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Remote site visits – a virtual child of necessity

By Bart Kavanagh

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Site inspections are at the heart of many of the issues that architect expert witnesses are called upon to assist with. What happens then, when everyone is required either to stay at home or to restrict their movements in order to avoid catching or spreading a potentially life-threatening virus?

Much information can be gleaned about a design from the architect's design drawings and much about the construction from a good set of as built drawings. What is drawn, however, is not always what is built and if the reality on site is critical to the understanding of issues that are central to a dispute, then an inspection of that reality may be necessary to underpin the credibility of the expert's report.

Where the issue involves the construction, rather than the layout, say, of a building the fabric will need to be opened up to expose the components installed and the method and quality of the construction. The areas to be opened up are often difficult to access; on roofs or high up on external walls. Inspections in such areas will need scaffold towers to be installed or access machinery, such as a cherry picker or a mobile elevating work platform (**MEWP**) to be deployed. These require installation and operation by skilled and experienced operatives who will need to be on site at the same time as, and often at close quarters to, the inspecting architect.

Once access has been arranged, opening up and dismantling of construction can take place. Again this will require skilled and experienced operatives and because the architect will usually need to see the progress of the opening up, rather than just the result, operative and architect will need to work closely to make the inspection effective.

Such site inspections were inevitably prevented when social contact was prohibited and current restrictions on social contact continue to present severe difficulties. For example where scaffolding or wall climbers are not available, and a MEWP platform of at least 2m wide is not available, physical inspections on site may be impracticable.

When working remotely from home became an unavoidable necessity, video calling and conferencing quickly became commonplace. As they proliferated most people mastered the software required, and adapted to the more stilted environment of the virtual meeting room, quite easily. Once prohibition of social contact eased into restriction, therefore, the question naturally arose of how to use or adapt this by now familiar technology to carry out virtual site inspections.

Some professional production companies began to develop and market interactive platforms using You Tube alongside other messaging software. Whilst many of these offer good quality visuals, they require preparation and the use of multiple software applications; this is not always user friendly. Also, if those operating the interactive platform have no experience of site investigations, as is likely, detailed and time-consuming directions may need to be provided.

Alternatively, established applications designed for video conferencing, such as Teams, Zoom, Blue Jean and others, offer acceptable visuals alongside easy and effective real time communications between the parties to a call. This is of real benefit where an inspecting architect needs to direct the work of the operative in response to what the opening up work reveals as it progresses.

Virtual site visits using these applications can be very effective in providing the architect expert with the information needed to form an opinion. They can also provide a vivid record of the whole process of the opening up as well as the final exposed result, thus reducing the need for other participants on site.

As restrictions ease further, and physical inspections on site become a possibility, the consideration of safety with respect to the virus is paramount. Key elements to be incorporated into the risk assessments and protocols prepared by the expert include: the age and underlying health conditions of staff; the availability and quality of Personal Protective Equipment, (**PPE**); training in the effective use of PPE; and whether the site can be reached without using public transport.

Also, the preparation of an effective risk assessment and method statement (**RAMS**) by the contractor to ensure appropriate conditions on the work site will be an essential pre-condition for any physical site inspection.

At the moment it seems likely that many experts, especially those of us whose expertise has been gained over a large number of years, will consider that physical site visits present too great a risk to their health and safety. As the threat from the virus diminishes, however, such visits are likely to be undertaken more and more frequently.

Nevertheless, the virtual site inspection has proved to be a valuable child of necessity. Its practical effectiveness, combined with its cost-effectiveness in eliminating the need to travel to and from a far flung site, is likely to earn this new sibling of the physical site inspection a permanent place in the expert's family of forensic techniques.

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Building Regulations Update for England: Part B – Fire Safety

By Martin Edwards

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Three years have passed since West London was lit up by the horrifying spectacle of the 67m high Grenfell Tower burning from top to bottom in the UK's worst-ever peacetime building fire, which resulted in 72 deaths.

Further serious, but non-fatal, fires have since occurred in England. These have included a range of external cladding materials – timber cladding, timber balconies, high-pressure laminate (HPL) cladding – and none of the buildings was over 18m tall to the floor of the top storey.

On 9 June 2019 a severe fire, believed to have been started by a barbeque, rapidly consumed the timber-clad balconies of a 5-storey block of flats in Barking, destroying 20 flats and damaging 10 others. The balcony floor and balustrade material was a heat-treated timber.

