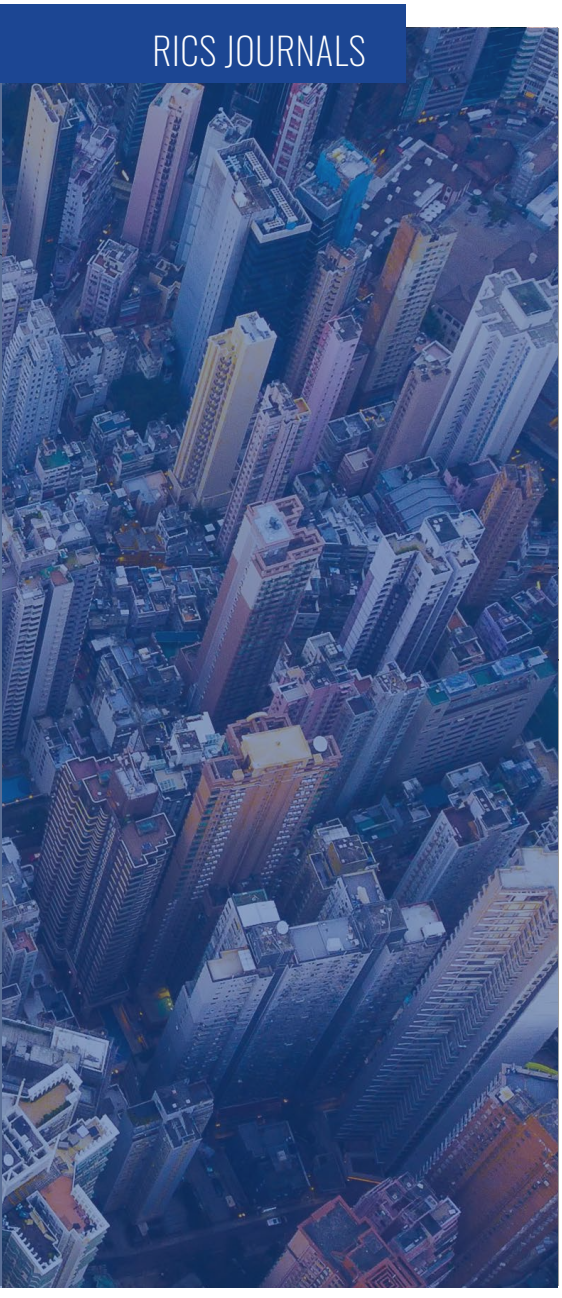
Construction Journal

Editor's choice

MARCH 2022 – MAY 2022

RICS JOURNALS



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Contents

Conflict Avoidance Process helps stop disputes before they happen

CONSTRUCTION JOURNAL
First published 7 April 2022

By Len Bunton FRICS
and Janey Milligan

Contractual disputes are an ever-growing threat to construction projects. But early intervention can prevent small problems from escalating into costly drawn-out affairs

Despite being considered an essential industry, the construction and infrastructure sector still experienced its fair share of difficulties as a result of the COVID-19 pandemic.

Supply chain interruptions and increased costs of materials, as well as other issues such as adapting to remote working and implementing new and changing health and safety measures, had a ripple effect and new construction work experienced a record fall in 2020.

However, a positive shift also occurred; the industry has experienced a change in mindset to a more collaborative, cooperative approach to the procurement and delivery of construction and engineering projects in the UK, and this is supported by the UK, Scottish and Welsh Governments and the NI Executive. A major contributing factor for this change has been the development and implementation of the RICS Conflict Avoidance Process (CAP).

What is the Conflict Avoidance Process?

CAP is an early intervention vehicle that encourages the resolution of emerging issues and prevents them from escalating into disputes. The process is managed by a CAP professional who is a technical expert on the subject at hand, as well as an experienced dispute resolver.

The CAP professional may take an inquisitorial approach, visiting the site, holding meetings with both parties, and requesting sight of particular documents, and whatever else they consider necessary to inform their understanding of the dispute. The CAP professional will issue within 28 days (unless otherwise agreed with the parties) a non-binding written recommendation for how parties should move forward and resolve the dispute.

It is a swift, efficient process conducted by an industry expert to help move the project forward without further delay. It then allows those involved to focus on delivery of the project.

CAP is now tried and tested following numerous pioneering projects carried out by Transport for London (TfL) and RICS over the past few years.

Over 250 procuring authorities and construction companies from across the supply chain have signed the Pledge

It has led to the resolution of various high-value disputes on live, large-scale engineering projects, resulting in significant savings and a reduction in legal and consultancy costs.

Key benefits of CAP

1. It preserves working relationships. By enabling parties to identify and dispose of emerging issues early, it helps to mitigate risk and protect both commercial relationships and business reputations.
2. CAP professionals are industry experts. They are credible and experienced in the subject matter on which the parties have a disagreement.
3. There is no upfront cost as you don't pay if you don't use it.
4. The CAP professional's recommendations are not binding, unless both parties agree otherwise.
5. Recommendations are fully reasoned out and give parties a clear indication as to what the outcome might be if the disagreement ends up being adjudicated, arbitrated or litigated.

Conflict Avoidance Pledge

The **Conflict Avoidance Pledge** was developed by several of the UK's leading professional bodies for construction and engineering. It is a voluntary commitment by organisations to proactively avoid and manage disputes by using early intervention procedures.

By signing the Conflict Avoidance Pledge, Pledge organisations will integrate the principles of cooperation and conflict avoidance into the way they conduct business. Over 250 procuring authorities and construction companies from across the supply chain have signed the Pledge, indicating their commitment to work collaboratively to avoid the time, costs and reputational damage that can be caused by unresolved disputes.

