

Architectural Acoustics: Controlling Exterior Noise in Modern High-Performance Buildings

By Chad Holmes, Marketing & Brand Manager, ROCKWOOL, North America

Building acoustics play an increasingly pivotal role in high-performance buildings as a design element central to occupant comfort and well-being. The building envelope should be expected to maintain consistent levels of noise protection. Outdoor to indoor noise reduction is essential, especially when looking at how to isolate or negate road noise and other sources of noise pollution in cities. Just as there are many sources of noise pollution, there are different methods architects and designers must consider to control exterior sound.

ACOUSTICS: THREE MAIN STEPS TO CONTROLLING EXTERIOR NOISE

There are three components to any plan for managing exterior sound: understanding the source-path-receiver model, selecting the right acoustic insulation for continuous exterior assemblies, and following general tips to soundproof from environmental noise pollution.

Step 1: Understanding the source-path-receiver model

When managing exterior sound, the source-path-receiver model is most useful. The principle remains the same for all building types: look at all the possible sources of noise and then look at all the possible entry points, or pathways, for the sound to travel. That list includes the roof, windows, doors, and wall assemblies. Building and design professionals are always encouraged to design exterior wall and roof insulation systems

to help block as much of that environmental noise as possible.

Step 2: Selecting the right acoustic insulation for continuous exterior assemblies

Integrating sound reduction measures into the planning and layout of your home or building can improve the indoor acoustics and reduce auditory stressors by limiting airborne transmission from external sources. Material selection is important for achieving acoustic objectives.

Consider the following checklist when evaluating the insulation to use in your continuous insulation applications:

- Raw materials used in manufacturing the insulation.
- Manufacturing processes.
- Operational performance.
- Combustibility of the insulation.
- Moisture mitigation properties.
- Overall durability.
- Impact on acoustic performance (outdoor-indoor transmission class (OITC) / sound transmission class (STC)).
- Stonewool insulation is well-suited to provide desired exterior wall OITC rating results. When properly installed in today's building enclosures, stone wool, as part of your CI system, supports thermal performance and provides additional acoustic comfort.

Step 3: Tips for soundproofing against environmental noise pollution

Noise travels through the weakest sections of the building envelope, meaning the effectiveness of a high-performing wall or

roof system may be reduced when the rest of the building is not equally designed.

Unwanted noise that enters a building through penetrations such as under a door, around a window, or around a connected exterior wall is called flanking noise. The assembly and its connecting features should be optimized during the planning stage of a project to minimize these potential flanking paths.

Review and consider the following applications during the planning process of your next project:

- Roofing: Stone wool insulation has superior sound abatement properties—essential for today's roof system. High-performing systems using stone wool insulation can add mass layers to assist with improving the sound attenuation properties of the assembly. Research has shown dense acoustic roof insulation, including stone wool flute fillers, are an effective solution for reducing sound transmission through a roof.
- Connecting assemblies: Areas of deficiency for façade sound transmission paths can be things such as roof soffits, vents, fans, air sealing details, and potentially others, depending on the type of façade system being constructed.
- Exterior wall systems: The type of construction and the building materials being used can improve acoustic performance in external wall assemblies. All insulation for exterior walls should be designed to meet or exceed energy code. Choose materials that help improve acoustic performance (like stone wool), while still meeting the

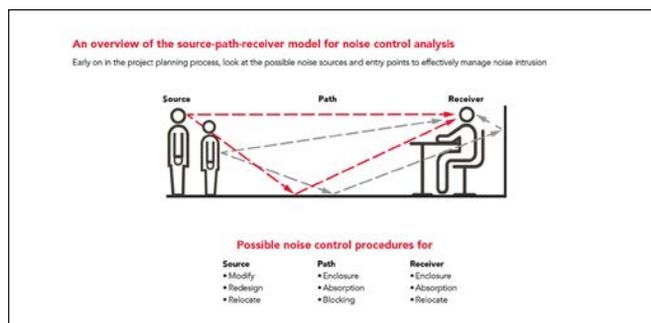


Figure 1. The source-path-receiver model.

