Building Control Journal

Fighting fire

Putting the Hackitt Review into practice

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Fighting fire

RICS has had extensive behind-the-scenes involvement in Dame Judith Hackitt’s Independent Review of Building Regulations and Fire Safety. Gary Strong outlines how RICS is helping ensure the recommendations are implemented.

As many of you know, Dame Judith Hackitt, former Chair of the Health and Safety Executive (HSE), was appointed to lead the Independent Review of the Building Regulations and Fire Safety in 2017, and published her interim report on 18 December (http://bit.ly/2oC4umd).

RICS was heavily involved in the lead-up to this, engaging with Dame Judith’s team directly and collaborating with the Construction Industry Council to ensure that the report was based on sound factual evidence and that sector interests did not dominate. We wanted to be certain that an industry often described as fragmented came together.

In the early part of this year, working groups were established by Dame Judith’s team to give their input into the final report, which was published on 17 May (https://bit.ly/2rN3yK3). RICS again deployed experts to these six working groups and was the only professional body to have representatives on most of them. Round-table meetings with the Secretary of State for Housing, Communities & Local Government, the Home Secretary and many professional bodies ushered in a new spirit for all involved in construction and fire safety to collaborate in the public interest.

Lost confidence

The interim report had been pretty damming of the industry – making reference to “a race to the bottom”, a culture of doing things “as cheaply as possible” and a “systemic regulatory failure”, as well as describing competence as “patchy”.

It was also clear to us in RICS that the public had lost confidence in the construction industry to provide fire-safe buildings, a fact that was picked up internationally. We began to hear anecdotes of investors being cautious about UK standards and, with Brexit looming, a reluctance to finance projects.

We have had a dedicated group working with Dame Judith’s team and the Ministry for Housing, Communities & Local Government (MHCLG) Building Safety Programme following the Grenfell fire on 14 June 2017. We are the only professional body to have sufficient resources to interface extensively and directly with these parties and enable many of the meetings of industry experts, and to ensure we work together in the public interest by demonstrating leadership on this important topic. Dame Judith’s final report made 53 principal recommendations, and more sub-recommendations, including the following:

- a stronger and tougher regulatory framework for higher-risk residential buildings (HRRBs), which are 10 storeys or more in height
- a proposed new Joint Competent Authority (JCA) comprising fire and rescue authorities, LABC and the HSE to oversee better management of risks in these buildings with safety case reviews throughout their entire lifecycle
- introduction of a safety case approach and permitting regime that will only allow buildings that are demonstrably safe to be constructed and occupied
- clear responsibilities for the ongoing active management of life safety during occupation
- mandatory incident reporting for HRRBs, with confidential reporting on structural safety to be used for all other buildings to cover every safety concern
- clearly established key roles and responsibilities, including tackling poor procurement practices

- a fundamental overhaul of guidance, making it simpler, clearer and easier to use, to support a systems approach towards building safety with more rigorous requirements where needed
- digital records to be kept for new HRRBs from initial design intent through to construction, including any changes that occur throughout occupation
- a stronger enforcement and sanctioning package, with criminal sanctions for non-compliance as well as large fines
- more effective leadership and assessment of competence among key roles to ensure building safety
- stronger testing, labelling and traceability of products used in construction that are critical to building safety
- empowering residents and ensuring they have a voice in the system.

Next steps

Almost immediately after publication of the final report, the most important question was “What next?” Many of the recommendations are being worked on behind the scenes, with RICS giving expert advice on these workstreams.

The change for approved inspectors was expected in some quarters, as Dame Judith says no organisation should be able to choose its own regulator. In future,
It was clear to us that the public had lost confidence in the construction industry to provide fire-safe buildings, a fact that was being picked up internationally.

The combination of the HSE, fire and rescue services and LABC in the form of the proposed JCA will oversee any plans for design and construction of HRRBs, as well as managing existing buildings (see the executive summary and Appendix E on competence in Dame Judith’s final report).

Golden thread
The so-called golden thread of fire safety that Dame Judith recommends – deploying digital safety case files, with gateway approval points from inception to handover to management in use – is an important step forwards in enabling transparency and accountability.

Under the recommendations, there will be new sanctions for non-compliance, bringing criminal courts into the process – an important step forwards in enabling transparency and accountability.

The role of building safety manager is also being created for HRRBs, the description and competencies of which are being scoped out as we go to press.

An example of the many workstreams now under way is the MHCLG Industry Response Group (IRG), which has in turn set up a competence steering group; I represent RICS on this steering group.

It has been charged with reporting to the Secretary of State for Housing, Communities & Local Government quarterly since its inception in May on the competencies that all actors in the planning, design, construction, refurbishment and management of HRRBs will have to exhibit, making its final recommendations by early 2019.

There is some controversy over the definition of HRRB – a new term that emerged in the Hackitt Review – as a higher-risk residential building more than 10 storeys high. However, the rationale for the narrow scope is simply that the new regulatory system will apply to an estimated 2,000–3,000 residential buildings, which will in itself be a significant undertaking.

While we do need to broaden this definition to include hospitals, care homes and student accommodation of any height as well, to do so now would bring the construction industry to a standstill. So the proposed new model will be put in place, tested and refined, before – we hope – being broadened out to other higher-risk complex buildings in time.

The competence of all actors including planners, architects, designers, building control surveyors, building surveyors, project managers, firefighters, installers, site supervisors and building managers will be scrutinised in future as the common framework develops and the defined competencies are checked by an overarching body that will come into being.

RICS has an established pathway and competency framework for fire safety, and we are ensuring in the IRG competency workshops that what emerges is workable and achievable for our members. We have already taken steps this year to enhance the importance of “Fire safety” as a competency. What we have been most concerned about, however, is whether anyone who is not a member of any professional body can demonstrate education, training and competence in life safety in the future.

As we all know and recognise, the fragmented, subcontracted nature of the construction industry does not lend itself easily to recognising and checking competencies by formal accreditation; but for all higher-risk buildings in future, such competency will have to be shown by all in order to earn the right to work on these buildings, with a quest for construction quality and building management quality driving culture change.

“

It was clear to us that the public had lost confidence in the construction industry to provide fire-safe buildings, a fact that was being picked up internationally.
On 30 January, a company director who had ignored site health and safety responsibilities was sentenced in Newport by a group of lawyers from Blake Morgan. Fortunately for the “director”, he was participating in a mock hearing at the Riverfront Arts Centre as part of the South Wales Working Well Together project. Jointly run by the Health and Safety Executive and the construction industry, the Working Well Together initiative was set up in 1998 to promote a positive health and safety culture by providing information and advice, often in the form of events.

The hearing was staged in full Crown court attire, using photographs of a fictitious site where the breach of regulations had supposedly taken place. The Blake Morgan team consisted of partner Robin Havard in the role of judge, and paralegal Steve Parish as clerk. Partner Claire Rawle was the prosecution advocate, while I acted for the fictional defendant company and director.