On 15 November 2019, a fire in a block of student flats in Bolton spread over its HPL cladding, completely destroying the top floor of the block. The building had 7 storeys, but is reportedly designed to be just under the critical 18m height to the top floor level.

The UK construction industry continues to be focused on the fire and life safety challenges associated with the existing building stock and new construction.

Amendment to regulations and guidance

Following the Grenfell Tower fire, the UK government commissioned Dame Judith Hackitt to carry out an independent review of building and fire safety regulations and their effectiveness. The final Hackitt report, "*Building a Safer Future*", was published on 17 May 2018. Amendments to Building Regulations and associated guidance have followed.

The Hackitt recommendations focused initially on new and existing high-rise residential buildings 10 storeys or more in height, but added:

"… a reasonable ambition might be for government to widen the definition in due course to include a wider set of residential buildings below 10 storeys or other residential buildings where people sleep (such as hospitals or care homes) which are normally less than 10 storeys high and will have vulnerable people sleeping within them."

The Building (Amendment) Regulations 2018

The 2018 amendments to the Building Regulations 2010 and to Approved Document B Fire Safety ("ADB"), and the publication of ADB 2019, were in direct response to Grenfell.

The Building (Amendment) Regulations 2018 came into force in England on 21 December 2018. New Regulations 7(2), 7(3) and 7(4) contain detailed and prescriptive technical requirements, conspicuously unlike the broad functional requirements of Schedule 1 to the Building Regulations 2010, which they amend.

All external wall materials, other than exemptions listed in Regulation 7(3), must now be classified A2-s1, d0 or A1 to BS EN 13501-1: 2007 (amended 2009). The fire classification requirements are more demanding and more widely applicable than previously advised in ADB 2006 and **they are mandatory requirements**, not merely recommendations as in ADB 2006.

The amendments effectively banned the use of combustible cladding in external walls of certain tall buildings, but only applied to "*relevant buildings*", defined as:

> *" (a) a "relevant building" means a building with a storey (not including roof-top plant areas or any storey consisting exclusively of plant rooms) at least 18 metres above ground level and which –*
>
> *(i) contains one or more dwellings;*
>
> *(ii) contains an institution; or*
>
> *(iii) contains a room for residential purposes (excluding any room in a hostel, hotel or boarding house); and*
>
> *(b) "above ground level" in relation to a storey means above ground level when measured from the lowest ground level adjoining the outside of a building to the top of the floor surface of the storey."*

The reason for excluding hostels, hotels and boarding houses (places where people sleep and may be unfamiliar with the building) from the list of "relevant buildings" is not stated. However, a government consultation paper published in June 2018 stated that hotels have different evacuation strategies from residential buildings and the risks are lower. Hotels are likely to be staffed and to have simultaneous or phased full evacuation strategies. Blocks of flats usually have a "stay-put" or "defend-in-place" evacuation strategy, where the residents stay in their dwellings unless instructed to leave by the fire service.

The mandatory requirements for "relevant buildings" (not all tall buildings) also include "specified attachments":

"Specified attachment" means—

> *i. a balcony attached to an external wall;*
>
> *ii. a device for reducing heat gain within a building by deflecting sunlight which is attached to an external wall; or*
>
> *iii. a solar panel attached to an external wall."*

Under the amended Building Regulations, external walls of a "*relevant building*" containing combustible insulation or cladding that together meet the performance criteria given in the BRE Report *Fire performance of external thermal insulation for walls of multi storey buildings* (BR 135) for cladding systems using full scale test data from BS 8414-1: 2002 or BS 8414-2: 2005, are no longer accepted as compliant.

For a "*relevant building*", the Building (Amendment) Regulations 2018 accept neither desktop study reports from fire specialists, nor a fire engineered approach to BS 7974, as options for demonstrating compliance with Part B4 (1) of Schedule 1 to the Building Regulations 2010, although these approaches were previously accepted by Building Control bodies prior to the Grenfell Tower fire.

The Building (Amendment) (Wales) Regulations 2019 are very similar to the Building (Amendment) Regulations 2018 in England, but only include balconies and solar panels as "specified attachments", not shading devices (brises soleil) as in England.

Approved Document B (Fire Safety) (2019)

ADB 2019 took effect on 30 August 2019 for use in England, not Wales. (Wales has continued with ADB 2006 edition. Volume 2 in Wales now incorporates 2010, 2013, 2016 and 2019 amendments.)

