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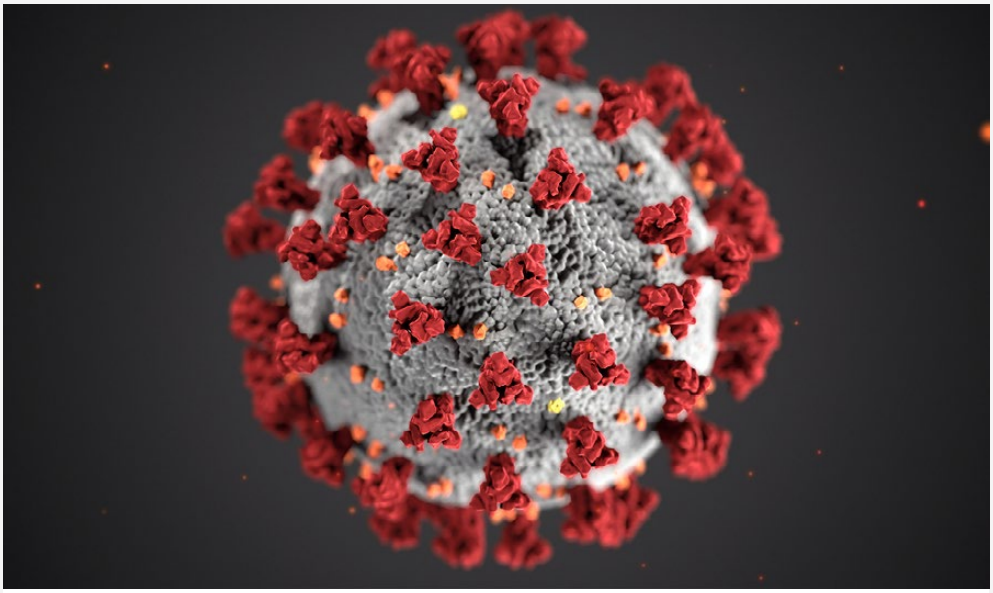

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Back to work; working in a Covid world

By Curtis Gubb and Kavita Kumari

The current COVID-19 pandemic is, unfortunately, unlikely to be the last of its kind. This begs the important question: How can we design our buildings to protect us now, and future-proof them for

subsequent viral outbreaks? The more thought leadership given by industry in this area the better.

At Cundall, we have been long term advocates of the WELL Building Standard. We have seen the benefits first hand with our London office One Carter Lane, which in 2016 became the first building in the UK and Europe to achieve the WELL Building Standard Gold certification — and only the seventh building certified in the world. We have also applied what we have learned to our new offices in Dubai, Doha, Birmingham, Singapore, Hong Kong and Dublin as well as to many of our clients' offices around the world. We have developed our own indoor environmental sensors and deployed them across our, and our clients' offices, which have further developed our understanding in this area. WELL looks to design buildings with people at the forefront, protecting their health and well-being, whilst enhancing user experience, but does it stand-up to the test provided by viruses such as COVID-19?

Air

We can be exposed to viruses via two mechanisms in the air. This can be through direct close contact transmission, by breathing in droplets exhaled from an infected person, through coughing and sneezing (and possibly by talking or singing, although the research in this area is still new) The second mechanism is airborne transmission, where aerosols/respiratory droplets (< 5 μm) can remain airborne for a number of hours (at least three hours with COVID-19 according to one study) under certain environmental conditions, where the virus can be inhaled. For COVID-19 , transmission via the second mechanism has still not been confirmed, although it seems likely based on research into similar viruses. As COVID-19 is a new strain, the intricacies behind its lifetime in the air and on surfaces is still being heavily researched and debated.

WELL stipulates minimum indoor ventilation rates (for both mechanical and natural) to ensure adequate fresh air is brought in from outside, helping dilute viruses and pollutants alike, and awards further points for enhanced supply rates up to 60% greater than the guideline. WELL also recommends particle filtration for ventilation systems, which in the case of outdoor

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virus contamination, e.g. if air exhausts and intakes are too close, can help capture some of the virus (depending on capture efficiency of the filters at $PM_{0.1}$) and prevent it travelling indoors. Further to this, research on certain other strains of corona- and various other viruses has found susceptibility to UV-C light; this is yet to be confirmed for COVID-19 specifically but it is reasonable to assume the same may apply. UV germicidal irradiation treatment is recommended by WELL, for projects without a forced air cooling system and for all spaces with greater than 10 occupants. However, consideration is required because with some UV-C generators (at lower wavelengths), ozone can be produced, which may aggravate respiratory diseases or catalyse further secondary pollutant reactions indoors.

