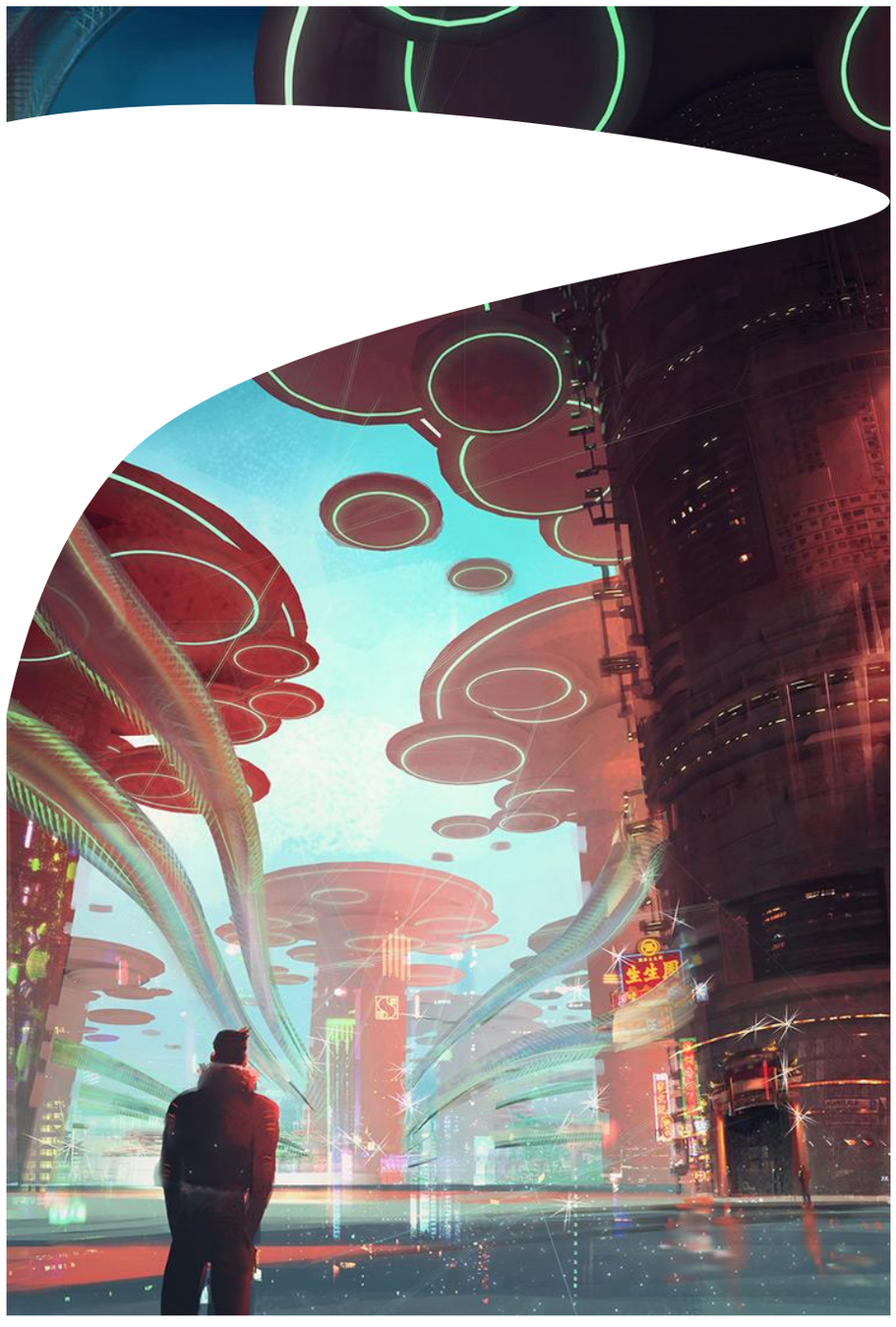
…sustainable building services solutions



the workplace…COVID-19 and beyond…

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The image on the front of this report may seem futuristic, but so were films 20 years ago about pandemics, and here we are in the midst of the COVID-19 pandemic. It has rocked the world and impacted the world economy.

Sometimes it takes a catastrophic event to trigger progress. They act as a wake-up call and stimulate new ideas based on new drivers. Traditional outdated and inefficient operational practices can then be challenged and refreshed with market support rather than resistance. We feel the COVID-19 pandemic will mean exactly this for engineering services serving the workplace and result in improved working environments.

History suggests that the economy will recover. It is the restrictions currently placed on individuals during the containment stage that, in some form, are here to stay and will mould the future of the workplace and how we interact with each other to conduct business.

As we migrate back to the workplace, the anxiety created during the worse periods of the pandemic will naturally provoke people to ask the question *'what is the suitability of my workplace and its resilience to limit the spread of viruses or any other airborne contaminants'.*

The world going forward will now demand a working environment that can satisfy questions such as this and prioritise health over outdated inflexible technical specifications.