ADB 2019 is published in two volumes as previously, but the contents have now been changed to:

Volume 1, *Dwellings;* (including blocks of flats)

Volume 2, *Buildings other than dwellings.*

The Main changes in the 2019 edition states that:

" *Approved Document B has been redrafted to clarify its language and content in line with the Department's style guide for approved documents. … There are no changes from the previous edition to the technical guidance within Approved Document B.*"

However, there were very significant amendments to ADB 2006 in November 2018 and further amendments in December 2018 and April 2019, so the user of ADB 2019 should not make any assumptions, but read the advice carefully.

In addition, ADB 2019 was corrected in September 2019, soon after it came into effect. The corrected issue is superficially indistinguishable from the first issue, but note that the more recent version has the list of *Main changes in the 2019 edition* and an index at the end.

Clarity of language was a 2013 recommendation to the government by the Coroner following the Inquest into the fatal Lakanal House fire in 2009.

ADB 2019 has been significantly restructured and re-ordered, so the guidance may not be in the location with which the reader is familiar.

The design of blocks of flats has moved from Volume 2 to Volume 1 in ADB 2019. Volume 1 now includes recommendations for flats in addition to houses, and as a result, has sacrificed the brevity of ADB 2006 Volume 1.

Both ADB 2019, Volume 1: *Dwellings* and Volume 2: *Buildings other than dwellings*, reproduce the 2018 amended Building Regulation 7, confirming the ban on combustible materials in the external walls and specified attachments of "relevant buildings" with a storey 18m above ground level. In "relevant buildings", Class A1 or A2-s1, d0 materials are obligatory in the construction of the external walls. (ADB 2019 uses European "Reaction to fire" classes as in BS EN 13501-1 and no longer national classes.)

Regarding components exempted in Regulation 7(3), sub-paragraph 12.16a states that, for a "relevant building", membranes used as part of the external wall construction should achieve a minimum classification of European Class B-s3, d0. There are already breather membranes and waterproofing membranes on the market that meet this requirement. However, there is no definition of the term "membranes" and no guidance as to whether the advice includes vapour control layers (VCLs), which would be more difficult to achieve.

In tall buildings (top storey more than 18m high), other than "relevant buildings", there is now an unambiguous recommendation in ADB 2019 (paragraph 10.6 of Volume 1 and paragraph 12.6 of Volume 2) that both the insulation and the core of the cladding panels should be the European equivalent of the old national classification "limited combustibility":

" *In a building with a storey 18m or more in height … any insulation product, filler material (such as the core materials of metal composite panels, sandwich panels and window spandrel panels but not including gaskets, sealants and similar) etc. used in the construction of an external wall should be class A2-s3, d2 or better.*"

(Note that the amendment in the guidance regarding materials and products to include specifically *the core materials of metal composite panels, sandwich panels and window spandrel panels* has not been applied to ADB in Wales.)

The former Appendix F: *Fire behaviour of insulating core panels used for internal structures*, has been largely eliminated in ADB 2019. This appendix was introduced to ADB 2000 in response to the fatal 1993 fire at Sun Valley Poultry, Herefordshire, amongst 30 UK fires involving composite panels during the 1990s.

Appendix F was based on early UK metal-faced composite panel experience with much thicker (typically 50–100mm) foam polymer cores. ADB 2000 and ADB 2006 explained the fire behaviour of composite panel materials and fixing systems, including degradation of polymeric materials, delamination between the facing and the core material, loss of structural integrity, concealed fire spread, toxic smoke production and rapid fire spread, much of which is common to external cladding and valid for thin ACM panels with PE cores. However, all of the explanatory content has been removed from ADB 2019 and only a few recommendations, in the context of internal wall and ceiling linings, survive in paragraph 4.10 of Volume 1 and paragraph 6.11 of Volume 2.

The new ADB 2019, Volume 1: *Dwellings*, retains the "stay-put" evacuation strategy for blocks of flats and explains:

" *Provisions are recommended to support a stay put evacuation strategy for blocks of flats. It is based on the principle that a fire is contained in the flat of origin and common escape routes are maintained relatively free from smoke and heat. It allows occupants, some of whom may require assistance to escape in the event of a fire, in other flats that are not affected to remain.*

Sufficient protection to common means of escape is necessary to allow occupants to escape should they choose to do so or are instructed/aided to by the fire service. A higher standard of protection is therefore needed to ensure common escape routes remain available for a longer period than is provided in other buildings."

Blocks of flats usually have a "stay-put" evacuation strategy and it has worked well for many years, but it is dependent on effective compartmentation, which failed at both Lakanal House (2009) and Grenfell Tower (2017).