It tends to be forgotten that health and safety enforcement forms part of the criminal law. Civil claims for compensation may be brought by injured parties, but when companies, directors or employees are found guilty of health and safety offences, they stand convicted as criminals. In addition, a health and safety offence can be committed by creation of a risk alone, and there is no need for anyone to have been injured.

Penalties

The Sentencing Council’s 2016 health and safety Sentencing Guidelines crystallise this by focusing on the risk of harm as opposed to any actual harm caused, and the 30 January event was designed to illustrate this emphasis. However, we also wanted to show how the guidelines have led to sharp increases in penalties by linking fines to company turnover rather than profitability, and fixing the amounts by reference to categories of culpability and harm risked.

The guidelines refer to “very high”, “high”, “medium” and “low” culpability. “Very high” signifies flagrant disregard for the law, for example being aware of failures but proceeding anyway; “medium” would be having some health and safety measures in place, but ones that are inadequate; “low” would mean that good measures are in place but not followed.

The fictional scenario related to a deficient construction site that had been visited by the Health and Safety Executive, and was then subject to enforcement action that the defendants had ignored. While no injuries had resulted, the enforcement had focused on the risk of harm from poor site organisation and planning of logistics and deliveries, poor traffic management, and poor fire risk controls. The case was novel in so far as previous mock hearings had used scenarios where harm had occurred.

“The guidelines have led to sharp increases in penalties by linking fines to company turnover rather than profitability.”

As a result of the failures, the defendants were prosecuted under the Construction (Design and Management) Regulations, or CDM Regulations, 2015. Indeed, one of the purposes of the updated regulations is to bring an holistic approach to health and safety management – so they were ideally suited to deal with the failures in question, as the prosecution advocate made clear in her opening address.

I made representations as best I could, but my mitigation rang hollow as pictures of the shambolic site were shown. With the help of a panto audience-style “jury”, our judge imposed a fine of more than £50,000 on the company and a suspended jail sentence on the director.

Holistic enforcement

A key message for surveyors is to appreciate that enforcement, particularly under the CDM Regulations, is increasingly holistic, and takes into account the way that health and safety risks can be created at the inception of a project as well as during the construction phase itself.

A prosecution can be brought for design and organisational failures at this early stage if they lead to a material risk of harm; for example, inaccurate calculations at the design stage could result in risks created during construction. Similarly, over-ordering of stock and not making suitable storage arrangements on site could also create a risk.

Another factor to appreciate is how the guidelines have radically increased the levels of fines. For example, a business with a £5m turnover convicted of an offence that creates a high risk of serious harm, and found to be in the medium range of culpability, could face a fine of up to £600,000.

Since the event, we have been asked to repeat the exercise for a number of organisations. By all means get in touch if you would like us to provide a similar session for you.

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Related competencies include Health and safety
Fire safety standards progress

RICS is continuing work with professional and standard-setting organisations in the UK and globally to develop and support the International Fire Safety Standards (IFSS) for buildings (see Building Control Journal September/October, p.6).

Led by RICS, the IFSS coalition will form a committee of technical fire experts that will develop the standards and ensure they are fit for purpose globally, and the coalition will then work with professionals, governments and supporters to implement these locally. Inconsistencies in some national codes, guidance and product testing will be harmonised as we seek to map and benchmark them.

Gary Strong FRICS is RICS Global Building Standards Director
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Fire safety conference to be repeated

RICS has taken the unprecedented decision to repeat a conference just two months after it was first held. The RICS Fire Safety Conference on 18 September quickly sold out, with huge demand for tickets. A second will therefore take place on 28 November, again at the Doubletree by Hilton – Tower of London Hotel, including the same session topics and most of the same speakers. Book now to secure a place while tickets last.

www.rics.org/fireconference

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New journal to build on success

From the next issue you will see some significant changes to this journal. As well as giving our journal suite a new look, we are launching a larger publication that will not only cover building control but also include building surveying and conservation. You will automatically receive the Built Environment Journal instead of Building Control Journal from the February/March 2019 edition.

To advertise contact Chris Cairns +44(0)20 7871 0927 or chrisc@wearesunday.com
There has been a great deal of criticism of the fire safety measures in UK residential tower blocks lately, in particular the provisions for fire detection and alarm. Public perception, however, may not always be in line with what is required by the Building Regulations, or what the fire engineering profession considers best practice. Eyewitness accounts from various fire incidents often say that the fire alarm system did not work, without appreciating that purpose-built residential blocks will usually employ a “stay put” policy and only the alarm in a flat that is on fire will be activated.

But we must also consider that people do not always react in their own best interest on hearing an alarm or, in some cases, even when they confront a fire.

**Fire alarms**
Fire alarms in the workplace are a regular event, or at least they should be. The system should be tested weekly, and we should all have been subjected to a fire drill occasionally. However, as real fire events are relatively infrequent, when the alarm does go off people do not react quickly, if at all, and assume it is either another drill or possibly a false alarm.

Delaying our reaction to an alarm could put us at risk should there actually be a fire in the building. There is even a video case study, well known in the fire engineering profession, of a fire in an off-licence where a display stand is clearly alight. As the fire grows, the CCTV footage shows a mother usher her children into the shop doorway to look at the blaze. One man is also seen entering the shop and then leaving quickly; he was later found by police to have two bottles of stolen spirits in his pockets.

To deal with the wide range of human behaviour – and to protect us, our property and contents from criminal activity that uses the fire as a diversion – various means of emergency evacuation are available, each with different supporting measures.

**Evacuation options**

**Simultaneous evacuation**
The simplest and most common method of evacuating a building is to set off...
an immediate alarm throughout the premises. Whether there is an automatic system – triggered by smoke or heat detectors, for example – or simply manual call points, the alarm is raised when a fire is discovered and everybody leaves.

As this is the method favoured in office buildings, it is the one with which we are most familiar; it is based on simple cause and effect and therefore appears the most logical. If there is a fire, why wouldn’t you get everybody out? There are now calls from the public for this to be the default for all tower blocks.

Security considerations include protection from entry where different tenants occupy parts of the same building, meaning that someone from a company in an office on one floor should not be able to enter the space occupied by another. If the building is empty because the alarm has gone off, you could be relying on CCTV for detection rather than prevention, unless there are door security and coded entry systems to restrict access.

The benefit of simultaneous evacuation, however, is its simplicity: it means a less sophisticated alarm and detection system can be used, and that a smaller burden is placed on management for coordinating the evacuation. Save for a fire warden sweep of the floor, there might be little else required.

Phased evacuation
In buildings using simultaneous evacuation, the fire precautions will require that sufficient capacity is provided for all the occupants to make their way out of the building together within a reasonable time. This is notionally set at two minutes 30 seconds, for reasons that we need not cover here. Although this is fine for smaller and lower-rise buildings, the width of escape routes in taller buildings, in particular the stairs, can make simultaneous evacuation of all occupants impractical.