Transparency with regards the science behind control of viruses is required to definitively deal with the problem. However, this is out of our control and we are engineers, so until more details are available, we have limited the subject matter within this document to areas where we can identify, improve or correct inherent shortfalls within tried and tested commercial office building engineering systems. The intention being to minimise or alleviate the concerns that the COVID-19 pandemic has raised, but also address the wider question relating to all airborne contaminants that will stem from it.

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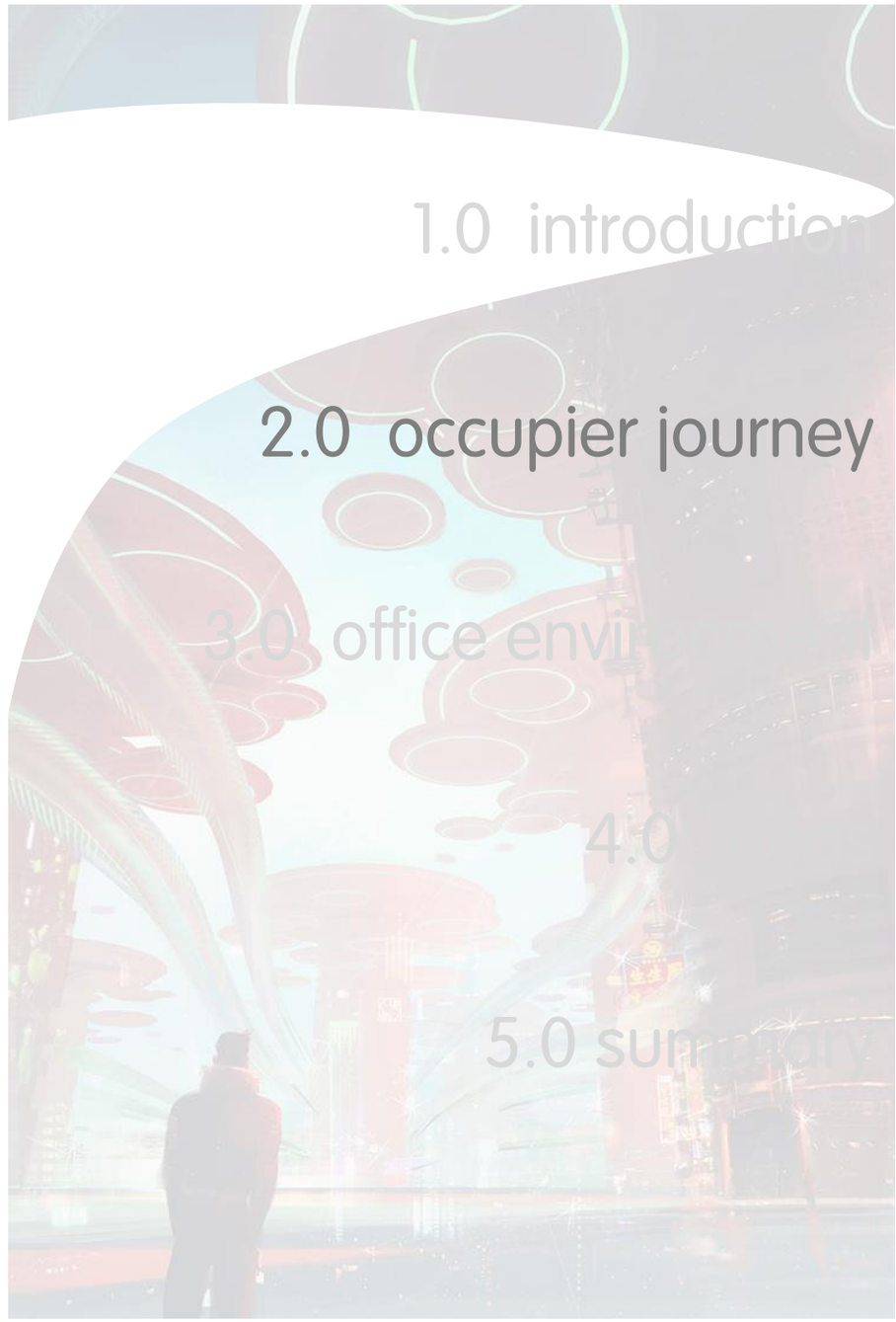

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the challenge…

Following the commute, typically occupants access their workspace through the reception or via an end of trip facility.