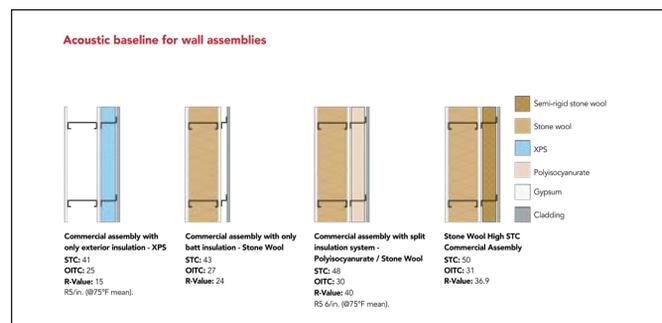


Figure 2. An acoustic baseline for wall assemblies.



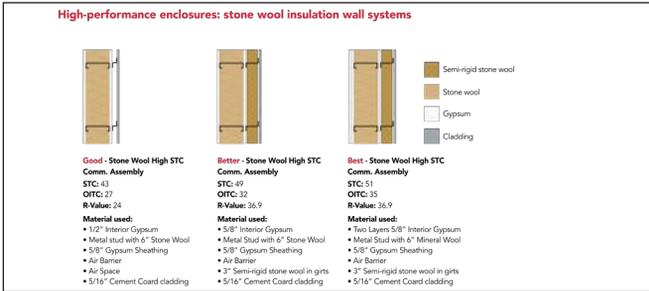


Figure 3. High-performance enclosures: stone wool insulation wall systems.

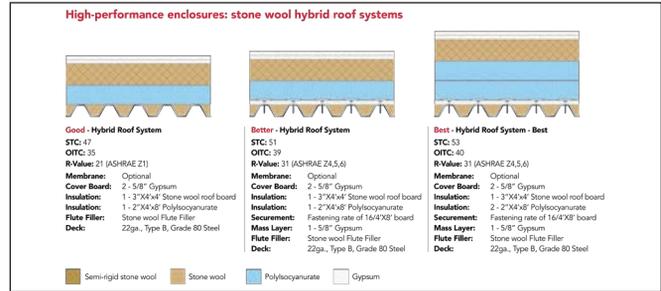


Figure 4. High-performance enclosures: stone wool hybrid roof systems.

other demands of your assembly to create cost-effective solutions and more livable spaces. For example, an assembly of foam

plastic insulation with multiple layers of gypsum could be optimized by changing to a stone wool insulation and a single

layer of gypsum, while achieving similar acoustic results.

- Windows and doors: Windows are one of the largest deficits in building wall design for acoustical control and heat loss. Pay careful attention when designing the windows and their connections to the wall elements for a high-performance wall system. Consider the type of window (we recommend double- or triple-pane for best acoustic performance), the pane thickness, and how it will be installed.
- Penetrations and joints between components: These should be sealed as required for thermal performance, which will also improve the building acoustics by reducing flanking paths.

To achieve the highest levels of STC, OITC, and R-value, various options exist. The figures on this page show three assemblies with different combinations of construction materials, illustrating how you can maximize performance.

Much of a building's sound-blocking can be achieved by the building envelope. Insulation is a simple, practical way to reduce noise pollution in homes and non-residential buildings. Choose insulating material carefully, and consider high-density insulation such as stone wool, which is excellent at noise reduction. Following the three main steps to controlling exterior noise will help improve acoustic performance and optimize occupant comfort. The design process is the best stage to consider acoustic control in today's modern, high-performance buildings. ■

Chad Holmes is marketing and brand manager for ROCKWOOL in North America. He has worked closely on acoustical programs, advocating their importance and relevance to modern construction. For more on acoustic insulation solutions, a blog series on architectural acoustics, or technical support to optimize acoustic performance in your building, visit www.rockwool.com.

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