With phased evacuation, the building population is broken down into smaller portions, usually by floor level. In this way fewer people will be using the escape routes at any one time and the width requirement for the stairs is reduced. Although flexible, the process is typically that occupants on the floor of fire origin – where it is first detected – are evacuated as the first phase, along with more vulnerable occupants such as people using wheelchairs or who have a sight impairment, and any basement floors. Evacuation of the remainder of the building will then be by phases of two floors at a time going up and subsequently two floors at a time going down until the entire building is vacated.

Other than the reduction in stair width, advantages include greater business continuity for occupants in the later phases of evacuation. It is possible that if a fire is quickly brought under control or there are false alarms then full evacuation of the building will be unnecessary.

The downside is that a greater level of management control will be required, as will more sophisticated detection and alarm systems that can warn of fire as well as signal evacuation, more staff training, and a higher degree of fire separation between floors.

Zone evacuation
Sometimes also known as staged evacuation, this is similar in concept to phased evacuation; but rather than being used in taller buildings this suits those with larger footprints, those that are more complex, or those where there might be a higher occupation density, such as shopping malls and transport hubs.

In these circumstances the building is divided into zones, which could coincide with smoke control, fire suppression, alarm zones or other divisions. Activation of the fire alarm in a given zone will prompt its evacuation, with occupants leaving the building or possibly moving into an adjacent zone.

As there is likely to be a line of sight between the fire zone and zones that are not being evacuated, this method requires greater management control of crowd issues, and potentially complex alarm and directional signals to provide the correct information and encourage the appropriate response from occupants.

Progressive horizontal evacuation
Like zoned evacuation, this involves moving parts of the population sideways out of the risk area, except that here the zones are physically separated from one another by fire-resisting walls and floors. The concept is that by moving people into a neighbouring fire compartment they will be temporarily safe, while the facilities and personnel needed to make further evacuation to the street are arranged.

This method is used in many healthcare buildings where occupants are more dependent on assistance for evacuation, or might not be able to leave the building at all. By its nature, this method is used where buildings are naturally highly managed and control of evacuation closely controlled.

Because the occupants might be vulnerable people such as hospital patients or care home residents, they remain inside for as long as it is safe to do so, and are protected:

- from the weather
- from becoming disoriented and getting lost outside
- from external personal attack.

The simplest and most common method of evacuating a building is to set off an immediate alarm throughout the premises.
Alternatives to evacuation

Staying put

Typically used in residential towers, the “stay put” policy is the least well understood means of escape and has recently come in for criticism, perhaps because it appears illogical and counter-intuitive.

People neither expect nor want to be unnecessarily disturbed in their own home and might be asleep when a fire breaks out. Coupled with the likely absence of management assistance on site, it is the standard procedure for smoke or heat detectors to alert only those residents in the dwelling where the fire originates.

Neighbours in a block will not be made aware of the alarm automatically, and are expected to stay put. Although this may seem contrary to the philosophy we expect, it does make sense if we think about the number of times our smoke alarm goes off by accident, and this approach has proven perfectly adequate for the past five decades or so of high-rise living.

To make this system acceptable, residential towers benefit from a higher degree of fire compartmentation than other types of building. By separating the tower into a series of smaller fire-resisting boxes and providing smoke ventilation to the escape routes – which is not usually necessary otherwise – the level of protection is much greater, and prolonged occupation during a real fire incident is made possible. Compartmentation has recently been called into question, but if it is designed, constructed and maintained correctly we know it works.

So what are the benefits of a “stay put” policy? If everybody is regularly made to leave a tower block and stand on the street when an alarm goes off but there is no fire then people will become complacent and reluctant to react when an actual fire has started, and might ignore an alarm.

This could be the case even when there is a fire in their own dwelling. Furthermore, because residents might take longer to react and evacuate a building it is possible, if not likely, that the routes used for access by the fire service will be congested.

If there is a fire, having all the residents of a tower block trying to use the stairs at the same time that the fire and rescue service are trying to ascend with equipment can seriously hamper early extinguishing of a blaze.

In this case, the procedure is to remain in place, secure doors and windows against entry and conceal occupants from view. If the room is not secure then moving to a secure space is necessary.

Invacuation and lockdown

Not all emergencies are fires, so the appropriate response is not always to escape from the building.

If moving outside puts people at a greater risk then the appropriate action is likely to involve moving to a refuge space within the building, away from windows and external doors. This might be in response to extreme weather such as tornados, to a bomb threat in the local area, or to the release of noxious gases and fumes.

Lockdown, although similar, is subtly different. There has been greater press coverage lately of terror attacks involving individuals with knives and guns. Consequently, my daughters now practise lockdown at school as regularly as fire drills.

In this case, the procedure is to remain in place, secure doors and windows against entry and conceal occupants from view. If the room is not secure then moving to a secure space is necessary.

Safe and secure egress

Fire safety and the means of evacuation or otherwise are taken into account as part and parcel of the routine design process for a new build, extension, fit-out or refurbishment, whether standard guidance recommendations are followed or a fire engineering approach is taken. But at what stage is security considered? And has it been integrated with other design features and emergency procedures?

In February, lone gunman Nikolas Cruz entered Stoneman Douglas High School in Florida, USA. The former pupil operated a fire call point and began shooting as people were evacuating the building. Reports suggest that the alarm caused confusion because there had been a fire drill earlier that day.

Cruz had been spotted just beforehand, and alert messages were sent. But despite the school operating lockdown procedures he managed to kill 17 people and injure 17 others. Had security been part of the integrated design and fire evacuation procedures, or if the building had been designed with a security strategy and the systems in place used to their full potential, then maybe the number of victims would have been fewer.

Security must be part of the initial design to be effective. Bolting on equipment at a later stage might not only be expensive, it might also be misguided and ineffective.

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Related competencies include

Fire safety

The simple way to differentiate between the two procedures is to think of invacuation as protection against indiscriminate events and lockdown as against a specific and targeted attack, although that target might be a location, building or institution rather than a specific person.
As the latest edition of the Wiring Regulations broadens their scope in terms of safety and other factors, Gary Parker highlights the significant changes that have been made.

Responsibly rewired

The Wiring Regulations have seen a new round of changes in the 18th edition, which is designed to keep up with the ever-evolving ways we design and install electrical works.

Jointly published by the Institution of Engineering and Technology and BSI in July, the 560-page document is due to come into effect in January 2019. Also known as BS 7671, it includes some subtle changes in wording, such as replacing “in use without a fault” with “under normal conditions”, in addition to some regulations being introduced, rewritten or removed entirely (https://bit.ly/2NXjJ0N).

Safety paramount

When carrying out or commissioning electrical or other engineering services work, the most basic yet most important responsibility is the preservation of life. Failure to fulfill that responsibility can have devastating consequences.