Further Recommendations:

- **££** Consider natural ventilation — as well as supporting the industries push for net zero, it often provides higher air exchange rates and in turn, a greater dilution factor.
- **££** Limit indoor air recirculation — or if unavoidable, incorporate UV or high efficiency particulate filtration. This will have an energy penalty, but it will hopefully be short-term.
- **££** Assess the pressure regime — to avoid transmission from high-risk areas to low-risk (as found in healthcare buildings) or through doors 'pumping' air from toilets to 'clean' areas.
- **£** Conduct a desktop study of the ventilation system to ensure sufficient outdoor air is being provided and determine potential pathways of aerosol transmission, if any.
- **£££** In complex flow regimes, or in buildings where natural ventilation is used — it may be necessary to use computational fluid dynamics (CFD) to assess ventilation effectiveness in more detail.

Humidity

Research suggests that keeping humidity between 40 – 60% will reduce most respiratory and viral transmission issues. In terms of virus transmission, humidity plays a key role in both the lifetime of aerosols/respiratory droplets (droplets) in the air and on surfaces, but also human sensitivity to infections. Low humidity affects both the nasal system and

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specifically the mucus membrane, making us more sensitive to infections. Droplets expelled from people in low humidity will shrink rapidly as they dry out, but can then remain airborne for a number of hours. Pathogens within these droplets will likely have an increased infectivity at a humidity < 40%, the same may also true at > 60%, although high humidity is generally not considered such a problem in the UK. For COVID-19 specifically, there is much debate around the effects of humidity on the lifetime of droplets containing the virus; this is important, because alongside a greater probability of inhalation, if the particles are in the air for longer, there is also a deposition of infected droplets on surfaces or objects for an unknown period of time after they are exhaled.

The WELL standard recommends that mechanical systems should have the capability to keep the humidity between 30% and 60% at all times — via controlled humidification — and this should be measured in practice for at least 98% of all business hours. This can be achieved with indoor environmental quality monitoring, with numerous low-cost sensors available.

Further Recommendations:

- **£££** Maintain best practice levels of humidity (40-60 %) at all times — either via humidification directly within the ventilation system or via local units.

Materials and Cleaning

We can be exposed indirectly to COVID-19 via a fomite, namely a contaminated surface or object and by then touching our eyes, nose or mouth. The lifetime of COVID-19 on fomites is therefore very important and is directly affected by the surface material as demonstrated in a recent study. This can vary from hours to days: with copper, COVID-19 was not detected after four hours; with plastic and stainless steel, viable virus was still detected after 72 hours. With adequate cleaning of surfaces and washing of hands, the virus can be removed; however, as mentioned above, because of the virus's uncertain lifetime in the air, concentration build-up could occur over a wide period of time, re-contaminating surfaces even after cleaning.

WELL stipulates that all regularly-used surfaces meet antimicrobial criteria set by the U.S. Environmental Protection Agency to kill and prevent microorganism growth. Both copper and brass perform well in this regard, as confirmed in the above study investigating COVID-19's lifetime on surfaces.

Additionally, the WELL standard provides clear guidance on both sink dimensions, water column length, automatic tap and soap dispensers and the use of paper towels as opposed to hand dryers. This is to ensure that where handwashing occurs, the virus is not deflected out of the basin contaminating the surrounding area. Automatic doors should be considered where feasible to reduce contact with typically high contact surfaces, especially between washing hand facilities in the toilets and kitchen/eating areas. Further to this, WELL requires a strict cleaning protocol to be followed and logged regularly; it may be recommended to increase the frequency of this cleaning log and the use of UV-C cleaning equipment on return to the workplace.

Further Recommendations:

- **£** Implement a clear and thorough cleaning strategy — following guidance from bodies such as the CDC, paying special attention to high-contact surfaces
- **££** Consider touch free access — where possible, especially to office accommodation and the route from wash facilities to the canteen
- **£** Self closing toilet lids — to prevent droplets becoming airborne during flushing
- **£** Add personal hygiene support — promoting regular and thorough handwashing as well as other personal hygiene matters to all employees
- **£££** Consider replacing materials which support the virus longer — namely, plastic and stainless steel with copper or brass

Future Considerations

As we look to move out of the lockdown phase and return to our regular places of work, ensuring our buildings are designed to optimise both our health and wellbeing will be more important than ever. Preparing from Day One will be of paramount importance, carrying out a 'return to work' protocol

alongside a virus-specific risk assessment would be recommended. Furthermore, we advise investigating the feasibility of implementing the principals set out within the WELL Building Standard into any new or existing building.

COVID-19 has been the biggest shock to our society and economy in recent memory. Lessons we learn from it will shape the way we design buildings moving forward. Our buildings, just like our society, are unlikely to ever be the same again.

Head over to our website to find out how Cundall has applied the WELL Building Standard™.

***The information provided is based on our current understanding, but because corona virus (SARS-CoV-2/COVID-19) information is so new, some guidance is taken from research looking at other viruses or papers that may not have gone through the full peer-review process. Cundall excludes any liability for any direct, indirect, incidental damages or any other damages that would result from, or are connected with the use of the information presented in this document.*

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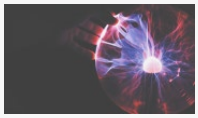

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