

Acoustic design for building envelopes – are you listening?

Sound and noise are one of the most important senses that we have, providing signals and communication to all of us. These sounds grab our attention in different ways, some can be informative and important and others an irritation.

By Richard Polling



A school in the Western Cape. Image: Pathfinda

To achieve the highest quality building standards in the world, building envelope systems need to meet structural, thermal and acoustic requirements.

There are three different forms of acoustic influence that impact on the design of building envelope solutions:

- 1. Rain drumming** – this is most familiar, for instance as you stand in a metal skin building and if not treated, you hear the rain drops hitting the metal roof system and it forms a drumming noise. In some cases, some schools in the Western Cape can lose over 25 days a year for teaching due to rain drumming.
- 2. Weighted sound reduction** – less familiar, is the ability of a building envelope to reduce the outside noise before it enters the inside of the building or vice versa. For example, a highway usually generates between 60 to 80 decibels (dB) of noise, if a building is located near a highway and the noise in the building could be very distracting.
- 3. Acoustic reverberation** – describes the sound which bounces around, or reverberates within a building or a space that causes echoes.

Are we listening?

All the above have a large impact to the inside of the building and design of building envelopes need to consider such issues.

For instance, let's take an example of a school or educational establishment near a highway or in a city. It is a proven fact that children best learn under certain thermal, air ventilation and acoustic conditions - very few schools in South Africa achieve these recommended conditions.

Recommended conditions for educational establishments:

- The room temperature must be between 22 to 25°C.
- Natural ventilation - the acceptable value is 2 000ppm of average carbon dioxide in the classroom over a 20-minute period.
- The correct noise level within a teaching block should be between 30 to 40dB.

How do we achieve these standards in building envelopes?

MRC's experience in acoustic design of building envelope solutions goes back more than 20 years, considering and installing a myriad of differing solutions to solve the problems with rain drumming, weighted sound reduction and acoustic reverberation, in both the new build and refurbishment sector of the construction industry.

Single skin metal roof sheets are well known to form a drumming noise when it rains or hails, but the use of a thermally efficient built up metal roof system has many benefits such as:

- Minimises the impact of rain drumming on the metal sheet.
- R-Value thermal performance up to 10 (m²K/W) to assist in maintaining a room temperature of between 22 and 25°C.
- Excellent weighted sound reduction of 40dB as a standard.
- Perforating the liner sheet and introducing an acoustic matt into the build-up system will absorb the sound and minimise the reverberation.
- Green Roof system can be installed on the roof and living walls for cladding to further assist in sound reverberation and weighted sound reduction along with increased R-Values of the system.

Therefore, in the example above we are now providing a cooler environment within the building, reducing the sound reduction from outside traffic from 60 to 80dB to 20 to 40dB and minimising the irritating reverberation of the sound within the room itself.

We take into account all these benefits before we consider additional measures such as false ceilings, internal partitions and unsightly acoustic matts underhung from the roof structure itself. 🏡



ABOUT THE AUTHOR

Richard Polling has more than 20 years of international experience designing, manufacturing, installing and auditing some of the most sophisticated building envelope systems complete with steel and precast structural framing.

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