When it comes to fire safety, the 18th edition expands on previous regulations and amendments, broadening the scope of installers’ and designers’ responsibility for ensuring safe installation to include consideration of fire engineering.

In chapter 42, “Protection against thermal effects”, a new regulation 421.7 has been introduced, which recommends the installation of arc-fault detection devices and suggests numerous possible locations for these.

Regulation 422.21 has also been redrafted. Reference to conditions BD2, BD3 and BD4 on escape routes has been deleted, and a note added stating that cables need to satisfy the requirements of the Construction Products Regulation in respect of their reaction to fire.

In chapter 52, “Selection and erection of wiring systems”, regulation 5211.201 on the support of wiring systems in escape routes has been replaced by a new regulation 5211.202, which requires cables to be adequately supported against their premature collapse in the event of a fire. This applies throughout the installation, not just in escape routes, and is relevant to all cable types rather than power cables alone.

Broader coverage

Since 2014, the Building Regulations have required all circuits in new or rewired homes to comply with the requirements of BS 7671, which requires an increased use of residual current devices and, more recently, metallic consumer units in dwellings. This requirement was implemented as part of BS 7671: 2008 + A3: 2015; however, the implementation of the regulation relating to metallic consumer units was delayed until 1 January 2016 (https://bit.ly/2nenkwd).

The 17th edition of the Wiring Regulations in 2015 had itself been amended from the previous version to ensure that all cable installations along escape routes were supported, so as to prevent premature collapse in the event of fire and improve fire safety for occupants and firefighters alike.

Before this change was introduced in the 17th edition, and the term “escape route” subsequently removed in the 18th so this approach covered all locations, many types of wiring system were liable to fall from walls and ceilings in the early stages of a fire, leaving cables hanging.

These would become entangled with firefighters’ breathing apparatus or uniforms, leaving them trapped and running out of air, and this led directly to the deaths of eight such emergency workers in the UK between 2005 and

The 18th edition has broadened installers’ and designers’ responsibility for providing a safe installation to consideration of fire engineering (https://bit.ly/2mSONox). These helped prompt the changes in legislation.

Clarity and compliance

Existing wiring installed in accordance with earlier editions of the regulations may not comply with the current edition in every respect, but this does not necessarily mean that it is unsafe for continued use or require upgrading. BS 7671 is not retrospective, so the changes are aimed at new installations.

However, the 18th edition has highlighted some areas in which clarity was perhaps lacking in the past.

The Electrical Contractors’ Association recommends that building surveyors continue to ensure their buildings are kept compliant by having suitably skilled and competent contractors carry out regular inspections of electrical systems, highlighting any potential failings and areas for improvement.

Gary Parker is Senior Technical Support Engineer at the Electrical Contractors’ Association.

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Related competencies include Construction technology and environmental services.
Choosing the right detection technology is essential if you are to avoid the twin risks of fire and false alarms. Simon Sandland-Taylor details how you can navigate the various options.

When selecting detectors for a fire alarm system, you must give equal consideration to optimising fire detection and minimising the occurrence of false alarms. The desirability of the former is often weighed against the disadvantages of the latter, although some critics maintain that the number, frequency and potential disruption of false alarms bring the value of fire detection itself into question. In actual fact, most false alarms are down to poor system design and incorrect detector selection and the risk can be significantly reduced by careful design and advances in technology, as this article shows.

Area fire risk
Fire detectors are selected according to the nature of the area where their use is planned, and any fire risk associated with it. Quite often, this can result in different technologies being used to ensure fire is detected while false alarms are avoided.

Detectors themselves are designed to identify one or more of fire's four characteristics: smoke, heat, combustion gas – such as carbon monoxide (CO) – and infrared or ultraviolet radiation.

In some fire detection and alarm systems, an alarm signal is initiated when one of these characteristics reaches a predetermined threshold. In other situations, a signal may be initiated, instead or in addition, when the rate at which this characteristic changes is indicative of a fire.

In the case of point detectors, smoke, heat, gas or radiation are monitored at a defined spot in the protected area, whereas line detectors recognise these along a defined line in that space.

Detection technologies
Smoke detection is the most common technology in automatic fire detection systems, and can take the following forms:
- Ionisation chambers are point detectors that identify smoke by the reduction in current it causes between electrodes.
- Optical point detectors identify smoke by a process of scattering light from a source within the detector.
- Optical beam detectors are line detectors sending light from a transmitter to a receiver, identifying smoke when it obscures the light source.
- Aspirating smoke detection uses a pump or fan to draw air samples through points in the protected area to a central detector, which can operate using an ionisation chamber or optical principles.

Heat detectors take the form of either point or line detectors, and may be designed to respond when a fixed temperature is reached. The heat detector may also include a sensor that responds to the rate of rise of temperature. Combustion gas detectors in turn are point detectors that respond to one or more of the gases, for example carbon monoxide, that are produced when combustion is incomplete due to a restricted amount of oxygen.

Flame detectors meanwhile detect the infrared or ultraviolet radiation that is emitted by flame, or both. Both kinds use radiation-sensitive cells that identify the fire directly or through built-in lenses or reflectors.

Some detectors contain more than one sensor, each of which responds to a different characteristic of fire. Such multi-sensor...
devices can be used to enhance detection of fire and reduce the risk of certain categories of false alarm.

Video is another means of detection, which monitors the protected area and analyses images electronically to identify the presence of smoke or flames from changes in the camera’s field of view.

Choice of fire detection principle
The choice of fire detector types should, ideally, be made early in the design stage to support the fire safety strategy. Sometimes this choice is revisited and modified as the building design evolves, or during installation and commissioning, or during periodic maintenance thereafter. Such modifications are not always clearly documented, however; neither is the rationale behind their selection at the design stage or later.

It is absolutely essential that the reasoning behind the selection and configuration of the detectors is clearly documented, and likewise the justification for any changes to them throughout the lifetime of a building, in order to verify continued suitability.

To help the selection and verification of detection, Annex E was introduced in BS 5839 Fire detection and fire alarm systems for buildings, Part 1: 2017. Entitled “Selection and application of fire detectors”, this informative annex provides a methodology for selecting and recording the type and sensitivity of and settings for detectors, taking into account the anticipated risk of fires and false alarms.

Template table
One way to ensure the correct detection technology is selected is to complete a template form for each detector. A simplified version using a number of examples is provided in Table 1, with accompanying guidance in Figure 1 and Tables 2 and 3.

The factors set out in the left-hand column of Table 1 should all be considered, so that the completed version can be used as a live document to help designers, commissioning engineers and service or maintenance technicians select detection and justify those choices and, where appropriate, substantiate any subsequent changes either in detector type or setting.

Figure 1 and Tables 2 and 3 on typical fire and false alarm risks can also inform the completion of the selection table.