The recommendations regarding common escape routes in blocks of flats are substantively unchanged, despite post-Grenfell lobbying. Subject to specified provisions, a single escape route and a single common stair are acceptable.

Part B3 of ADB 2019, Volume 1, does not include the advice in ADB 2006 regarding car parks, although car parks are very often included in blocks of flats. The first fatal UK car park fire occurred in a block of sheltered flats over a semi-basement car park in Bristol in 2006. The guidance for car parks is included in ADB 2019, Volume 2, Section 11, largely unchanged since 2006.

As first published, ADB 2019, Part B3, paragraph 7.4, recommended sprinklers for blocks of flats with a floor more than 30m above ground: the same advice as in ADB 2006, despite much lobbying from the fire service and others. This recommendation has just been revised: see May 2020 amendments following.

ADB 2019 edition, May 2020 amendments

The changes to the guidance focus on fire safety provisions in blocks of flats and therefore apply principally to ADB 2019, Volume 1. Note that the critical height at which the recommendations apply is top storey more than 11m above ground level, i.e. a 4 or possibly 5-storey block.

a. **Sprinklers**: A reduction in the trigger height from 30m to 11m.

Paragraph 7.4 now states:

" Blocks of flats with a top storey more than 11m above ground level (see Diagram D6) should be fitted with a sprinkler system throughout the building in accordance with Appendix E.

***NOTE**: Sprinklers should be provided within the individual flats, they do not need to be provided in the common areas such as stairs, corridors or landings when these areas are fire sterile."*

Table B4 Minimum periods of fire resistance, item 1. Residential: a. Block of flats – without sprinkler system, is also amended to read "Not permitted" for buildings with height of top floor above ground of more than 11m.

b. **Wayfinding signage** for the fire service: A new recommendation for floor identification and flat indication signage within blocks of flats with storeys over 11m.

New paragraphs 15.13 – 15.16 are devised to assist the fire service to identify each storey from the firefighting stair and firefighting lift, and the location of each flat. There are provisions to ensure the legibility of the signs in low level lighting conditions. The difficulty in reading signage in smoke conditions has affected many firefighting operations, including Grenfell.

There are conventions for numbering the floors, which are intuitive and in common use in the UK, but may be unfamiliar to residents from other countries. Flat indicator signs are recommended, sited immediately below the floor identification signs.

However, there is no convention recommended on flat numbering, so the flat number does not have to derive from the floor designation number, although most building designers and managers already do this.

A note reads: "*In the case of multi-storey flats with two or more entrances, the flat number should only be indicated on the normal access storey.*"

Two recent fatal fires (Lakanal House 2009 and Shirley Towers 2010) involved "scissor flats", in which individual flats cross the width of the block spanning over and under the central corridors, so all sleeping accommodation is on one side of the block and all living spaces are on the opposite side. At Shirley Towers, the fire flat, No. 72, had its entrance on the 9th floor and a fire exit on the 11th floor, giving the fire service a logistical headache. Firefighters normally set up their operational bridgehead 2 storeys below the fire floor, so this was on the 7th floor, but the lift operator understandably delivered colleagues only to the 5th floor.

The amendments apply in England and take effect on 26 November 2020. (Wales already has more demanding requirements for fire suppression systems.)

Learning from recent fires

In the fire on 9 June 2019, which consumed the timber-clad balconies of a 5-storey block of flats in Barking, the balcony floor and balustrade material was a heat-treated timber that achieved only Class D to BS EN 13501. There is still no provision against such use of timber cladding on buildings less than 18m tall in ADB 2019, but there is now advice in MHCLG "*Advice for Building Owners of Multi-storey, Multi-occupied Residential Buildings*" (Jan 2020) to remove and replace balconies constructed of combustible materials.

The block of student flats in Bolton, where fire spread over the HPL cladding on 15 November 2019, was a building just under the critical 18m height to the top floor level. This being the case, it should have had Class B-s3, d2 cladding on the top storey over 18m above the lowest adjacent ground level, and below 18m the cladding should have been Class C-s3, d2. Standard HPL cladding typically has a Class D reaction to fire performance. MHCLG "*Advice for Building Owners of Multi-storey, Multi-occupied Residential Buildings*" (Jan 2020) now recommends remediation of HPL cladding for some tall residential buildings and for hospitals and care homes, but even so does not apply to the Bolton building.