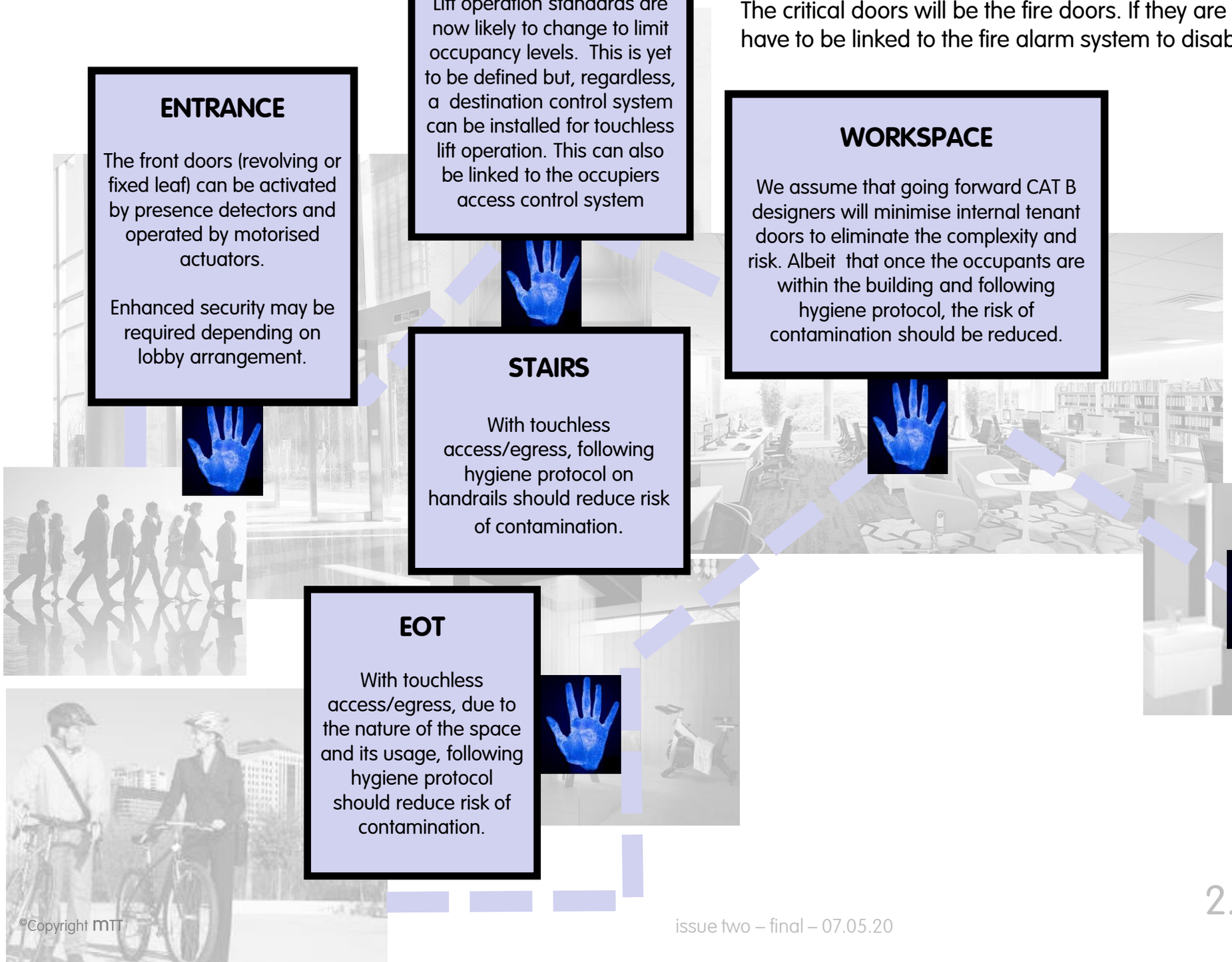
During the day, they will then use washroom facilities and possibly go in and out of the building to get lunch or attend meetings etc.

Throughout this journey, there are a number of main 'touch points' where contamination could occur.

ideas…

As noted, there are already systems and equipment available to facilitate touchless entry and egress from office buildings.

However, once in the building, internal doors could prove to be more of a problem. The critical doors will be the fire doors. If they are to be remotely operated, they will have to be linked to the fire alarm system to disable under alarm.



ENTRANCE

The front doors (revolving or fixed leaf) can be activated by presence detectors and operated by motorised actuators.

Enhanced security may be required depending on lobby arrangement.

LIFTS

Lift operation standards are now likely to change to limit occupancy levels. This is yet to be defined but, regardless, a destination control system can be installed for touchless lift operation. This can also be linked to the occupiers access control system

STAIRS

With touchless access/egress, following hygiene protocol on handrails should reduce risk of contamination.

WORKSPACE

We assume that going forward CAT B designers will minimise internal tenant doors to eliminate the complexity and risk. Albeit that once the occupants are within the building and following hygiene protocol, the risk of contamination should be reduced.

EOT

With touchless access/egress, due to the nature of the space and its usage, following hygiene protocol should reduce risk of contamination.

WASHROOMS

With touchless access/egress, following hygiene protocol should reduce risk of contamination.

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As can be seen, implementing measures to de-risk the journey to the workspace is easily understood by tenants as its logical and visually identifiable. They will get it!

Once within the workspace, the emphasis will be the environment and how it is maintained. This is not so easy to see or understand. It is this lack of understanding that will potentially cause concern.

Currently, the agent world rely heavily on BCO and CIBSE standard specifications as yardsticks when acting for tenants. More recently BREEAM, WELL and WiredScore have also come to the fore to address environmental and wellness issues.

