



Single, Double, or Triple Glazing?

Common sense would seem to indicate that the more layers of glass a window has, the better it will reduce noise. Sadly, it's not that easy. In some situations, adding another layer of glass can actually make the noise worse! How is this possible? When noise strikes a window, it causes the glass to vibrate. This vibration re-radiates some of the noise into the building. How much noise is re-radiated depends upon how good the window is at blocking the noise. As you know, noise consists of many different frequencies. The less a window vibrates at the frequency you're trying to block, the better the window performs.

However, every window also has what's known as a **resonant frequency**. This is the frequency at which the window has a natural tendency to vibrate. If the resonant frequency of the window is close to, or the same as, the frequency of the noise you're trying to block, the window will perform very poorly. Like a tuning fork, it will vibrate along with the noise and re-radiate much of it into the building.

The trick in good acoustical design is to match the frequency of the noise you're trying to block with a glazing assembly that possesses the appropriate frequency characteristics. The resonant frequency is a function of the mass of the window panes and the depth of the airspace in double- and triple-glazed assemblies. The larger the airspace, or the heavier the panes, the lower the frequency at which the resonance occurs.

For comparison, consider a double-glazed window consisting of two panes of 1/8" glass separated by a 5/8" air gap. This assembly has a resonant frequency of about 250 Hz. A single-glazed window of 1/4" glass has a resonant frequency of about 2,500 Hz. Obviously, in this example, a single pane of 1/4" glass is better at blocking a low frequency noise source than a dual-glazed window. This is important because most of the annoying environmental noise we have to mitigate, including traffic, train and aircraft noise, occurs at low frequencies.

You could ask, then, why are double-glazed windows with narrow air gaps used so often if they're so poor at mitigating common noise sources? The answer is simple: they provide much better thermal insulation than single-glazed windows. For the same reason, triple-glazed windows are often used in colder climates like those in Finland, Canada and Russia. Such glazing would also be good for sound insulation, but only if the airspaces are more than 3" to 4" deep. Otherwise, at low frequencies triple glazing can be even worse than double glazing because it has *two* resonant frequencies. So in places with a warm climate and a relatively quiet environment, single-glazed windows can be good enough if the glass is not too thin.

In our opinion, 1/4" glass is optimal under these conditions. It's not very expensive or heavy, it provides reasonably good sound insulation, and—also important—it doesn't rattle under vibration. Better sound insulation can be achieved with double- and triple-glazed windows, but the airspaces need to be deep enough.

So, taking all this into account, to make the best choice for any specific glazing application we need to know the frequency of the sound we're trying to block and the performance characteristics of the glazing assemblies under consideration. By obtaining laboratory test reports from the window manufacturer, we can ascertain their performance characteristics and make an educated choice as to which assembly would be the most appropriate.

These are the reasons why acoustical consultants are reticent to agree to substitute glazing assemblies after recommending specific selections. Unless we have the test reports for the substitute window, we're not able to determine whether it would work. And that's what we're here for: to work with you to find the optimum result for your project.

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