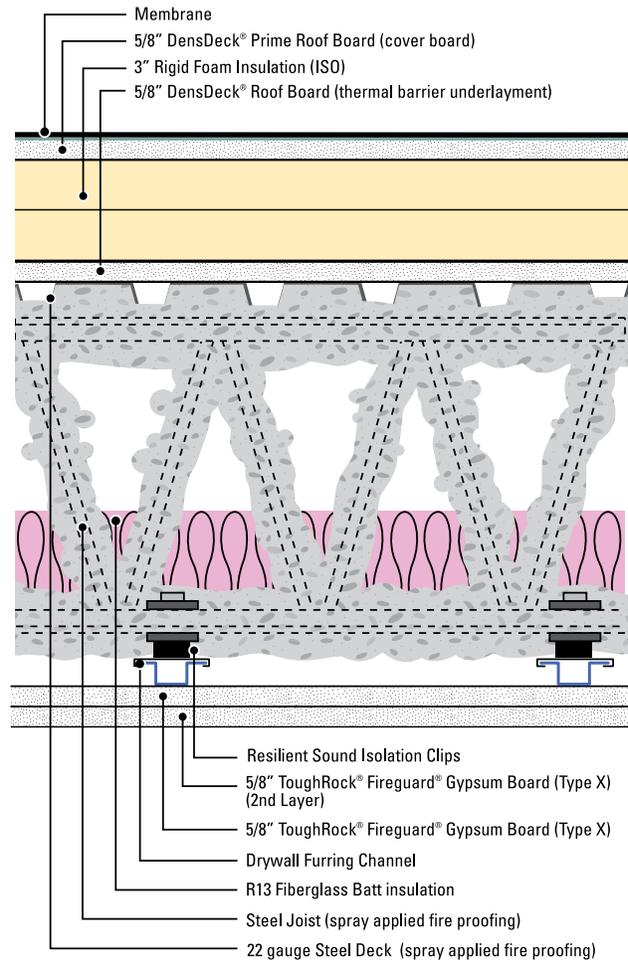


Diagram 2: STC=61**
RAL#TL11-065



As shown in **Diagram #1**, the tested assembly consisted of a structural steel joist framing system and 22 gauge metal deck with a suspended 1/2" drywall ceiling. A 5/8" DensDeck® thermal barrier was installed over the steel deck and 3" of isocyanurate foam insulation with a 1/2" DensDeck® Prime cover board was placed over the thermal barrier. A 45-mil TPO membrane was then adhered to the DensDeck Prime.

This assembly consists of very standard commercial roofing components and can be easily understood by both the specifier and the contractor.

Several additional assemblies were tested to determine what could be done to improve this level of sound isolation. Double layers of 1/4" DensDeck cover boards resulted in comparable

STC values to one layer of 1/2" board. Using Resilient Sound Isolation Clips (RSIC) to suspend the drywall ceiling and changing from 1/2" drywall to 5/8" drywall increased the STC value 2 points to 58 with OITC 43. Adding a 2" thick mineral fiber board (rock wool) under the foam insulation increased the STC value another point to 59, with OITC increasing to 44.

** Tests per ASTM E 90 and ASTM E 413, were conducted in 2011 at Riverbank Acoustical Laboratories. Results are based on characteristics, properties and performance of materials and systems obtained under controlled test conditions. Actual results may vary. Assemblies are presented for illustration only. It is important that you consult a design professional for assembly information. Georgia-Pacific Gypsum does not provide architectural or engineering services.

While ToughRock Gypsum Board is shown in both examples, moisture- and mold-resistant DensArmor Plus® Interior Panels may be substituted.

An STC rating of 61 and an OITC rating of 49 were achieved with an assembly consisting of steel joist framing and 22-gauge metal deck with sprayed-on fireproofing. **(Diagram #2)** A 5/8" DensDeck thermal barrier on top of the steel deck was covered with two layers of 1.5" isocyanurate foam insulation, 5/8" thick DensDeck® Prime cover board and a 45-mil TPO fully-adhered membrane. A double layer of 5/8" drywall ceiling with 3.5" fiberglass batt insulation above it was suspended from the structure with Resilient Sound Isolation Clips.

This performance may also safely achieve the STC 50 requirement for K-12 schools in LEED® for Schools 2007 or provides the extra credit available in LEED for Schools 2009. In fact, this same system may work for residential roof applications as well.

For more information on DensDeck® Roof Boards, visit www.densdeck.com.

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CAUTION For product fire, safety and use information, go to www.buildgp.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.