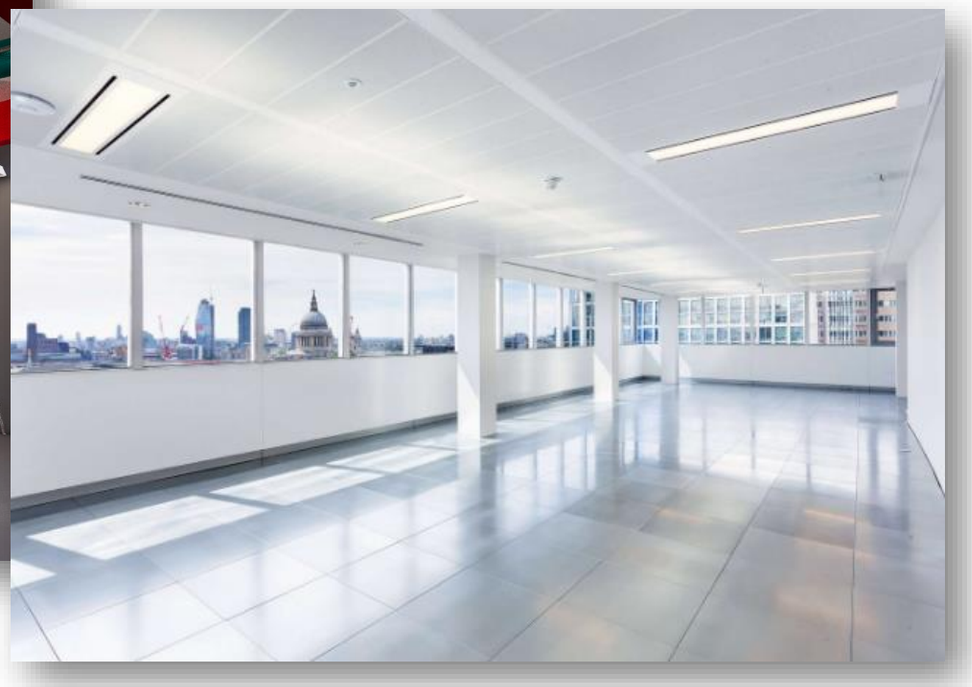
At present, the specification for most commercial buildings covers the requirements of a very broad market when in reality 80-90% of all occupiers could be satisfied with a reduced specification. This results in most engineering systems operating below their efficient capacity. It is more frustrating as it has been demonstrated that actual usage of buildings is way below design standards but the market hasn't adjusted and the perception remains that you can't let your building without ticking these boxes.

Following this pandemic, we feel there will be a big shift away from 'standard' requirements and the rules will be re-written with the emphasis being on the welfare of the occupants and not the box-ticking exercise. Buildings that can offer a cleaner environment will win over conventional offers. The choice is likely to be health over inflated power allowances for example which will allow alternative solutions to be properly considered, rather than dismissed out of hand.

When these reduced specifications are applied across the entire building, the savings made in infrastructure and energy will show real benefits environmentally and the capital freed up could be spent to enhance the user experience.

The main contributor to achieving a clean environment is the air conditioning/ventilation system. Within this section we have outlined the systems utilised within most commercial offices and their strengths and weaknesses with regards to protecting the occupiers from contaminants.

There are many air conditioning systems and variants of them. However, most Grade A commercial offices use the ceiling void to distribute the fresh air, extract the polluted air and to house the terminal devices used to supply tempered air to the space for heating and cooling. This is a fundamental problem when trying to create a clean environment. We have addressed this issue in the following pages.



This image shows a typical ceiling void services for a fan coil unit solution.

the challenge…

The inherent issue with ceiling mounted solutions, is that conditioned air is supplied from the ceiling into the space. In most cases, the conditioned air is a mixture of fresh air and filtered recirculated air taken from the ceiling void (mixing systems). This air then entrains room air at the point of supply. As the entrained air is room air rising from the workspace, it contains impurities. These impurities are then recirculated back into the workspace. Going forward, this is likely to be a fundamental concern for occupiers as following the current pandemic, their attention is focused on the need to isolate from possible contamination.

Scientists have yet to issue categoric data to determine if the offending particulates can actually remain airborne or not, but someone's perception is often their reality and this should be addressed as we cant predict the make up of future viruses etc.

Conditioned Supply Air

Extract Air

Entrained Air

There are alternative terminal devices, for example VAV (variable air volume boxes), that are sometimes used, but regardless, the problem still exists.

Up to now, due to the nature of normal contaminants and our bodies natural defence mechanisms ability to deal with them, these commonly used systems have been widely accepted. Hence they are installed in most commercial buildings. It has not been seen as a problem.

Obviously with the heightened concerns, office space providers are likely to be challenged on this and will need to demonstrate all possible steps have been taken to limited or remove the risk.

Early indications from the Government is that screens, such as the ones shown to the right, will be required for certain office environments to comply with the 'back to work' strategy.