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Progress to date

Support for CAP and a commitment to embedding conflict avoidance mechanisms into projects is gaining traction across the UK. The Conflict Avoidance Coalition Steering Group, which is made up of the leading professional bodies for construction and engineering (including RICS, RIBA, ICE, CIArb, ICES, TfL, Network Rail, and DRBF) continues to work together to promote conflict avoidance and the Pledge across the construction industry. Support for the principles of collaborative working has been received from BEIS, the CLC, the CICV Forum in Scotland, and many more.

In Scotland, a Working Group is driving the campaign forward by bringing together a raft of procuring authorities, including the Scottish Futures Trust and NHS Scotland, who have indicated their commitment to conflict avoidance by signing the Pledge and writing CAP into their contracts. There is also ongoing engagement with the Small Business Commissioner and key government regulators regarding the implementation of CAP into major projects.

In conjunction with RICS, a number of CAP Ambassadors are joining the initiative to advocate the benefits of CAP and to encourage more organisations to sign the Pledge.

How to get involved

Becoming a Pledge signatory will signify your commitment to working collaboratively to ensuring projects are delivered on time, on budget. It will also indicate to others that you see value in maintaining good business relationships and dealing with disputes early and amicably.

Another recent development has been the formation of the Conflict Avoidance Community on LinkedIn and to date 370 organisations have joined the Community to share experiences and to input into developing a conflict avoidance culture.

For further information please contact **capledge@rics.org**

> "For many years, disputes have delayed too many projects and damaged too many commercial relationships and brands, often at immense financial costs.
>
> The Conflict Avoidance Pledge and tried and tested procedures such as CAP, which can be highly effective at dealing with emerging problems early and cheaply, are simply common sense.
>
> It is encouraging to see more and more people and businesses embrace the concept of conflict avoidance and take practical steps to implement CAP into their contractual arrangements."
>
> Martin Burns, Head of ADR Research and Development, RICS

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The day job: A quantity surveyor in Hong Kong

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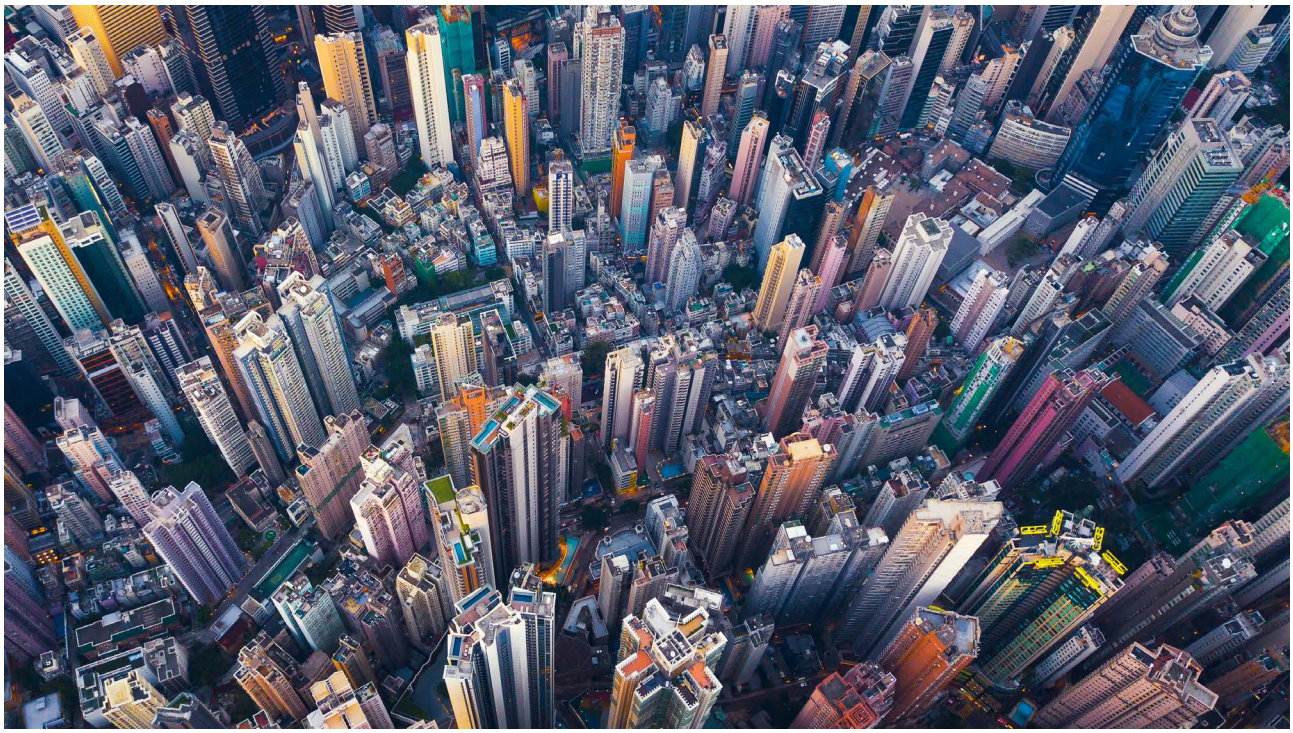

By Dr Stanley Chow FRICS

Insights gained in more than 25 years of consultancy have emphasised for one QS the value of becoming chartered, and prompted him to share his experience with the next generation of professionals

Construction Journal (CJ): Tell us a little about how you became a quantity surveyor (QS).

