

Trends, Expectations & Realities

in Residential Window Renewal

By Jeremy Nixon, Managing Engineer at Brown & Beattie Ltd.



Making the decision to replace windows in your buildings and homes is a big one. It can seem daunting with all of the choices available out there, not to mention building code requirements and technical performance data (which I'll save us all from getting into here!), but it doesn't have to be.

At their most basic, windows are essentially just thin pieces of glass and framing materials (aluminum, vinyl, wood, fibre-glass are the most common) that separate our interior and exterior environments. Windows are, of course, much more complex than that; however, for this purpose, that portrayal should suffice. While

technologies are evolving, windows remain distinct with limitations compared to other building envelope components. While you can stuff lots of puffy, thick insulating materials into other areas of a building envelope, windows do not have the same luxury. They are limited essentially by the air space that one can create





New, aluminum-framed windows with operable awnings for fresh air.

between pieces of glass and within framing members.

We can add coatings (like low-emissivity) and replace air with fancy, inert gases (argon is the most common) in sealed glass lites to try to “trick” them into performing better. We can sometimes choose

framing materials that are thermally better than others, depending on the situation. Presently, we cannot effectively match the thermal characteristics that we can achieve in other areas of the building envelope (within current technological and manufacturing limits). We are,

however, often doubling (or more) the performance of windows that we are replacing, especially in older buildings that still only have single-glazing. This change can be significant on the component of our buildings that are the thermally the worst performing and typically the cause for the greatest energy loss.

Before a decision is made to replace windows, some questions should be asked, including:

- Why do I want new windows?
- What do I hope they will achieve?
- What do I want them to look like?
- How much am I willing to spend?

After a bit of initial deliberation, it should become clear that there is a balance to be struck between technical, architectural, and financial considerations. While some of those considerations will align, others may not.

Just a few of the important questions that should be deliberated at the outset of a project in the design phase include:

- Are my windows leaky or drafty? Do I feel cold in the winter or perhaps too warm in the summer? Is condensation a particular concern?
- Do I want to be able to open any of my window areas? If so, do I want those operable components to be sliding types or compression gasket types



Condensation on an outer slider of a paired assembly, due to interior unit humidity.





A window replacement project in progress. On the right are old windows, on the left are new ones. While they intentionally look architecturally similar, they are anything but, in terms of performance. Large, overhead paired, single-glazed sliders were replaced with fixed triple-glazed IGUs. Operable triple-glazed awnings were added in lower window areas. All IGUs were upgraded from double-glazed to triple-glazed, complete with argon gas fill and two low-emissivity coatings.

complete with cranks on casements or awnings? Do my new windows need to be able to accommodate air conditioning units?

- Is technical performance of the utmost importance, or are the architectural considerations? For this article, I will focus on the technical considerations, as another article in this magazine (on page 53) looks at the more architectural considerations.

There are many other questions that could be raised and will undoubtedly come up. Your building envelope consultant (recommended that you have one) should be able to help you navigate the many variables to be considered as well as the unforeseen conditions that will undoubtedly arise during construction.

EXPECTATIONS VS. REALITIES

Whatever decisions are ultimately made, it is important that a real, honest discussion is had about what to expect.

This type of discussion should not only be at the owner/board/manager level, but also among the residents, especially if the building is a condominium, in which there is a more direct financial impact to the resident owners.

Now, I'm not suggesting that residents at large should necessarily be consulted in detail on what the windows should be, as that can open an entire side dialogue that is typically ineffective and causes hard feelings. There should, however, at least be a sense among the residents that the project is felt to be necessary, a belief that there are problems that can be solved by replacing the windows, and perhaps some cursory input into what they want the windows to do and look like, though, ultimately, the owner and/or board are the ones who need to make final decisions.

The other aspect of open, honest discussion is to make clear what should and should not be expected of windows. Too often, expectations among residents are

that new windows will be the miracle solution to all in-suite conditioning problems, when, in fact, those concerns are already somewhat within each resident's control.

While new windows are certainly a significant part of the overall strategy, it does not start and end with them—they are simply one part. When this expectation is not properly tempered at the outset, it can create headaches later on. Even when properly educated, complaints still arise to varying degrees. Provided the project team and decision-makers are properly advised, it becomes simpler to target specific complaints and problems after-the-fact and often find practical solutions to them.

It can be difficult to teach residents that the nature of their occupancy in their units needs to be in balance with the window technology and building systems. While anyone can occupy their unit in any fashion they please, education is required for them to understand that if, for



example, they like it hot and humid, no technology will practically be able to limit the condensation that forms as a result when it gets even a little bit cool outside.

To make the point of the nature of occupancy from unit to unit clearer, let's further discuss condensation for a moment. When the window technology is the same in every unit, and condensation is an issue in one unit but not others that are, say, directly above and below (thereby having effectively the same external exposure conditions), it showcases how differences in occupant behaviour can affect the perceived performance of windows. In my experience, it does not take much to tip that balance.