Guidance on completing selection table
● Detector reference: it is good practice to give each detector a unique reference such as detector 1, detector 2 and so on.
● Protected area: this should correspond to the system category as defined in BS 5839–1: 2017 clause 5.
● Anticipated use of area: only the main use of the area needs to be listed.
● Fire risk(s): fire risk can be described as the fire type or in terms of the cause; for instance, a fire involving electrical cables could be described as smouldering white smoke or as overheating electrical cables. Table 2, which gives some examples of fire risk, should be used to help complete this field.

False alarm risk(s): only the predominant false alarm risk

Table 1

<table>
<thead>
<tr>
<th>Detector reference</th>
<th>Example 1</th>
<th>Example 2</th>
<th>Example 3</th>
<th>Example 4</th>
<th>Example 5</th>
<th>Example 6</th>
<th>Example 7</th>
<th>Example 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protected area or type of area</td>
<td>Hotel bedroom with en-suite shower</td>
<td>Disabled person’s hotel bedroom with en-suite shower</td>
<td>Small office kitchen with toaster and microwave but no oven</td>
<td>Commercial kitchen with oven in community centre</td>
<td>Escape stairs</td>
<td>Boiler room</td>
<td>Data storage room</td>
<td>Sawmill</td>
</tr>
<tr>
<td>Predominant use of area</td>
<td>Sleeping</td>
<td>Sleeping</td>
<td>Tea, coffees, toast, microwave cooking</td>
<td>Cooking</td>
<td>Escape route</td>
<td>Boiler room</td>
<td>Data storage</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>Fire risk(s)</td>
<td>Smouldering dark smoke</td>
<td>Smouldering dark smoke</td>
<td>Flaming (dirty)</td>
<td>Flaming (dirty)</td>
<td>Smouldering white smoke</td>
<td>Flaming (dirty)</td>
<td>Smouldering white smoke</td>
<td>Smouldering white smoke</td>
</tr>
<tr>
<td>False alarm risk(s)</td>
<td>Steam</td>
<td>Smoke</td>
<td>Smoke or steam</td>
<td>Smoke or steam, rapid heat rise</td>
<td>N/A</td>
<td>Dust</td>
<td>N/A</td>
<td>Dust</td>
</tr>
<tr>
<td>Detector setting</td>
<td>See commentary (overleaf) for each case</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certified modes chosen?</td>
<td>Yes, for all these examples</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceptable to interested parties</td>
<td>N/A; only required if detectors with non-certified settings are used</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire strategy met?</td>
<td>Yes, for all these examples</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rationale for selection of detector type and choice of setting</td>
<td>Heat detector, fixed-point, middle setting</td>
<td>Early warning; provides increased escape time</td>
<td>Lowest temperature [most sensitive setting], and rate of rise</td>
<td>Highest temperature [least sensitive setting]</td>
<td>Early warning [highest sensitivity]</td>
<td>Highest temperature [least sensitive setting], and rate of rise</td>
<td>Specialist advice required</td>
<td>Very early detection necessary</td>
</tr>
<tr>
<td>Comments or actions</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Sandland-Taylor Consultancy
needs to be identified. The examples of risk in Table 3 should be used to help complete this field.

- **Detection type**: select the detection type that gives the desired form of warning and minimises false alarm risk.
- **Detector setting**: this is critical, because settings in a detector type vary from manufacturer to manufacturer. Some produce different ranges of addressable detector – which comprise a series of detectors and devices connected to a central control panel – with differing sensitivity settings, and it might be necessary to seek specific advice from the chosen detector company.
- **Certified modes**: some detectors may have operation modes that are not certified to the relevant part of BS EN 54, but these should be avoided where at all possible. However, where such modes are used, the decision to do so and the rationale for it should be agreed in writing by all relevant interested parties following a fire risk assessment, and then noted in the detector selection table.
- **Acceptable to interested parties**: BS 5839–1: 2017 clause 6 defines relevant interested parties, including the building control body and the fire authority.
- **Fire strategy**: it is imperative that the implications of any future change to detector type or to settings are fully understood, such that the objectives of the fire strategy continue to be met throughout the lifetime of the building.
- **Rationale for selection of detector type and choice of setting**: this should be recorded to inform and assist any future decisions that might be taken in relation to the suitability of the detector and its settings.
- **Comments or actions**: any additional, relevant information concerning the detector selection should be provided, and there should also be a record of any required changes – for instance, fine-tuning the sensitivity of a particular detector by adjusting its settings or the substitution of one detector type with another, such as replacement of a smoke detector with a multi-sensor optical–heat device.

### Commentary on selection table examples

**1. Hotel room with en-suite shower**

In a category L2 or L3 system for an hotel (see Building Control Journal June/July, pp.12–13 for details of categories), it is acceptable to install heat detectors in bedrooms; the objective in such a case is to warn all occupants before the integrity of the bedroom door is threatened by fire. Some hotel chains, however, prefer to have smoke detection fitted to give them warning that a guest is smoking in a bedroom, as this enables them to take prompt action. Such smoke detection provision would inevitably increase the risk of false alarms, so it is not a decision to be taken lightly; however, a compromise might be to provide a combined optical–heat detector. The rationale for this kind of decision must be clearly documented in the selection table.

**2. Disabled person’s hotel room with en-suite shower**

In this example, the hotel bedroom has smoke detection to give the earliest possible warning for disabled persons, and thereby afford them more time to escape in the event of a fire. Ionisation smoke detection is chosen in preference to optical technology to reduce the risk of false alarms from steam produced by the shower or a kettle.

**3. Small kitchen with toaster and microwave**

This is an example of a typical food preparation area provided in many workplaces. In this scenario, ionisation or optical smoke detection is not recommended due to the risk of false alarms from the production of steam and smoke particulates. A low fixed-temperature heat detector with a setting to pick up a sudden rate of rise would be most desirable in this situation.

**4. Commercial-type kitchen**

This particular scenario has the potential for three false alarm risks: smoke and steam production as well as rapid thermal change caused by opening oven doors. A heat detector with the highest setting – albeit the lowest sensitivity – would strike an ideal balance between fire detection and false alarm reduction.

**5. Escape stairs in protected stairway**

Maintaining the integrity of protected stairs is essential to ensure a safe means of escape. As these are fire-sterile areas, the risk of fire in a stair enclosure should be very low. However, consideration should be given to the possibility of smoke entering the protected stairway. Either ionisation or optical smoke detectors would provide an early warning in this event, with the latter being the preferred choice as they would detect any smoke that might obscure people’s vision and make escape more difficult.

**6. Boiler room**

Smoke detection would not be suitable due to the presence of dust and dirt. Room temperatures are likely to be relatively high, and could fluctuate from time to time.
A heat detector with a high fixed-temperature setting would mitigate false alarm risks. If temperature fluctuations are less significant, a heat detector with combined rate of temperature rise and high fixed-temperature settings could suffice.