Stanley Chow: I received my diploma in building studies in 1994. After that I joined a QS consultancy. At the same time, I took a part-time evening higher diploma in building, graduating in 1997.

During this time, I knew that becoming chartered would be a significant benefit to my QS career. So, after I completed my higher diploma, I went to the UK to study further. I received a BSc (Hons) in quantity surveying with the higher diploma counting towards it, and an MSc in construction management and economics the following year. I spent a total of eight years working on my fundamental skills and taking CPD while in a consultant role in Hong Kong and achieved my MRICS. After 5 years of membership, I achieved FRICS when I was 34 years old.

Although there is no legal requirement in Hong Kong and China to be chartered if you are going to practise as a surveyor, RICS guidance and training is designed to maintain the highest professional standards for members. Therefore, local clients in these markets rightly feel that RICS members can add value to projects, and many seek to employ a QS who is chartered.

Local clients ... rightly feel that RICS members can add value to projects, and many seek to employ a QS who is chartered

CJ: Can you tell us about some interesting projects you have been involved in?

SC: As a contractor QS, I worked on a hospital extension project. This gave me an insight into the special requirements for such buildings, including the thickness of reinforced concrete, with heavy steel plates in the slabs and walls to contain x-ray radiation.

The experience helped me understand the importance of special requirements for different types of project. As a developer QS, I worked on a variety of projects including residential, commercial, retail and hotels.

I also found that there is a common misunderstanding about the difference between working as a QS for a consultancy and for a developer. In general, the former focus on the raw numbers, but the latter are primarily concerned with cost. Given my experience, I advise QSs working in consultancy that they should focus on the holistic cost rather than just a set of numbers.

In addition, I have found that whether I am working for a contractor, consultant, or developer, RICS standards and guidance are a fruitful source of information for QS practitioners.

CJ: Before you became a university lecturer, were you involved in mentoring?

SC: I have worked with RICS for more than 15 years, starting as a mentor when I achieved MRICS. In 2015, I was invited by the RICS **Learning Hub** to provide training sessions for potential APC applicants. I have also worked as a counsellor, and was an assessor for RICS APC final interview panels for many years.

Most candidates struggle to prepare correctly for the final interview. In training them, I shared my point of view as an assessor and offered them guidance. It was very meaningful to me, and I enjoyed it a lot.

I applied to become an RICS licensed assessor trainer (LAT) in 2018. After being trained and assessed in the UK, I became an RICS LAT for Hong Kong. There are just three such trainers in the city, and I am proud to say I am the only LAT representing both QS and project management (PM) pathways in Hong Kong.

I love to share my knowledge and experience with the next generation. I know they need more support and encouragement.

CJ: Do you have any advice you'd like to share with APC candidates?

SC: Becoming a chartered surveyor is the most important professional achievement in our lives; it is a globally recognised qualification. It might be difficult to achieve, but do not give up! Finding a suitable mentor or counsellor is critical for candidates. RICS members always welcome candidates who seek help.

Becoming a chartered surveyor is the most important professional achievement in our lives

CJ: Do you have any advice for members who might consider becoming an APC assessor?

SC: Being an assessor is a prestigious role, which maintains the high standard of RICS membership. Both candidates and assessors need to understand the APC requirements thoroughly and prepare well, because assessment represents a significant time commitment.

Assessors are gatekeepers for the profession and have a duty to advocate for surveying. A good assessor must be passionate in promoting the use of professional standards.

I encourage assessors to make the following five commitments.

1. Always provide a high standard of service. As a proud assessor myself, I do not just encourage assessors to share assessment experience but also continue to keep abreast of construction industry developments.
2. Take responsibility. Assessors should commit to promoting the surveying profession and supporting every APC candidate on their qualification journey.
3. Assessors must abide to by the letter and spirit of guidance on diversity and inclusion.
4. Treat others with respect. Assessors must think and act without bias and discrimination.
5. Committing time is the most important attribute for assessors.

CJ: What changes would you like to see in the construction industry in Hong Kong and China?

SC: The global shift towards sustainable construction is as high on the agenda here as it is everywhere else. Modular integrated construction (similar to Modern Methods of Construction in UK) is one innovative method now commonly used in Hong Kong, for instance. New technologies and sustainable or recyclable materials are also a high priority in China and Hong Kong at present.

Being an assessor is a prestigious role, which maintains the high standard of RICS membership

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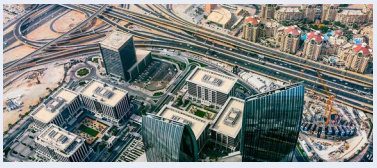

The day job: a quantity surveyor in the UAE

By Chido Madamombe

CJ: What general engagement do you have with the construction sector outside China?

SC: A large number of Chinese developers are investing in property markets outside the country. I believe this trend will last for a few years. Hence, a globally recognised qualification – MRICS – is crucial for any QS who may want to contribute to projects around the world.

CJ: What do you think will be the new or most important innovations in construction in the next five years?

SC: As I mentioned above, sustainable and recyclable materials are very important. In coming years, innovative technologies such as BIM, MMC etc. will come into common usage.

The goals of protecting the environment and saving energy will become focal points for construction. Balancing time, cost and quality with sustainability will become more and more important in the industry.

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The value of information management for surveyors

CONSTRUCTION JOURNAL
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By Sarah Davidson FRICS

Surveyors need to embrace the use of the data and information management processes set out in 19650-2 to ensure that clients and other parties receive the right information in a useable format and timely manner

When appointed by a client as an architect, surveyor, project manager, engineer or contractor on a project, the chances are that an organisation is going to produce information such as a cost plan, programme or model.