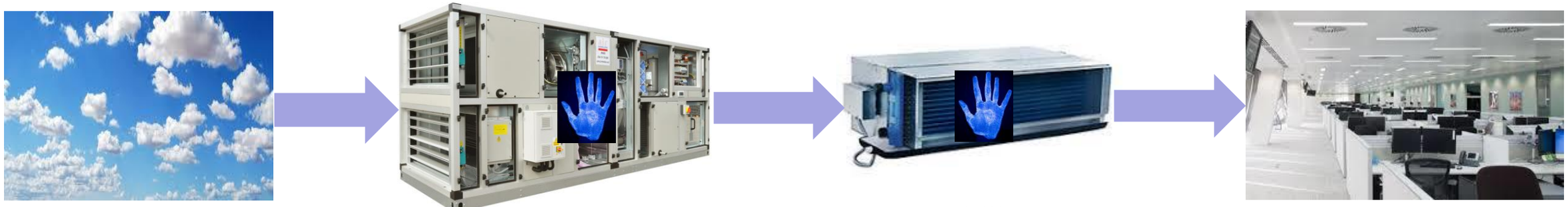
Whilst these will help with direct screening of the occupants, they will not stop the air from above impacting the occupants micro-climate.

So; what can be done for existing installations that utilise ceiling supply systems?

Initially, we will concentrate on the biggest problem; what are the options available for existing installations utilising ceiling supply devices? Following on, we will look at ideas for new installations.

Note: As the purpose of this report is to offer initial high-level thoughts and ideas, we have based this particular analysis on a fan coil unit system as it is the most commonly used. For any other systems, specific analysis is required as the relevance of the comments will vary.

As with the occupier journey, the air within a building has its own journey, from outside, via conditioning/terminal units and into the space.

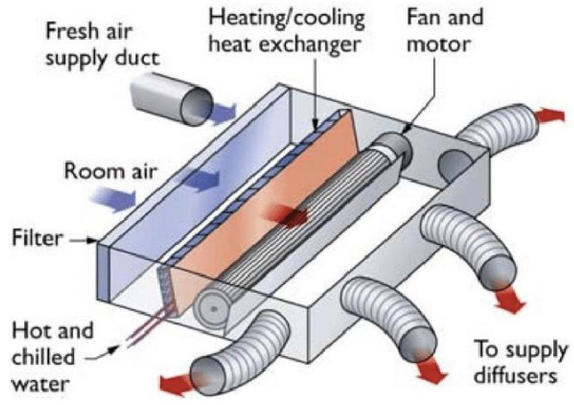


On this journey, the fresh air is filtered in two places. Once within the air handling unit (AHU), and then at the fan coil unit (FCU) before being supplied into the space.

A FCU system is termed a 'minimum fresh air' mixing system. This is because a fixed amount of fresh air is supplied to the space based on occupancy levels. An example being 16l/s per person based on one person per 10m^2. The fresh air is then mixed with return air from the space (via the ceiling void) drawn into the rear of the FCU, filtered, conditioned and then supplied into the space.

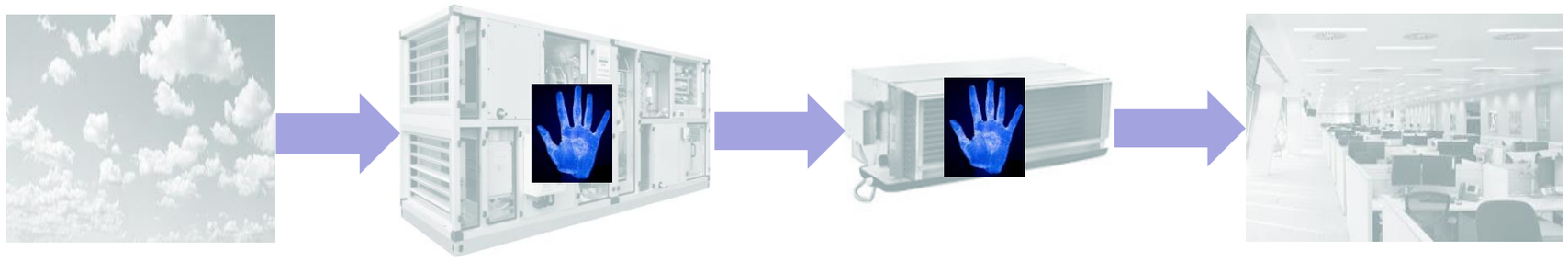
The quantity of air supplied to the space from the FCU is normally fixed and is supplied at a variable temperature to offset the heating or cooling loads with the space.

The fresh air, as a percentage of the total air supplied to the space from the FCU, is often only around 15-20%.



ideas…

So; with existing FCU systems, we can and should improve the filtration at the AHU and (when the technology exists) at the FCU, but we cannot prevent the recirculation locally of impurities within the space.