**7. Data storage room or suite**
Loss of a data storage room or suite could devastate a business, and therefore rapid detection of fire is critical in such a situation. Aspirating smoke detection is up to 100 times more sensitive than traditional point smoke detectors, and can identify smoke even before it is visible to the human eye. Specialist advice should be sought for such an application, however.

**8. Sawmill**
In this scenario, a carbon monoxide detector would be most suitable to prevent smouldering in the early stages from developing into a major life-threatening fire. In such an environment, a smoke or heat detector would only be activated once a significant fire had taken hold.

---

**Table 2**

<table>
<thead>
<tr>
<th>Fire phenomenon</th>
<th>Example fire(s)</th>
<th>Ionisation detection</th>
<th>Optical (scatter) detection</th>
<th>CD detection</th>
<th>Heat detection</th>
<th>Flame detection</th>
<th>Typical two-sensor detection (e.g. optical–heat)</th>
<th>Typical three-sensor detection (e.g. optical–heat–CD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smouldering white smoke</td>
<td>Smouldering electrical fire</td>
<td>**</td>
<td>*****</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*****</td>
<td>*****</td>
</tr>
<tr>
<td></td>
<td>Smouldering wood</td>
<td>***</td>
<td>*****</td>
<td>****</td>
<td>*</td>
<td>*</td>
<td>*****</td>
<td>*****</td>
</tr>
<tr>
<td>Smouldering dark smoke</td>
<td>Smouldering furnishings</td>
<td>**</td>
<td>****</td>
<td>***</td>
<td>**</td>
<td>***</td>
<td>*****</td>
<td>*****</td>
</tr>
<tr>
<td>Smouldering,</td>
<td>Waste-paper bin fire</td>
<td>****</td>
<td>****</td>
<td>**</td>
<td>**</td>
<td>***</td>
<td>****</td>
<td>****</td>
</tr>
<tr>
<td>changing to flaming</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flaming (clean burn)</td>
<td>Burning solvents</td>
<td>*</td>
<td>*</td>
<td>***</td>
<td>*****</td>
<td>***</td>
<td>****</td>
<td>****</td>
</tr>
<tr>
<td>Flaming (dirty burn)</td>
<td>Burning oils</td>
<td>**</td>
<td>***</td>
<td>**</td>
<td>***</td>
<td>***</td>
<td>****</td>
<td>****</td>
</tr>
</tbody>
</table>

**Table 3**

<table>
<thead>
<tr>
<th>False alarm risk</th>
<th>Example false alarm location/cause</th>
<th>Ionisation rejection</th>
<th>Optical (scatter) rejection</th>
<th>CD rejection</th>
<th>Heat rejection</th>
<th>Flame rejection</th>
<th>Typical two-sensor rejection (e.g. optical–heat)</th>
<th>Typical three-sensor rejection (e.g. optical–heat–CD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam</td>
<td>Shower or bathroom</td>
<td>*****</td>
<td>**</td>
<td>*****</td>
<td>****</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Smoke</td>
<td>Smoking; kitchen or cooking fumes</td>
<td>*</td>
<td>***</td>
<td>****</td>
<td>*****</td>
<td>***</td>
<td>****</td>
<td>****</td>
</tr>
<tr>
<td>Dust</td>
<td>Warehouse</td>
<td>***</td>
<td>**</td>
<td>*****</td>
<td>*****</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Other particular</td>
<td>Aerosol canister products; artificial smoke</td>
<td>*</td>
<td>*</td>
<td>*****</td>
<td>*****</td>
<td>***</td>
<td>****</td>
<td>****</td>
</tr>
<tr>
<td>Sparks/naked flames</td>
<td>Welding</td>
<td>**</td>
<td>**</td>
<td>***</td>
<td>***</td>
<td>*</td>
<td>*****</td>
<td>*****</td>
</tr>
<tr>
<td>Substance ingress</td>
<td>Insects</td>
<td>**</td>
<td>***</td>
<td>*****</td>
<td>****</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
</tr>
<tr>
<td>High ambient airflow</td>
<td>Air conditioning; open doors or windows</td>
<td>**</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
</tr>
<tr>
<td>Rapid thermal change</td>
<td>Opening of ovens</td>
<td>**</td>
<td>*****</td>
<td>*</td>
<td>*****</td>
<td>***</td>
<td>****</td>
<td>****</td>
</tr>
</tbody>
</table>

**Key:**
- **Very good**
- **Good**
- **Moderate**
- **Poor**
- **Very poor**

---

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I have worked in building control since 1990, and after 17 years in local government enforcing the Building Regulations, I moved on to work at an approved inspector 11 years ago.

During this latter part of my career as a surveyor in private practice, I have worked as an active auditor of private building control bodies (BCBs) for the Construction Industry Council Approved Inspectors Register (CICAIR), and as an APC chairman and assessor for both RICS and the Chartered Association of Building Engineers.

In these roles I have asked questions of my colleagues, peers and students about Building Regulation enforcement in the private sector. In answer, I often hear that an approved inspector cannot enforce compliance with the regulations as this is the duty of local authorities only.

**Legal mechanism**

These answers are half right: the work must be referred back to the local authority for enforcement action to be formalised, but approved inspectors must also follow legal procedures. It is this that has inspired me to write this article.

The legislation that shapes the way BCBs administer their functions comes from the Building Act 1984, section 91 of which places a duty on local authorities to enforce the Building Regulations in their areas of administration. It is intended that they do so in either one of two ways: 
- under the provisions of section 35 of the act, they may take court action against those responsible for building work in respect of any breach of the Building Regulations
- they may serve a notice under the provisions of section 36 to request removal or alteration of any works that do not comply with any of the relevant scheduled requirements of the Building Regulations, so as to secure compliance.

However, section 48 of the act suspends local authorities’ duty to take any such action when an active initial notice has been served in respect to a development; in other words, they cannot take enforcement action during the time that works are controlled by an approved inspector. So how, during this period, are the relevant Building Regulations effectively enforced?

**Duty**

To answer this, it is first necessary to explain an approved inspector’s duty.

They must follow the administrative provisions in the Building (Approved Inspector etc.) Regulations 2010, referred to as the AI Regulations, which state that it is the function of an inspector to take such steps as are reasonable to satisfy themselves, within the limits of professional skill and care, that the controlled works are likely to comply with the relevant requirements from the Building Regulations.

But what happens when controlled works cannot be verified by the approved inspector as likely to be compliant? The act and the AI Regulations both make provision for such an event.

Section 52 of the act deals with cancelling the initial notice, giving three instances when an approved inspector may do so; the suspension of the local authority’s duty is then lifted, and it may instigate action in respect to any breach of Building Regulations.

The three instances specified in the act are as follows:
- the approved inspector becomes or expects to become unable to carry out their function with any aspect of the work
- the approved inspector believes any of the work is being carried out in such a way that they are unable adequately to carry out their function
- the approved inspector believes there is a contravention of any provision of the Building Regulations with respect to any of the work.