This information will quite possibly be needed by the client themselves. Where this is case, the obligation to deliver the information will be (should be) captured in the appointment between the client and the organisation.

The information might also be necessary to support work by other parties, whether the client needs it or not.

So, there is information that has to be delivered to fulfil contractual obligations and information that needs to be delivered for the project to progress (and for other members of the team to fulfil their obligations).

While we might be extremely competent in our particular specialisms, there are times when we're poor at sharing information when it's needed, in the right form and format and to the correct level of detail.

Maybe the client hasn't been specific about what they want and when; maybe we didn't get the information we needed from the client or other parties. Whatever the reason, this failure to provide the right information tends to have consequences for someone – often the client, sometimes ourselves – during the asset's life.

BIM Level 2 is no more

One objective of the UK government's BIM Level 2 initiative was to tackle this issue, and it was arguably successful to a point. It at least got us thinking about the potential of data and information, while collaboration became part of our day-to-day vocabulary, and technology moved on at pace.

However, time passes, we learn from experience and initiatives change and evolve. BIM Level 2 is no more. In its place we have the UK BIM Framework – the delivery vehicle for the information management mandate in the UK government's 2021 policy paper **Transforming Infrastructure Performance: Roadmap to 2030** (TIP).

The paper helpfully defines BIM as a combination of processes, standards and technology through which it is possible to generate, visualise, exchange and assure – and subsequently use and reuse – data and information as a trustworthy foundation for decision-making.

BIM Level 2 is no more. In its place we have the UK BIM Framework

There are two important points to bear in mind.

1 BIM covers the management of all forms of information, not just geometrical models.
2 It focuses on enabling robust processes through the use of standards and technology.

What is the UK BIM Framework?

The UK BIM Framework is a collection of standards supported by guidance and resources. These provide us with the processes so that we can manage information successfully throughout an asset's life: the standards tell us what we need to do, and the guidance and resources help us to understand why and how.

The standards include the BS EN ISO 19650 series, which sets out the processes for managing information during the design, construction and operation phases of an asset. The series is relevant to anyone who requires and uses or produces information. I think we can safely say that means all of us.

- ISO 19650-1 set out the concepts that are at the heart of the series.
- ISO 19650-2 is the standard covering the design and construction phase.
- ISO 19650-3 covers an asset's operational phase.
- ISO 19650-5 considers a security-minded approach.

New standards will be available in due course, to cover information exchange superseding BS 1992-4, and health and safety, superseding PAS 1192-6.

If you are familiar with the requirements of PAS 1192-2 and 1192-3, it is worth highlighting that there are aspects of these that are picked up by the ISO 19650 series. Equally, there are new concepts to consider.

BIM covers the management of all forms of information, not just geometrical models

Key points when applying ISO 19650-2

There are a few clear messages when we apply ISO 19650-2.

1 The information management process begins and ends with the client. They have to articulate what information they need from whom, when and to what degree of detail. They also have to set out the standards and processes to be adhered to in producing and exchanging information (the information management resources). The need for information is determined by proper consideration of what it will be used for, so that only useful and useable information is produced. The client then plays an important role in accepting or rejecting information, and they lead the process of reflecting on lessons learned from the project.
2 Any appointment in the supply chain should include the information management resources with information requirements that are specific to them. This is so that the organisation knows exactly what it needs to produce and what is going to make this information acceptable to the client or other party that needs it.
3 The capability and capacity to manage and share information is a key part of tender evaluation.
4 Information production and exchange should be planned; where there are just a few information deliverables, very little planning will be necessary.
5 Information should be checked and approved before sharing it with the client.
6 Information that the client needs should be shared through a common data environment, ideally one established by the client themselves.

The capability and capacity to manage and share information is a key part of tender evaluation

Making the change from manual to automatic

Just as our understanding of data and information manipulation and use continues to evolve, so does what we are required to do as surveyors and the way we do it.

When I was a practising quantity surveyor, I both feared and relished aspects of my job. I was often hesitant to start a big quantity take-off or cost planning activity. But by the end of it, I knew the design inside out and I'd often learned about some configuration of construction I hadn't seen before. I was equipped for detailed and confident discussions with the client and other members of the design and construction team.

It was a valuable process. But quite a lot of my work involved activities that could be easily automated. In addition, I was often reproducing or duplicating information that I had been given. The potential for error was high. So what informed my approach to such tasks?

1. The information I needed was often represented in PDF drawings and Excel or Word schedules and specifications. This meant that I had to copy it or rewrite it.
2. I didn't always trust the information to be as detailed or complete as I needed it to be.
3. The technology to help me properly wasn't widely available
4. I was convinced that my approach and reproducing information, was a process necessary to doing my job properly.

Admittedly it's a long time since I was in an active surveying role, although colleagues continue to report similar experiences. However, things have changed and we need to evolve.

First, if the processes set out in ISO 19650-2 are embraced by the client and the design and construction team then information should be available to us when we need it in an accessible and useable format. We should also be able to trust that the information we need is as complete as it needs to be and as correct as it needs to be.

Second, technology has moved on significantly. Using geometrical modelling software to produce designs

Quite a lot of my work involved activities that could be easily automated

certainly benefits surveyors. The data generated in modelling can be accessed, manipulated and supplemented so we can model and manage quantities, costs, options and risks.

This means that there is no duplication of specifications, no unnecessary measuring of quantities, no manual comparison of designs, and no poring for hours over drawings. It means that it is much easier to recommend or respond to changes in design. The ability to visualise and navigate geometrical models also helps us to understand design proposals in detail and in context.