On the face of it, this could potentially be a major negative for the occupiers. However, as this situation is so widespread and it will be impossible to retrofit 'cleaner' systems due to the practicalities of doing so, we believe this situation will be managed as best as possible during periods of heightened concern and these systems (with enhanced filtration) will be accepted. However, going forward, a re-think will be required. For example; reconfiguration of fresh air supplies to facilitate purging is one easy win.

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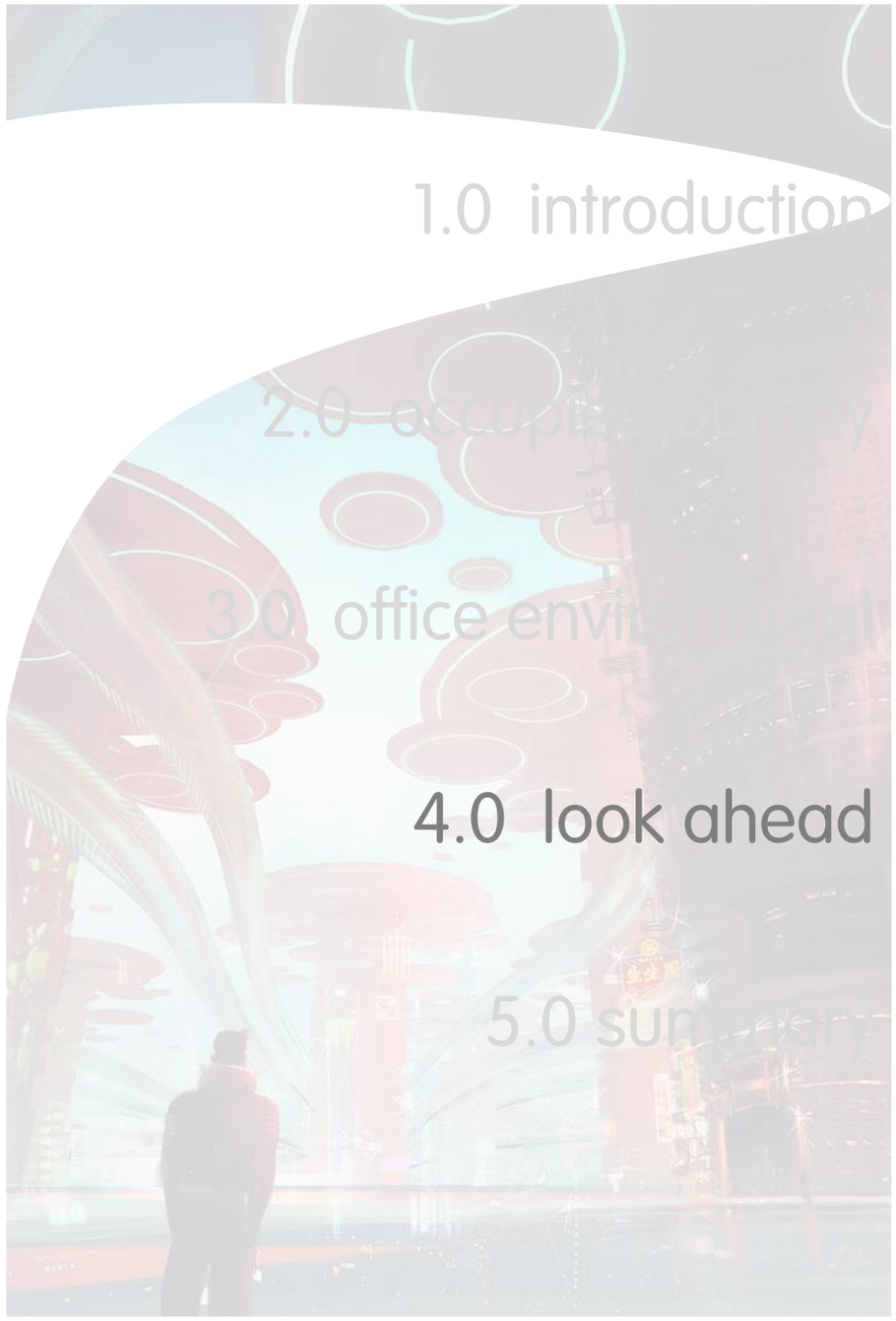


As noted, there are a number of alternative systems, and variations on a theme, but all ceiling mounted mixing systems have the potential to recirculate contaminated air.

So what alternatives exist to reduce this risk of contamination?

An extreme solution is laminar down flow. However, this is for pharmaceutical and medical applications and is not a viable option for the commercial market.