In any of these circumstances, the approved inspector must cancel the initial notice using a prescribed form, which is given in the AI Regulations’ schedules.

**Defective work**

In the case of point 1, the person responsible for the work may have fallen into contractual dispute with the approved inspector, who has then withheld their service; or, the approved inspector may no longer be able to service the work.

However, I would like to concentrate on points 2 and 3, when an approved inspector witnesses defective work or suspects that work covered up before inspection might be non-compliant.

Although it is relatively uncommon, an approved inspector might not have been informed of works commencing and so not have had the opportunity to inspect them during their initial stages. For whatever reason, critical stages of inspection may also have been missed, such as an excavation before casting the concrete foundation of a building. If this is the case, the building work may have advanced beyond the stage when an approved inspector can form a view of likely compliance.

If the approved inspector is not able to see exposed works and form such a view, or the builder simply refuses a request to expose the works to allow further inspections to assess likely compliance, then the approved inspector must cancel the initial notice.

“**There is a legal mechanism for approved inspectors to play their part in the enforcement process**
It is wise for an approved inspector to deal with such instances swiftly so that legal process can be followed and the matter can be referred to the local authority quickly. In accordance with the Building Control Performance Standards (BCPS), the approved inspector should furnish the local authority with enough information that it can take appropriate enforcement action against those responsible for the work.

The BCPS advocate best practice that all BCBs must follow to ensure their service to their clients and the law. The BCPS must be followed by an approved inspector as a condition of their licence to practise from CICAIR, which acts in accordance with the delegation order from the government to approve and regulate inspectors’ activities.

**Non-compliant work**

The third instance in which an initial notice can be cancelled comes about when an approved inspector witnesses work that does not comply with a relevant Building Regulation requirement.

Under such circumstances, the approved inspector must give a contravention notice to the person responsible for the building work. AI Regulation 18 deals with the “cancellation of initial notice”, and offers guidance for the shape of the notice of contravention.

It states that if an approved inspector believes any of the work described in an initial notice contravenes any provision of the Building Regulations, they may give notice in writing to the person carrying out the work, specifying:

- the requirement of the Building Regulations that, in the approved inspector’s opinion, has not been fulfilled
- the location of the work that contravenes that requirement.

The contravention notice shall inform the person carrying out the work that they have three months, beginning on the day the notice is given, to pull down, remove or alter the contravening work to make it comply with the Building Regulations. If the contravening work is not remedied to comply with the regulations within this three-month period, the approved inspector shall cancel the initial notice, resulting in a reversion of control of the work to the local authority under AI Regulation 19.

On the reversion of work, a local authority may, after giving reasonable notice to the person responsible for this work, request sufficient plans to identify the extent of any non-compliance with the regulations. It may also request that the owner cut into, lay open or pull down so much of the work as prevents it from ascertaining whether any other work complies with the functional requirements. It should be noted that reversion of work previously controlled by an approved inspector is different to a regularisation application.

The wording in AI Regulation 18 is very similar to that given in section 36 of the act, because both are intended to serve the same purpose. This is quite deliberate, as the aim is to achieve continuity of control in the enforcement of Building Regulations between approved inspectors and local authorities.

Through the means that I have described, BCBs are able to work harmoniously to secure the safety of people in and around buildings, by ensuring swift and effective enforcement of the Building Regulations.

Andrew Crooks is Chief Executive of jhai limited andrew.crooks@jhai.co.uk

Related competencies include Legal/regulatory compliance
Care work

Conversion of an historic school in Cleethorpes into a nursing home was made possible by a proposal that was both careful and imaginative, as Jane Keely relates.

Cleethorpes is probably best known as a quiet seaside resort on the North Lincolnshire coast. It is now also the location of a care home that caught the attention of the media when it opened in September 2016 for its imaginative engagement with residents, and won the Best Regeneration Project at the Pinders Healthcare Design Awards the following year.

The building that now forms Lindsey Hall Nursing Home is well known in the annals of local history in Cleethorpes. For 46 years, it housed Cleethorpes Girls’ Grammar School before becoming Lower Lindsey School.

Following its closure, it remained empty for a substantial period. When it eventually came to the sale of the redundant, council-owned building, four interested parties submitted proposals for the site: a charity, an hotel, a housebuilder and Yorkare – a care provider based in the East Riding of Yorkshire.

Local lists

Although the building was not formally listed, it was included in the Local List of Historic Assets of Special Interest. This status doesn’t impose any restrictions on the building, however; neither does it give additional protection from harm.

When county or district councils or unitary authorities compile local lists, their intention is to raise awareness of the importance of the buildings thus listed. The lists also provide an important middle ground between the extensive historic environment record, which contains information on the archaeology and heritage structures in a particular area, and the more stringent criteria of the national designations.

The local authority was keen that the proposed scheme for Lower Lindsey School retain and restore as much of the original building as possible. Respect for its history was also a key factor in the decision to accept the Yorkare proposal.

Architectural input on the scheme came from Fluid Design Associates, a design practice formed 10 years ago by directors Matt Coulson and Andrew Jenkins. It specialises in healthcare developments, with both directors and their team having extensive knowledge in designing for dementia care and the elderly.

The firm was under no illusion as to the complexities of converting a building of historical interest into a modern care facility. Before starting the design, Fluid worked closely with Yorkare to obtain a detailed understanding of the intended care provision and the way the care team would operate the facility.

Care homes design

It is important that the design of care homes allows people with age-related impairments to understand and be able to negotiate their living environment.

Approved Document M gives some guidance for people with mobility impairment and a little direction for design for those with impaired sight or hearing. But there is nothing in the Approved Documents to assist in designing for those with cognitive impairment; and, while the safety of the residents is the overriding requirement, residents’ quality of life is enhanced when they can live as independently as possible in their surroundings.

When an individual leaves their small, private home to move into a care facility it is a big change, not only for that individual but also their family. Residents often have difficulty comprehending that living unaccompanied is no longer safe for them so, when designing the new care home, Fluid Design wanted to create a hub that offered a sense of community.

Evacuation strategies

Early discussions with Assent Building Control were fundamental to ensuring that the evolving design enabled safe and controlled evacuation if necessary, but without compromising the safety of the residents on a day-to-day basis.

Progressive horizontal evacuation was proposed to let residents reach a place of relative safety within a short distance. Further evacuation would also be possible when pressure of time was less.

Apart from a central three-storey structure with a basement, the majority of the existing building had a single storey. Through the initial discussions with Assent, it was agreed that staff accommodation would be housed in the central multi-storey segment, with the remaining single-storey building extended to form a figure of eight.

This design created two natural courtyards that would allow the residents to enjoy an external environment within the safe demise of the home. The travel distances from the courtyards necessitated two separate escape routes, and it was important that a fire in one compartment adjacent to either courtyard should not compromise...
safe evacuation from these areas. The proposals therefore included escape routes into separate fire compartments, of which there totalled more than 17 on the ground floor alone.