A framework for reliable information

It seems to me that ever since we heard the phrase 'BIM Level 2', there have been discussions about what the future holds for quantity surveyors. I believe that it is very positive – but on the proviso that we embrace data and the technology that will enable us to manipulate it.

To do this we have to be able to trust the data and information that we receive and produce, and we have not only to rely on but also contribute to sound information management processes.

So visit the **UK BIM Framework** and take a look at the guidance and resources available. Think about the information you produce, the information you rely on, and the benefits for you, the project team and the client of information that can be trusted. Think about how you use technology – how your processes, and ultimately your profit margins, could be improved if you had reliable data and information you could use.

Then, the next time you see the words BIM Level 2 in a tender or appointment document, stop. Go back to the client and steer them towards the UK BIM Framework. And when you see UK BIM Framework in a tender or appointment document, check the resources that set out the information and technology processes and start planning how you will produce and share information.

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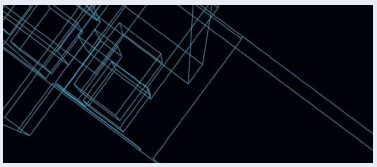

The BIM management competency

By Ewan Craig

The how and why of carbon dioxide monitoring

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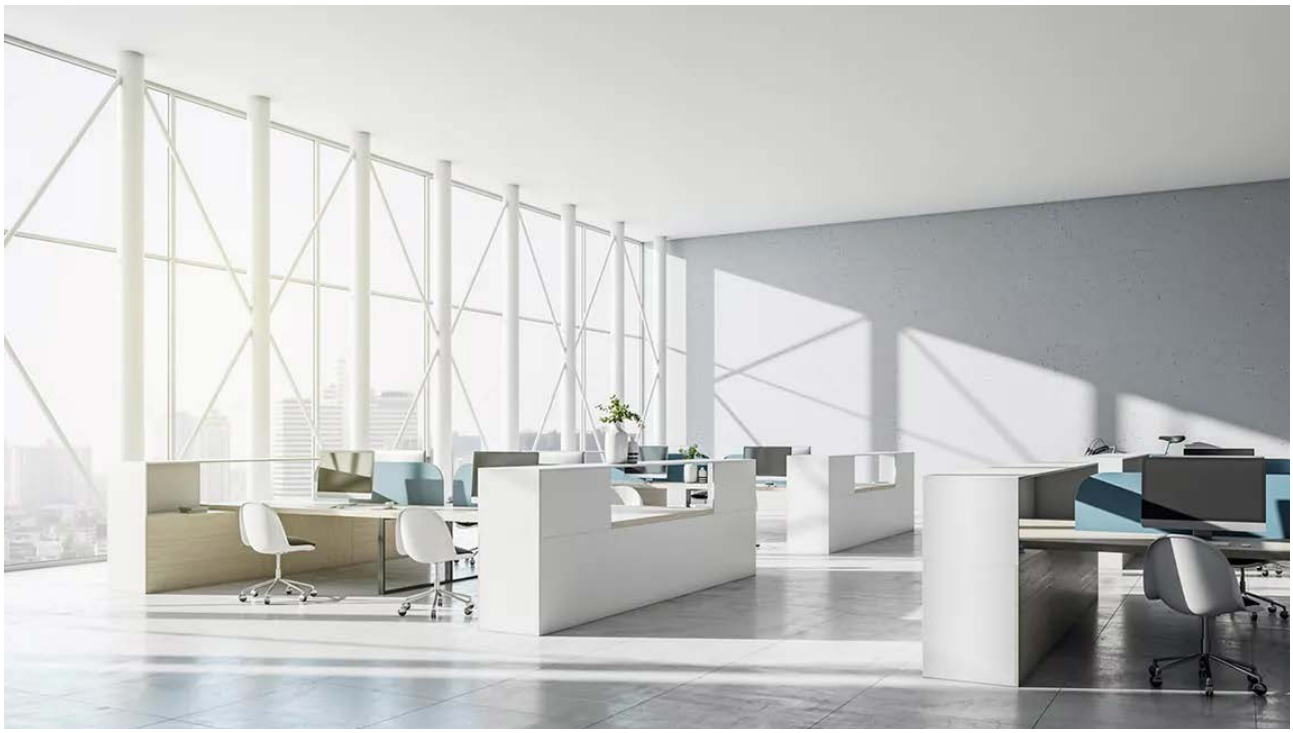

By Edwin Wealend

Monitoring carbon dioxide is soon to be required under Approved Document F, but is not without its problems. What should surveyors know about carbon dioxide in the air we breathe indoors?

Carbon dioxide, or CO_2, is a colourless and odourless gas. On average, it is found at about 400 parts per million (ppm) in the atmosphere, though most people will be aware that this concentration has been rising at an increasingly rapid rate since the first Industrial Revolution.

The gas is a product of both combustion and respiration, and it is this latter characteristic that makes it a useful proxy for air quality in the indoor environment.

Elevated levels of CO_2 are in most cases not immediately harmful to human health. However, they can be used as an indication of insufficient dilution of airborne pollutants such as volatile organic compounds (VOCs) and other bio-effluents, which are emitted or brought into a space by occupants. In short, high levels of CO_2 usually mean that not enough fresh air is being provided.