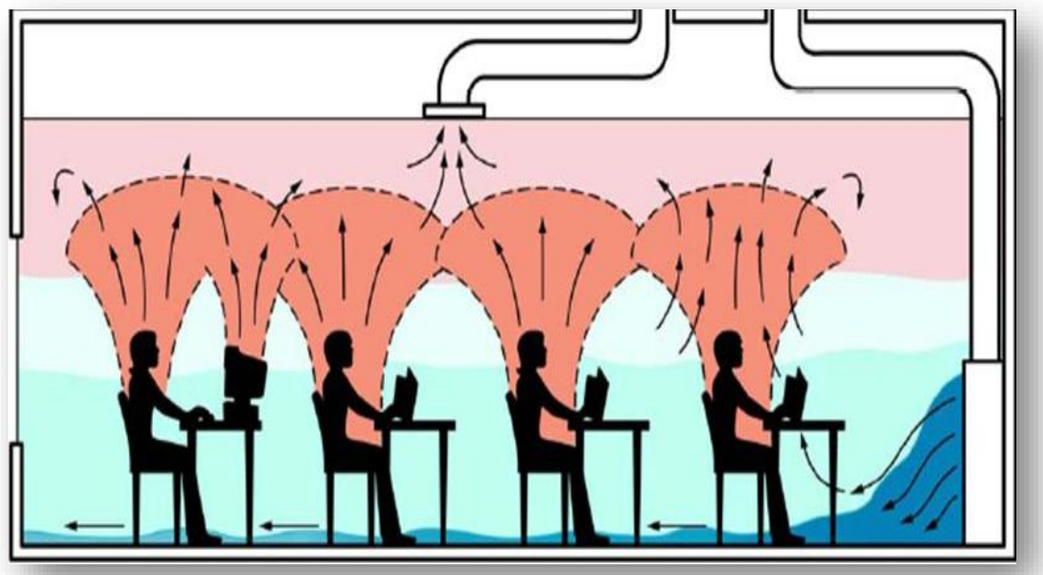
For many years underfloor or displacement systems have been used in various applications all over the world. In the Far East and Scandinavia, they are generally accepted and widely used for the commercial office market where the driver of the provider is to provide a quality environment that is fit for purpose, and not one based on rigid technical provisions.

In the UK, some providers have embraced the philosophy and successfully utilised underfloor systems to supply the commercial office market. Pure displacement is more challenging.

Conventional displacement systems are passive. They are termed 'all air' systems.

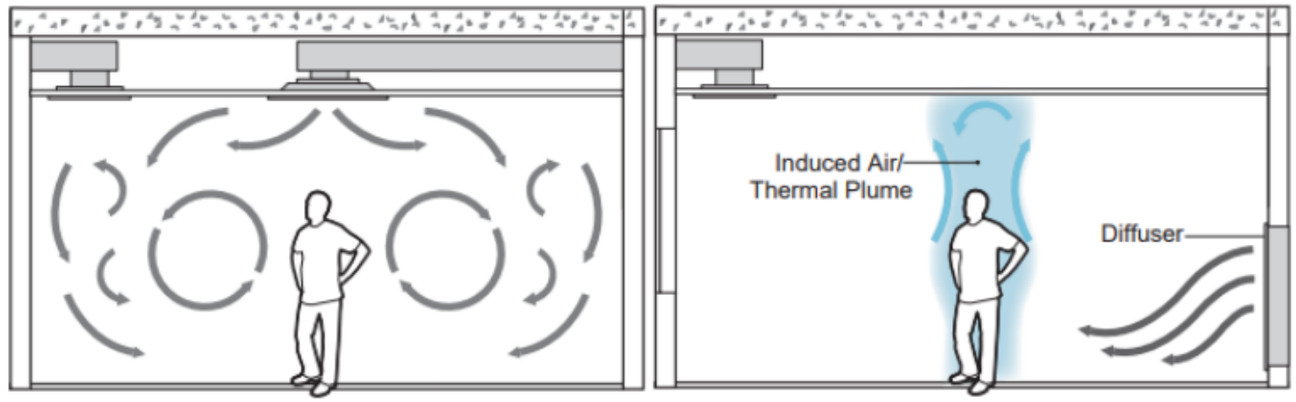
They rely on air being supplied at low level around three to four degrees below the notional occupied zone temperature. This air is then attracted to the heat sources within the space and as it heats up, it rises up the heat source creating a micro-climate. Low level supply air is either via plenums or floor mounted swirl diffusers.

Polluted air is then extracted at high level. There is no recirculation of polluted air.



In this scenario, heavy contaminants will fall to the floor and due to the passive nature of the system, they are likely to stay there, as appose to mixing with the air in the occupied zone.

This image shows the difference between a mixing system and displacement. It is clear which one provides the cleanest environment.



