Covid-19 Infection Risk Modelling

MODELLING TEAM
Thomas Avery-Hickmott MSc
Dr Giulio Vita MEng PhD
Patricia Pino IMEchE MEng CEng
Rob Rowsell IMEchE MEng CEng

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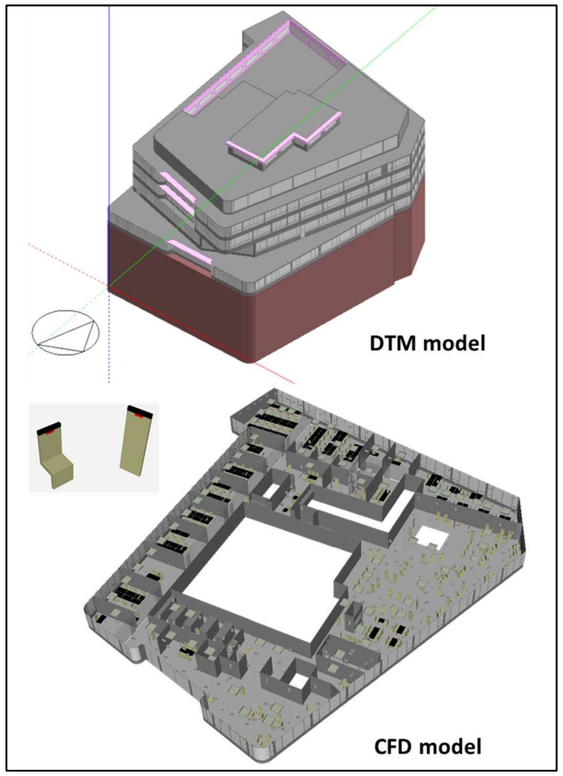
COMBINING DTM/CFD CAPABILITY

Both Dynamic Thermal Modelling (DTM) and Computational Fluid Dynamics (CFD) were used to establish airflow and thermal conditions inside the space.

A full DTM of the office building was run over the coldest and warmest weeks of the data year. The and day and time within these periods that result in the highest CO2 concentrations was identified and selected for steady-state CFD modelling.

The DTM modelling solved for the effects of radiant heat transfer and informed key boundary conditions in the CFD modelling. It also provided an initial measure of internal CO2 concentrations.

The CFD then solved for convective heat transfer and its effect on airflow.



Geometries of DTM model using DesignBuilder Software and CFD model, using Ansys Fluent

OPENAIR METHODOLOGY

The OpenAIR methodology is based on CFD airflow data combined with informed assumptions on viral loads from well-established literature.

Estimated CO_2 values obtained in both the DTM and CFD models were firstly used to assess the performance of HVAC system and identify poorly ventilated areas. Age-of-Air values were also derived from the CFD model.

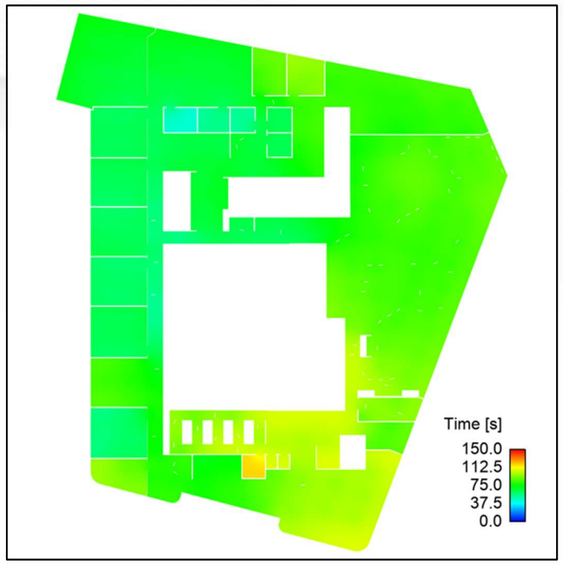
A number of emitters, representing asymptomatic infected people, were placed around the building, at various locations. These captured a good variety of office spaces as well as locations of relatively high CO_2 concentrations.

A value for the limiting dose of Covid-19 RNA copies required for a 63% chance of infection (HIN63) was obtained from the available literature.

Assuming minimum distancing requirements are enforced and masks are not worn, the modelling can focus on estimating risks resulting form the transport of aerosol particles.

Results were expressed as hourly airborne infection rate, and displayed the % of the limiting dose that an occupant would inhale in an hour.

CO_2 concentration (ppm)



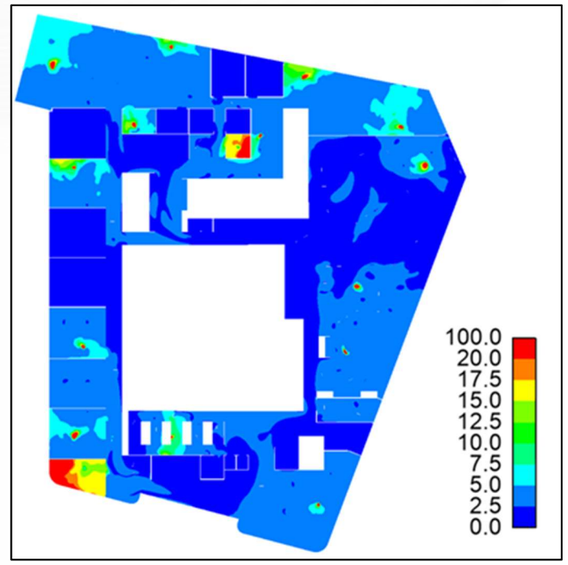
Age-of-Air results (s)

Emitter groups subdividing emitter persons.

INDICATIVE RESULTS

Research on the required dose for Covid transmission is ongoing, so the results are only indicative to a general risk of infection.

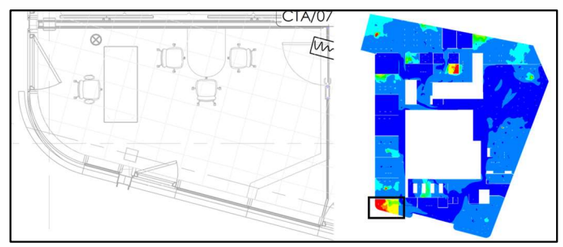
However, as our understanding of Covid-19 improves, this methodology can be used as an indicator of ventilation efficiency with regards to airborne diffusion of contaminants.



Hourly Airborne Infection Rate (%)

INFORMING DESIGN

Using this methodology designers can understand the risk within their spaces, and where appropriate develop strategies to mitigate it. This can involve changes to HVAC systems or internal layouts and/or generating protocols for the occupancy or general use of the space.



Testing different Furniture layout options