Elevated levels of CO_2 ... can be used as an indication of insufficient dilution of airborne pollutants

Why carbon dioxide correlates with COVID-19

After a slow start, most health organisations and governments have acknowledged that SARS-CoV-2, the Coronavirus that causes the disease COVID-19, is primarily spread in the form of droplets and aerosols expelled through respiration. In addition, the generation of these aerosols is increased when people breathe more forcefully, for example by singing, talking loudly, or exercising – activities that also generate more CO_2.

This correlation between CO_2 concentration and the risk of COVID-19 infection has led many organisations, such as the UK government's Scientific Advisory Group for Emergencies (SAGE) and the Chartered Institution of Building Services Engineers, to recommend the use of CO_2 monitors in some indoor spaces.

This allows occupants, who may well have no expertise in the science of building ventilation, to assess quickly whether a space is poorly ventilated, and hence presents a higher risk of COVID-19. A high-profile example of this approach is the **government's** recent distribution of 300,000 CO_2 monitors to schools in England and Wales.

It should be noted that SAGE highlighted a number of cases where CO_2 is not a good indicator of infection risk. These include large spaces where a significant reservoir of indoor air may disguise more local transmission risks.

Is regulation catching up?

The use of CO_2 monitors has also been included in the recent revision of the English Building Regulations Approved **Document F**, which takes effect on 15 June.

For new buildings, offices that have a floor area between 50m^2 and 320m^2 – corresponding roughly to volumes between 125m^3 and 800m^3 – and rooms where 'singing, loud speech and aerobic exercise' are likely to take place, should now assess indoor air quality using CO_2 monitors or other sensors.

While the Building Regulations have contained guidelines on common air pollutants for a number of years, this is the first time that continuous indoor air quality measurement has been legally required. As a result, CO_2 monitoring will almost certainly become a standard part of ventilation design, likely connected to a central building management system (BMS). Smart designs will use the CO_2 monitors to control the amount of fresh air supplied into the space, reducing fan power and assisting the drive towards net zero.

How carbon dioxide affects health and productivity

As well as an indicator of the fresh air supply to a space and its relationship to COVID-19 risk, the impact of CO_2 itself on health and productivity has been studied for decades.

At very high levels – more than 5,000ppm – there are known health and safety risks, which are covered by health and safety **legislation**. Even at levels exceeding 2,000ppm, which may be experienced regularly in poorly ventilated spaces, most research shows an increase in drowsiness and lower performance.

At levels less than 1,500ppm, which are more typical of modern buildings, the impact of CO_2 on human health

This is the first time that continuous indoor air quality measurement has been legally required

and performance is less consistent. A **study** by Xiaojing Zhang and colleagues found no clear relationship between CO_2 and cognitive performance. Some studies even found that higher levels of CO_2 on its own actually increased performance, up to a point.

This inconsistency likely results from the extreme difficulty of trying to prove causation between a change in the environment and a person's productivity. There are almost endless confounding factors that could lead to a change in performance, including other indoor pollutants.

The indoor environment is a cocktail of many chemical and biological elements, many of which are not actively harmful. If the source of these elements is indoors, as it is with many VOCs, using CO_2 monitoring to increase awareness of poor ventilation may have the added benefit of reducing the health risks associated with them.

But the air outside is not always fresh, and for many city-dwellers the concentration of pollutants such as nitrogen dioxide (NO_2), particulates (PM2.5 and PM10) and ozone (O_3) can regularly **exceed healthy levels**. By opening a window to reduce CO_2 levels, occupants may actively make air quality worse.

So using CO_2 as the sole proxy for air quality has limitations, and will not always lead to improved air quality. If there are other internal or external sources that are not measured and managed effectively, then the health of occupants can still be at risk.

Those concerned with wider air quality should look to use a monitor that incorporates additional common pollutants including PM2.5, total VOCs, NO_2 or O_3. They can also apply the principles found in health and well-being schemes that address air quality, including **WELL**, **RESET** or **AirRated**.

The indoor environment is a cocktail of many chemical and biological elements

Targets for carbon dioxide levels vary widely

The complexity inherent in ensuring good indoor air quality is reflected in the different standards used across the UK, let alone the world, in defining the target CO_2 level.

The Health and Safety Executive (HSE) has produced **guidance** for using CO_2 monitors for COVID-19 risk assessment. This states that CO_2 levels of less than 800ppm are likely to indicate that a space is well ventilated, and this is recommended for areas with high levels of aerosol generation. A reading higher than 1,500ppm is indicative of poor ventilation, and requires corrective action such as opening windows.

The standard **BS EN16798-1** predates COVID-19 and gives a value of 950ppm CO_2 for a high level of indoor air quality for general use. Meanwhile, **Building Bulletin 101** covers school ventilation in the UK, and suggests a daily average of 1,000ppm for mechanically ventilated and 1,500ppm for naturally ventilated spaces, which reflects the variability of wind-driven ventilation.

Overall, a level below 1,000ppm is acceptable in most spaces; 800ppm is good, and required for spaces with higher levels of aerosol generation; and 600ppm is excellent, but may come with an energy penalty. To get below 600ppm in a well-occupied space means providing significant amounts of outdoor air, which requires more energy for ventilation fans, and heating and cooling. Providing visual feedback to occupants about CO_2 levels – typically in the form of a traffic light system or similar – will enable them to act if air quality is poor.

The complexity inherent in ensuring good indoor air quality is reflected in the different standards used across the UK

Reducing energy consumption and other technical issues

This brings us on to the issue of the ongoing climate emergency, and the global push to reduce the energy consumption of buildings.

With a global COVID-19 pandemic raging, and the link made between poor air quality and infection risk, many organisations and governments pushed for ventilation to be set to maximum for as long as people were in a building. Energy considerations were sidelined in favour of saving lives and reducing immediate impacts on health.