Main limitations with pure displacement are;

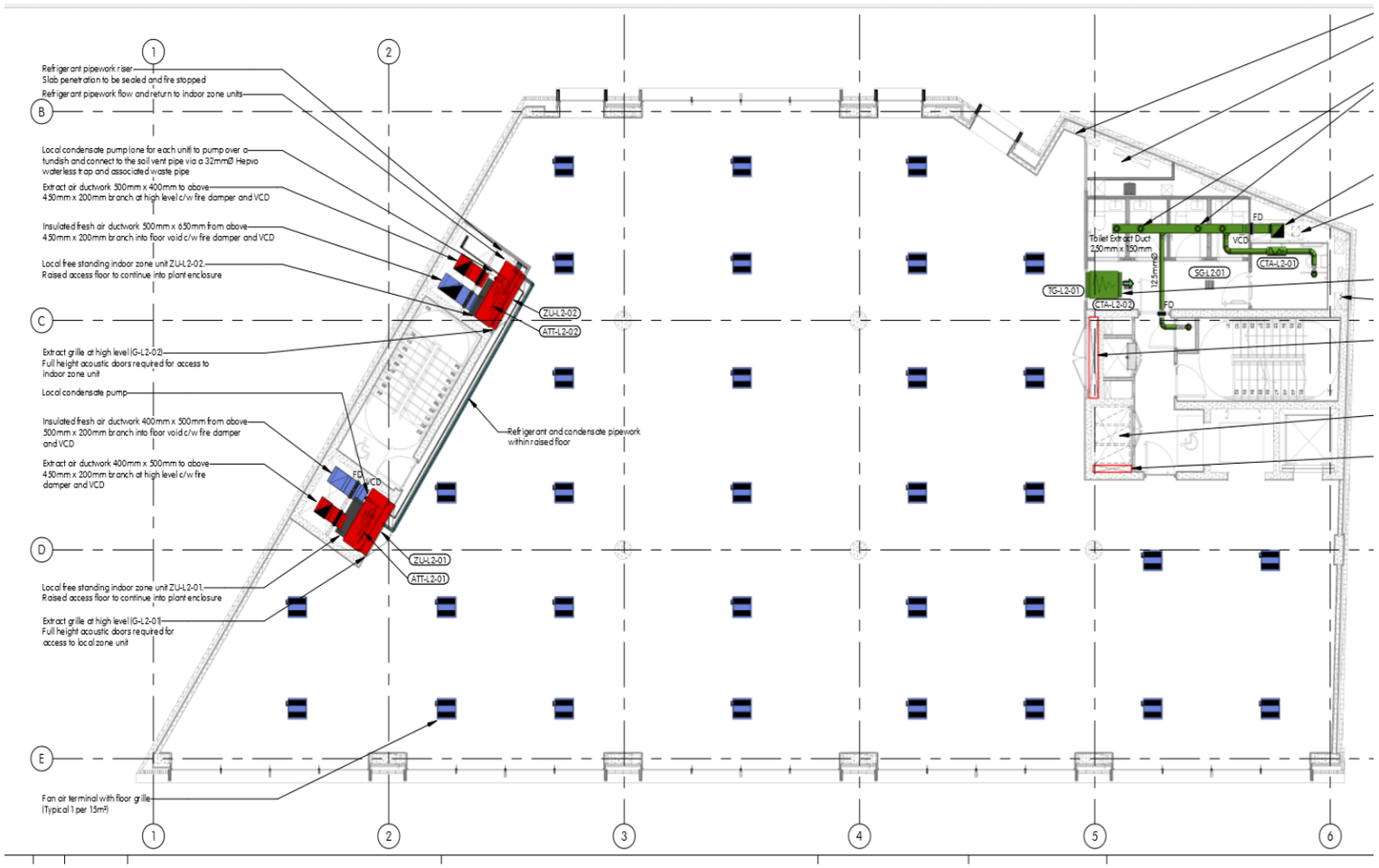
- It is not a retrofit solution, more a new build option
- It needs good floor to floor dimensions as It relies on stratification and comfort conditions being maintained only within the occupied zone.
- It can only deal with limited small power cooling loads which are lower that that currently being specified.
- It requires more plant and riser space than a FCU system.

Although it has these limitations, through application and detailed engineering, we feel the bespoke requirements of most office users could be satisfied.

Although pure displacement may not be a viable option for the majority of applications, we feel that If the impact of this pandemic is to focus occupier awareness on the ability for their systems to provide a clean environment, underfloor/low level supply, coupled with high level extract will become the new standard.

This being the case, the quasi solutions of choice, which is already used extensively around the world and in some buildings within London and the UK, will be underfloor solutions.

The image is a typical floor of project utilising an underfloor system we completed for an institutional client recently.



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There cannot be a wholesale change overnight. Existing systems have been perfectly adequate to date, even with other viruses and suchlike as part of our life. The fundamental change is that now the population is more aware, and certainly in the short term anxious, about how their environment could affect them.

So; how do we make the best of what we have and adapt them to alleviate these fears as best we can?

Some easy wins are detailed within sections 2 and 3 of this report, and there will be others, such as regular ductwork cleaning and enhanced hygiene protocols. However, as buildings come back to be refurbished, we believe that this is the time to take stock and design solutions to minimise future risks and realign occupier perceptions to maximise revenue.

We have successfully implemented suitable systems within limited building envelopes previously, so we know physically it can be done.

The major shift has to come from the market to support designs and systems that are economic, efficient and fit for purpose. Not fit for any imaginable purpose. After all, most commercial occupiers have similar occupational density and power requirements. Flexibility within the infrastructure and spatial provision can be allowed for that 'just in case' scenario.

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