Message from the President

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BUILDING PHYSICS: FIGHTING COVID-19

The built environment is being challenged under the present circumstances of COVID-19 infections. Designers are questioned, and building physicists are put-to-the-test with interior spaces' appropriateness and resilience to resisting the pandemic's consequences. Have buildings' construction stakeholders been sufficiently mindful to address related risks?

We strongly believe building physics, with mindful building envelope practices, can increase our chances of controlling viral transmissions.

THREE BUILDING ENVELOPE VIRUS SPREAD CONCERNS

1 Natural ventilation: While natural ventilation is crucial for bringing fresh air into buildings, operable windows haven't been predominantly considered in recently built enclosures. Fixed glazing is primarily practiced. Planning with windows in mind—and opening those windows—helps extract airborne contaminants from the space, making infections less likely. Most of our recent building projects are constantly under-ventilated. This not only promotes disease transmission but also expressively impairs perceptivity. Buildings / spaces without operable windows are generally questionable, from a resiliency perspective and whether they can remain occupied in cases of power or mechanical ventilation failures. Reasonable building physics practices encourage sufficient operable glazing for passive cooling and natural ventilation.

2 Indoors' relative humidity: Responsible envelope designs are expected to soundly withstand comfortable relative humidity (RH) levels without suffering condensation consequences, and they maintain the hygiene criteria.

Hygiene reference conditions and practices are conducive to maintaining health and preventing disease, especially through cleanliness. In building indoor environments, the risk of growing bacteria, viruses, fungi, infections, etc., increases with very low or high RH levels. Unfortunately, many traditional walls / interfaces still fail during cold(er) outdoor periods.

Research demonstrates that keeping a healthy RH between 35 and 55 per cent reduces the transmission of viruses. With higher RH levels, microdroplets containing virus can fall faster to the ground. Dry, indoor air is connected to more transmission via human infection. A lower RH dries out and inflames the mucous membrane lining the respiratory tract; as a result, the risk of cold, flu, and other infections substantially increases. Low humidity also causes eye dryness and irritation, so skin gets flaky and itchy and needs constant moisturizing.

Unfortunately, most project specifications are forced to allow low RH levels due to envelopes falling short of adequate performance (expressly glazing). Components could not maintain condensation-free surfaces during cold weather. We can change that.

The obvious solution is providing sufficient indoor humidification to achieve an average RH level between 40 and 60 per cent. Condensation, mould, or bacterial growth remain challenging problems for most traditional envelopes and persist, even with more advanced systems, if boundaries and anchoring, for example, aren't well-resolved. That applies to both transparent and opaque walls, while neither is exempt from managing RH levels if thermal bridging is ignored.

3 Economics: With well-insulated exterior walls and airtight components and transitions, it's appreciated that one doesn't lose or gain energy through them uncontrolled. Innovative envelope systems scoring high on effective R-value and airtightness are on the right side of the thermal transfer separation / resistance scale. Higher R-values are projected in opaque spans, but with today's readily available glazing systems, it's easily feasible to build with 0.5 W/m^{2}K triple units, for instance. This helps separate interior conditioned space temperatures from the exterior elements, so occupants are much more comfortable and productive while working from home. The cost of heating and cooling is therefore minimized. Occupants don't have to pay much to condition the space, which is quite helpful, especially if their income is impacted during a pandemic's lockdown.

AN INDIRECT ENVELOPE-RELATED FACTOR

Air recirculation has always been fundamentally unhygienic, not providing enough oxygen, and it likely redistributes airborne virus-contaminated microdroplets. Stakeholders may argue this, convincing clientele that air recirculation is perfectly normal and that nobody had died from it—yet. It's time for reconsideration. Advanced building standards such as Passive House strictly require 100 per cent fresh air supply in lieu of traditional air recirculation. That's greatly relying on the airtight building envelope. ■