In the long term, this approach is unsustainable, and would lead to excessive heating and cooling of buildings, just at the time these should be drastically reduced. Thankfully, the new focus on CO_2 monitoring devices has provided an excellent opportunity to incorporate demand control ventilation (DCV). This helps reduce energy consumption in many building types, while maintaining high levels of indoor air quality. DCV works by taking readings from CO_2 monitors in a space and increasing or decreasing the air supply accordingly.

By reducing the outdoor air supply, fan speed is significantly decreased, and less energy is required to heat or cool the air before supplying it to the occupied space. Integrating the CO_2 monitors with building control systems where possible can support DCV. This will both improve health and well-being and reduce energy consumption.

It should be noted, though, that CO_2 monitors are not infallible. Much of the interest in monitoring has been prompted by a reduction in the cost of these devices and the ease of connecting them to the internet. Non-dispersive infra-red (NDIR) sensors are generally regarded as the minimum standard, and are specified as such in the new Part F and other guidance.

Sensors that identify a CO_2 equivalent (CO_2e) are typically cheaper. These estimate air quality according to whichever bundle of chemicals they are able to detect, typically VOCs. However, this introduces significant uncertainty, and should be avoided.

Demand control ventilation ... helps reduce energy consumption in many building types, while maintaining high levels of indoor air quality

As with any measurement device, CO_2 monitors also require ongoing calibration. This should usually be undertaken annually and can be managed alongside other calibration processes, although some manufacturers use techniques that may allow longer periods between calibration. Alternative approaches include hot-swappable sensors in the devices, and takeback schemes where the sensors are replaced periodically.

Internet of things (IoT) devices, which are typically connected to building networks and send data to a central store or link to a building management system for control purposes, can also present network security risks, which need to be managed by IT teams. In short, you should select a suitable NDIR monitor, be aware of the calibration requirements, how to use them in different types of spaces, and how to connect them safely to building systems.

It should be clear that the issue of CO_2 monitoring is not a straightforward one. But following a methodical approach to the issues it raises should lead to buildings that are energy-efficient, safe and healthy.

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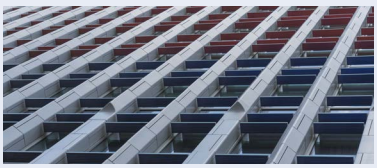

Making the most of the return to the office

By Rob Harris and Neil Pennell

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What to expect when procuring Passivhaus homes

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By Andrew Kubski MRICS

West of Scotland Housing Association (WSHA) is currently developing the largest Passivhaus scheme in Glasgow. It will also be Scotland's largest development of flats to meet the energy efficiency standard.

The project, at Springfield Cross, comprises 36 one- and two-bedroom flats for social rent. It is being constructed by **CCG** (Scotland) in partnership with **hub West Scotland** (hWS) and is due for completion in June.

The £7.5m project is being funded by WSHA's private finance, as well as support from Glasgow City Council under the Affordable Housing Supply Programme Grant.

As well as building to the Passivhaus standard, the contractor CCG is using off-site construction to reduce waste and vehicle movements, thus helping to lower carbon emissions both in construction and on site.

This is important to WSHA, as we launched our first **Green Strategy** in 2020. We are demonstrating a strong commitment to reducing our contribution to climate change by decreasing waste, energy consumption and harmful emissions, lowering the overall carbon footprint of the organisation.

How Passivhaus differs from conventional contracting

Construction contractors currently lack experience in procuring Passivhaus developments, which makes the process more difficult. At the outset of the project, for instance, the variation of cost estimates from both cost consultants and tendering contractors ranged from 5% to 30%.

Even the agreed final Springfield Cross contract suggests that Passivhaus could be around 10% more expensive than a traditional build on a like-for-like basis. Part of this is due to completing an exemplar flat before the remainder of the units were complete, more frequent quality inspections and tool-box talks with construction workers. It is hoped that in time – as higher demand, greater familiarity and upskilling in the sector play their part – this can be reduced.

However, there is no denying that the design and construction of a Passivhaus development takes longer, and so it is likely that it will remain more expensive than traditional builds for now.

Planning the procurement route is also important, particularly when there is a period of finding our way with client and contractor alike.

There is no denying that the design and construction of a Passivhaus development takes longer

Benefits from building to the standard

Passivhaus is a higher standard for energy efficiency that reduces a building's ecological footprint. It results in ultra-low energy homes that require little energy for space heating or cooling.

Passivhaus allows for energy savings of up to 90% compared with the average building stock, and more than 75% compared to average new builds. With rampant increases in energy bills, this is more important than ever. Lower fuel bills for tenants are a key objective for the WSHA board and development team.

To achieve Passivhaus certification, which WSHA stipulated from the outset, an independent certifier is required who can review the design. They look in particular at the thermal bridging, potential for overheating and product performance. These are checked against the criteria for compliance before finalising the design so work can start on site.

Buildings can meet the standard by using thicker, high-performance insulation for walls and floors – up to 600mm in places – as well as Passivhaus-accredited triple-glazed windows, and individual flat and common area entry doors.

Each flat is fitted with a mechanical ventilation heat recovery system (MVHR), which collects heat generated by residents' day-to-day activities, such as use of electronics, showers, and other appliances. It also extracts excess moisture and odours from showering and cooking.

Any heat collected is recycled back into the property to provide tenants with clean air at an ambient temperature that improves air quality and therefore benefits tenants' **health**.