Of the various serious fires which occurred during 2019, none of the buildings was over 18m to the floor of the top storey, so the Building (Amendment) Regulations 2018 would not apply to them. Given that most of the new recommendations in the 2019 edition of ADB apply only to 18m+ tall residential or institutional buildings, this raises the question of whether the guidance should extend to other building types and to buildings that are less tall.

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Practical Completion and BIM

By John Gouldsmith & Bart Kavanagh

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As the National Building Specification (**NBS**) releases its 10th annual BIM report, this article examines the relationship of Building Information Modelling (**BIM**) deliverables to Practical Completion, (**PC**). By BIM deliverable, I mean not the BIM used for the design and procurement phases, but a BIM that is to be provided under the terms of the Building Contract for the Client/ Employer to use in the management of the property after PC.

The JCT Standard Building Contract 2016 describes PC in the following clauses.

Clause 2.30 addresses the completion of the works

> "2.30 When in the Architect/Contract Administrator's opinion practical completion of the Works or a Section is achieved **and the Contractor has complied sufficiently with clauses 2.40 and 3.23 in respect of the supply of documents and information**, then:

Clause 2.40 addresses the provision of Contractor's Design documents.

> "*Where there is a Contractor's Designed Portion, the Contractor, in addition to his obligations under the CDM Regulations in relation to information for the health and safety file, shall, before practical completion of the Works or relevant Section and without further charge to the Employer, supply for retention and use by the Employer such Contractor's Design Documents and related information as is specified in the Contract Documents or as the Employer may reasonably require that show or describe the Contractor's Designed Portion as built or relate to the*
> *maintenance and operation of it or its installations.*"

Clause 3.23 addresses the Construction (Design and Management) Regulations 2015 (CDM).

> "*.1 the Employer shall ensure that the Principal Designer carries out his duties and, where the Contractor is not the Principal Contractor, shall ensure that the Principal Contractor carries out his duties under those regulations;*

.2 … the Contractor shall comply with regulations 8 and 15 and, where he is the Principal Contractor, with regulations 12 to 14; …"

The JCT also published a Practice Note "BIM and JCT contracts" in 2019, although this does not specifically address the issues considered in this article.

Regulation 8 of the CDM requires:

> *"(6) Any person who is required by these Regulations to provide information or instruction must ensure the information or instruction is comprehensible and provided as soon as is practicable."*

Regulation 12 requires the preparation of a health and safety file, (HSF), which must "*… contain information relating to the project which is likely to be needed during any subsequent project to ensure the health and safety of any person.*" This must be kept up to date during the course of the design and construction of the project and:

> "*(10) At the end of the project, the principal designer, or where there is no principal designer the principal contractor, must pass the health and safety file to the client.*"

In addition, ***Part 8***, regulation 38 of the Building Regulations 2010 requires the provision of Fire Safety Information (**FSI**):

> "*(2) The person carrying out the work shall give fire safety information to the responsible person not later than the date of completion of the work, or the date of occupation of the building or extension, whichever is the earlier.*
>
> *(3) In this regulation—*
>
> *(a) "fire safety information" means information relating to the design and construction of the building or extension, and the services, fittings and equipment provided in or in connection with the building or extension which will assist the responsible person to operate and maintain the building or extension with reasonable safety; …*"

BS EN ISO 19650-1-2018, (**ISO 19650**), 'Organisation and digitisation of information about buildings and civil engineering works, including building information modelling' provides guidance on the fundamentals and definition of information requirements and any resulting BIM. Annex A to ISO 19650 seems, however, to be written from the perspective of an information manager, rather than that of a construction contract administrator. It covers issues raised in general, but does not for example:

- Establish project information requirements for PC;
- Establish project H&S and FSI requirements, milestones, etc.; or
- Discuss compatibility with the construction contract requirements and clauses.

At paragraph 5.1.2 it states:

> "*The appointing party shall establish the project's information requirements, as described in ISO 19650-1:2018, 5.3, to address the questions to which the appointing party needs answer(s) at each of the key decision points throughout the project. In doing this, the appointing party shall consider: …*
>
> *— the intended purpose for which the information will be used by the appointing party; …*"

It will be incumbent on the Employer, therefore, or someone directly appointed by the Employer for the purpose, to define what is required of the BIM in relation to the HSF and FSI requirements and to ensure that these are all compatible with the form of construction contract adopted for the project.

Large organisations which regularly act as Employer are likely to develop their own processes and procedures to effect the application of ISO 19650 to their particular needs. Given the critical nature of

HSF and FSI, however, all Employers will need to ensure that BIM as a deliverable is adequately aligned with their construction contracts.