That is not to say that choices in window design are at all unimportant—quite the opposite, in fact—but only that there is a practical limit to the technology. Residents retain some of the means to control conditions within their units by using existing building systems appropriately (i.e. thermostat settings, humidity settings if available, function and operation of exhaust fans appropriately, etc.) to the extent that they are willing and find it necessary to do so.

WINDOW DESIGN UPDATES

As the nature of the residential marketplace and the consumer becomes increasingly sophisticated, it is clearer that certain acceptable choices of the past are no longer so in today's environment. A staple window design of the past 30-plus years in multi-unit residential buildings (MURBs) has been the classic, double-glazed, fixed insulating glass unit (IGU) over operable paired single-glazed sliders. The glass may have included a low-emissivity coating, though not always, and probably just air infill in the IGUs.

Presently, while double-glazed IGUs remain a benchmark choice, they are now typically updated to include argon gas fill and low-emissivity coatings. Paired single-glazed operable sliders are, in most instances, now a poor choice, as they are thermally inefficient and leaky (both air and water). They do not perform as well as double-glazed IGU sliders, or even better, some type of compression gasket-operable type of IGU casement or awnings. From a condensation control standpoint, as well as thermal performance and leakage resistance, the latter choices have certainly demonstrated superiority.

On most new residential MURBs (in the GTA, at least), if there are operable windows at all, they tend to be awning types. This turnkey industry has perhaps somewhat recognized the value in a relatively small additional investment as being worthwhile in terms of fewer call-backs. Sliding operable windows are increasingly a thing of the past in that application. In the renewal world, we are seeing more clients opt for the value of this type of operable component, as well (in MURBs in particular). They look much better, too, at least in this author's opinion!

As noted, IGUs have effectively evolved to include argon gas fill as a standard replacement for air, with low-emissivity coatings seemingly being the norm now. Not as common, though available, krypton gas fill is an even more thermally efficient (though costly) alternative, and does not yet seem to have a significant share of the marketplace. Spacer technology separating the glass lites is also improving and can somewhat further affect the overall performance.

Increasingly, IGUs are including triple-glazing, which, in my firm's



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experience, is where some significant gains in performance can be realized. All that means is you now have three pieces of glass instead of two, stacked one in front of another between spacers. Doing so creates two “insulating” air-spaces instead of one, to each of which you can add those fancy inert gas fills and low-emissivity coatings. The relatively low-cost premium for roughly doubling the thermal efficiency of the IGU is, in my mind, well worth the additional cost if thinking long-term and, of course, provided you can afford it now.

Framing choices for MURBs are somewhat limited to thermally broken aluminum and better-performing fiberglass. Aluminum has the lion’s share of the local market mostly because the additional premium to fiberglass does not yet seemingly “pay back” within the life of the window. The selection of the thermal break material and configuration is essentially what determines the performance of aluminum sections. They can vary significantly on type and manufacturer and, of course, become more costly the more efficient they are.

For low-rise construction (houses, townhomes, etc.), the most common modern framing choice is vinyl, the performance of which can also vary somewhat, depending on type and manufacturer. Wood is certainly a premium choice worth considering, and it still has an important place, especially in higher-end and heritage homes or buildings, although it comes with a higher maintenance cost than other choices. While aluminum and fiberglass are certainly available to low-rise situations, the same cannot typically be said of vinyl or wood to MURBs due to flame spread and structural considerations.

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ENSURING SMOOTH INSTALLATIONS

The final aspect of window replacements worth discussing is what happens when the installations actually start. There should be a suitable shop drawing review followed by a mock-up installation and in-situ testing. I cannot stress the importance of not only completing this process, but of not rushing it. In particular, the mock-up permits review of the various flashing and tie-in details that can be critical to long-term performance. Everyone is



New vinyl townhome windows.



understandably eager to get the show on the road; however, the discovery that happens here can be invaluable to how well the general installations actually go, ensuring the windows will perform as intended.

There is, perhaps, no more intrusive a project than window replacements, as contractors are invariably in your home. Because of that, there is perhaps no greater frustration when a project does not go well, which, more often than not, is a function of poor planning and rushing. Again, more reason to complete your due diligence at the outset.

Add to this that while the replacements are happening, the home is, technically speaking, a construction site and only authorized persons should be permitted. Typically, this will exclude the residents, which most understand, but some are more "sensitive" to. There are many ways to create accommodation, though we will not indulge those here. Ultimately, replacements are meant to occur in a single day. If this is not feasible, no more will be removed and replaced in a day than will allow the safe return of the home to the residents by the end of that working day.



Follow-ups to repair finishes will typically be required to varying degrees (which will not usually require residents to vacate their units). Well-planned, this should occur within days, though frustratingly, sometimes seem to linger for weeks or longer. Typically, once things are back to normal and everyone can just sit back and enjoy, the disruption will have been worth it.

There is much more that could be said on this topic; however, your local, experienced building envelope practitioner will

be able to build on the discussion in this article. ■

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