Passivhaus is a higher standard for energy efficiency that reduces a building's ecological footprint

Procuring the Springfield Cross development

Although the concept of Passivhaus isn't new, detailed knowledge of the design, planning and build stages is still rare among mainstream contractors and design teams in the UK, particularly when looking to scale up from the smaller developments that have been more typical of those built to the standard until recently.

With the Scottish government recently setting out ambitious plans for 100,000 new affordable homes by 2032, contractors may have enough on their order books without taking on the uncertainty of extending into a new building technique.

However, there is no doubt that there is a movement towards this energy standard becoming more mainstream; Kingdom HA, Hanover HA and Midlothian Council all have Passivhaus developments in their programmes.

The typical *Official Journal of the European Union* (*OJEU*) route of a restricted tendering exercise was considered, and some soft market testing was carried out. Ultimately, however, WSHA felt this was too risky. Such procurement leads to a successful bidder being identified based on their response to the buyer's tender documents, including the detailed design and supporting bill of quantities.

Instead, WSHA was keen to work with a partner rather than have the typical client–contractor relationship, as per the *OJEU* route. WSHA also wanted to discuss options for some of the construction challenges and work through these as partners. Importantly, we felt that working in partnership with a contractor to ensure a suitable design may represent better value for money.

The **housing association** engaged with hWS, which already had experience in providing commercial Passivhaus schemes for the public sector.

Although the concept of Passivhaus isn't new, detailed knowledge ... is still rare among mainstream contractors

After developing a detailed understanding of WSHA's brief and budget, hWS was able to run a tender competition from its own pre-tendered framework. This resulted in the appointment of CCG (Scotland) Ltd as the WSHA's construction partner.

Using the planning package in design

WSHA engaged Robert Potter and Partners as architects, whose team included a certified European designer of passive housing. The architectural process included the use of the **Passive House Planning Package** (PHPP) to test the design proposals as they emerged.

The PHPP took account of orientation, overshadowing by surrounding buildings, U-values for optional forms of construction, possible heating and ventilation strategies, and other site-specific considerations. The design-stage PHPP complies with the Passivhaus standard.

However, this was not without challenges. Informed by others who had dipped their toe in the water with Passivhaus development, the initial concept was to have a light-gauge steel-frame structure that would reduce the likelihood of thermal bridges. However, this design became prohibitively expensive, and a traditional brick construction at ground-floor level with a timber frame construction on the upper floors, manufactured off site, was agreed.

The PHPP was continually updated as a predictive tool to reflect finalised construction detailing, the use of alternatives where materials were in short supply, and the methods selected for avoiding thermal bridging.

At the completion stage, the PHPP incorporates any evolution of the design during the site works. This will then be submitted for checking as part of the formal certification process.

Achieving Passivhaus certification relies on the approved accredited products being used and high-quality work being carried out on site

What Passivhaus checking and certification involves

Achieving Passivhaus certification relies on the approved accredited products being used and high-quality work being carried out on site. This is to ensure that the building performance meets the modelled design predictions.

A Passivhaus champion has been appointed by the contractor to manage a robust inspection regime. The contractor conducts toolbox talks with those working on site to explain fully the **tapes and membrane function**, and where these have to be used to achieve the required airtightness.

Numerous quality checks are carried out by the contractor, Passivhaus champion and WSHA's clerk of works throughout the build process and recorded on a quality control tracker. The checks are carried out at each key construction stage, including laying the foundations, installing the membranes and insulation, installing and commissioning the MVHR and so on. At each stage, the so-called gateway must be passed in order to progress to the next key construction stage

The contractor is required to take photographic evidence of the quality of the work, as well as collating product order and delivery details to ensure they correspond with what was approved before work started on site. The product is also checked before installation to ensure it is not damaged, and again afterwards to check the quality of the work.

These records are reviewed by the Passivhaus certifier alongside the construction drawings, and any issues are raised and rectified before progressing to the next stage. Regular airtightness tests are carried out, starting at the framing stage which is when the premanufactured internal wall panels can be set out internally inside the insulated external walls and the windows have been installed. The next test is at the installation of internal partitions after

Numerous quality checks are carried out by the contractor

they have been insulated, once more on commissioning the MVHR, and finally on completion.

The single certificate for the Springfield Cross development reflects the fact that it is one large block of 36 units, treated as a single passive house. If it were split into two blocks there would be two certificates; similarly, if it were a series of semi-detached houses or terraces each individual block would need its own certificate.

The certifier also reviews the commissioning results from services installations and air testing results on completion, to validate certification to the Passivhaus standard.

Occupiers adjust to a different way of living

WSHA tenants will also play their part in whether the association continues to build more homes to this standard.

Tenants will have to get used to living in the property and learn how to get the best out of their new homes. Temperature cannot be adjusted quickly by turning the central heating on. Instead, the property needs to be maintained at a comfortable temperature day and night.

There will also be constant low-level background noise from the mechanical ventilation system. This has been mitigated through placement of the unit within an insulated cupboard space within the kitchen, which is deemed to be less sensitive for noise. The home meets noise standards under Section 3 of the requirements of CIBSE *Guide B2: Ventilation and air conditioning* (2016).

However, money being saved on significantly lower fuel bills will help tenants accept the small compromises they have to make, to ensure that they and their passive house home can live in harmony.

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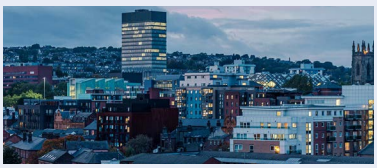

Why an updated EPC is vital to hitting net zero

By Catherine Garrido

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