Different construction contract variants and different forms will have significant and subtle variations [1], but the following general principles regarding the incorporation of BIM deliverables are likely to be the same in each case:

- Define any contractual BIM deliverable and how it relates to PC at the outset;
- Define if and how any contractual BIM deliverable provides any part of the HSF and/ or FSI and how it relates to PC at the outset;
- Define the BIM acceptance testing process at the outset;
- Allow sufficient time for the BIM acceptance testing process, including sufficient rectification of any defects prior to PC;
- Ensure that the BIM requirement is aligned with the construction contract;
- Adequately monitor the BIM to ensure that each PC requirement is duly delivered.

Currently, there is very little specific guidance on how this might be achieved; the various BIM textbooks and guides that are available, do not address the handover of BIM at PC in depth or at all. Certainly, they do not address:

- How to assess whether a BIM deliverable is adequate for PC?
- How to assess whether a BIM deliverable provides adequate HSF or FSI?

If a BIM deliverable is included in the contract, especially if it contains the HSF and/or FSI, then the Employer will need to put in place a suitable method of review and assessment, to ensure compliance with the terms of the contract, to satisfy the statutory requirements, and to enable the CA to either:

- endorse the BIM as acceptable for PC from their own assessment and testing, or
- endorse the BIM as acceptable for PC after assessment and testing by others.

In this regard, I suggest that the steps that would apply to practical completion of the physical construction works could be applied equally to PC of the BIM deliverable, for example:

- Commissioning the BIM as the H&S information and the FSI;
- Snagging the BIM against pre-defined H&S and FSI information functionality;
- Training of Employer staff in how to use the BIM effectively as H&S information and FSI.

Paragraph 5.7.4 of ISO 19650 provides the following guidance on how this might be done:

> *"The appointing party shall undertake a review of the information model in accordance with the project's information production methods and procedures.*
>
> *In doing this, the appointing party shall consider:*
>
> *— the deliverables listed in the master information delivery plan;*
>
> *— the appointing party's exchange information requirements;*
>
> *— the acceptance criteria for each information requirement; and*
>
> *— the level of information need for each information requirement.*
>
> *If the review is successful, the appointing party shall accept the information model as a deliverable within the project's common data environment.*
>
> *If the review is unsuccessful, the appointing party shall reject the information model and instruct the lead appointed party to amend the information and re-submit for appointing party's acceptance.*

Partial acceptance of the information to be exchanged (as defined within the MIDP) can lead to coordination issues, therefore it is recommended that the appointing party either accepts or rejects the entire information model." [2]

The adequacy of the HSF and FSI contained in the BIM is a matter for the Employer, Principal Designer and/or Principal Contractor to agree upon and some formalised review (and correction if necessary) of a BIM containing HSF and/or FSI will be needed before PC can be certified. The time and cost of this process must be planned for and included in the contract documents, including risk and contingency allowances for when approvals are potentially not given or delayed.

Compliance with the Building Regulations must also be considered and incorporated into the BIM deliverable. This begs the question, should the Building Control authority review, and approve/ certify, the relevant aspects of the BIM if it contains FSI? It seems to me that they should, because the provision of FSI is a requirement of the Building Regulations for construction works.

The effective handover of a BIM deliverable containing H&S and FSI is important because the consequences of mistakes and misunderstandings are potentially serious. One can easily see how the cost of rectification or loss associated with a defective BIM could – for small to medium projects – cost the same sum as the building project to put right.

Perhaps more importantly, a defective BIM deliverable that leads to an H&S offence or conviction could be devasting, for the person fined or convicted. Also, a defective BIM that leads to an H&S incident, or fire say, where incorrect information it contains has been relied upon could generate a wide variety of losses, claims and disputes.

In summary, a BIM deliverable has the potential to: provide an effective and efficient transfer of critical HSF and FSI information from the Contractor to the Employer; to accommodate the requirements of the Regulatory Reform Fire Safety Order (**RRFSO**) and fire risk assessment; and to be a convenient tool for facility management during the operational life of the property. If the potential is to be fully realised, however, the BIM criteria need to be considered from the outset, managed and updated throughout the course of the project and subject to robust scrutiny at PC before being handed over to the Employer.

[1] *See articles in the Summer and Autumn 2019 editions of Perspective.*

[2] ISO 19650 provides a useful flow diagram, including how the process is to be reset/ redone, if either the information model is rejected.

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