Another consideration in safeguarding the residents was the provision of green break-glass points. The possibility for manual release of the electronically powered locks to external doors was considered a weak point when ensuring that residents did not leave the safe confines of the home, an issue that has historically proven problematic in care homes for a number of operators.

In order to discourage tampering with the door-release system, covers were placed on the green break-glass points, with plastic stays that could be easily broken by the trained staff but not by residents. Wallpaper with bright, random colours was also found to deter the residents from the break-glass points.

As with all evacuation strategies, particularly more specialist ones, it was important that the fire strategy and key features were recorded so they could be communicated to the building management once works were complete.

**Interior design**

To give residents further help to identify their surroundings, the interior design included individually coloured bedroom doors. This also has obvious benefits for the partially sighted.

It was agreed that the doors to ancillary accommodation could in contrast be kept as plain and as inconspicuous as possible – another example of careful design being used as an appropriate but gentle deterrent in the residential environment.

The original school features gave the design team an opportunity to create a sense of neighbourhood. The old assembly hall was turned into an indoor street scene including several shop facades, a working hair salon and café, as well as a bowling green and bandstand (see image, below left). These are specifically designed with the residents in mind and feature objects and items that will provoke memories.

The inclusion of this scene would provide significant points of interest for the residents, giving them a place where they could interact with their families: the traditional style of the street would offer them mental stimulation and a relaxed environment for their visitors. The covered hall also meant that the facility was useable throughout the year. A smaller street arcade captured the imagination of the media, including a licensed bar with courtyard seating, a cinema and further working shops.

The recreational spaces also had a serious function in helping the residents identify key areas, the aim being to reduce confusion and disorientation. Wayfinding, especially for residents with dementia, plays a big part in the well-being of those living in the home.

**Windows**

The floorspace of the original school was more than 3,500m², and so improvements to the existing building were required to increase its energy efficiency, in line with Approved Document L2B. As part of the renovation, it was proposed that all the existing windows would be replaced, and although the conservation officer based at North East Lincolnshire Council was keen for the design team to specify timber windows the council did eventually agree to uPVC conservation windows that give a better thermal performance.

The height of the existing windows let a tremendous amount of natural light into the building, and this was an aspect that the design team was keen to retain as far as possible.

Even though the height of the existing glazing did ultimately have to be reduced, it was possible at the same time to retain the existing appearance to the external elevation. Careful detailing was agreed to reduce the risk of cold bridging where the new ceiling met the existing glazing above the ceiling line.

A combined heat and power system was installed, together with an energy management system and LED lighting throughout the home. These features helped ensure the care home achieved an A-rated energy performance.

Matt Coulson comments: “Our key objective when setting out on the project was to make sure that the home we created had a positive impact on the people living in the building. We are pleased that through our design we have been able to make a difference to the quality of life of the residents, their family members and friends.”

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In March, during this centennial year for the RAF, the London Borough of Hillingdon’s Battle of Britain Bunker and Visitor Centre in Uxbridge, Middlesex opened to the public.

The centre is designed to sustain the ongoing viability of the bunker – the heritage site used by No. 11 Group Fighter Command during the Second World War – to make a significant contribution to the RAF’s public engagement goals.

Aircraft history
The centre also reaffirms the borough’s contribution to national history. The base that the bunker supported not only stationed many of the aircraft that flew in the Battle of Britain and Polish fighter squadrons during the war, but also subsequently provided supporting flight infrastructure during the construction of Heathrow Airport in 1946. More recently, it stationed four Typhoon fighter aircraft during the London 2012 Olympics.

In 2016, the borough took over custodianship of the historical site from the Ministry of Defence. In May 2018, the centre won the title of Best Public Service Building in the LABC Building Excellence Awards for the London regionals, and also qualified for the national finals due to be held in November.

The project has been carried out jointly by the London Borough of Hillingdon’s building control team, led by Anthony Oloyede, contractors VolkerFitzpatrick and architects Pattern Design. Oloyede explains that: “The construction team, consultants and borough building control met regularly throughout the build to ensure all aspects of required compliance were fulfilled and the visitor centre progressed smoothly to very tight timescales. Our teamwork helped to deliver a striking building for visitors to admire and enjoy.”

VolkerFitzpatrick selected Pattern for its expertise in building information modelling (BIM), which it was thought would ease the challenge of a 52-week programme. The centre covers 2,000m² and is set across two levels, including a metal-deck upper floor in the exhibition hall. The design embraces the central themes of flight and stealth, with a shell-like form and winged geometry.

Hurricane hangar
Providing a dynamic, multifunctional space, the centre is designed to be used for a range of activities and events, in orbit around the central display hangar. This 519m² main hangar houses a variety of exhibits including suspended replica Spitfire and Hurricane aircraft from the Second World War; a 100-seat auditorium and lecture hall; a café and gift shop; reception area; toilets; and a workspace for schools, corporate events and functions.

The building’s exterior uses a combination of cladding and statement curtain walling around a steel-frame structure. The design and build process allowed the design team to choose products more in keeping with the building’s concept of stealth and flight.

The Battle of Britain Bunker and Visitor Centre netted the London Borough of Hillingdon a regional LABC Building Excellence Award. Helen Murray explains how it achieved this.
The original choice of Standard Kalzip standing seam cladding was replaced with aluminium rainscreen panels, custom-manufactured to fit the complex, winged geometry.

The aluminium was painted black to create an impressive volume against the wooded site, while managing to diffuse the reflected light softly during the day. This achieves the illusion of an adamantine structure that nonetheless succeeds in disappearing into the surrounding landscape.

Design challenges
The angled structure and winged geometry of the building presented some challenges that demanded agile solutions. For instance, the design team inventively applied fire batt – fibreboard used for fire protection – to create an airtight seal around difficult structural steel members.

When it came to routing building services, 3D modelling in a high-end BIM environment was key. Bespoke ductwork, equipment and fittings were manufactured for the ventilation system, managing unusual angles such as 3.5°, 6° and 57°. Routes for the grilles in the exhibition hall were hidden in the wall construction to maximise the space available to the client.

To avoid large, unsightly heat, ventilation and air conditioning plant, the build team instituted a hybrid between displacement ventilation and variable air volume systems. This is designed to be controlled by the building management system to distribute air to spaces as required, modulating air volumes with greater efficiency. The displacement ventilation method in the auditorium and exhibition spaces also minimises air speed to ensure ongoing, even comfort for visitors in the high-ceilinged spaces.

Aesthetic innovations
As the external aesthetic was a prime consideration, the services’ terminations from the building were kept to a minimum and, where required by regulations, gas flues and soil vents were customised to match the rainscreen envelope. Similarly, the photovoltaic (PV) array installed to provide low- to zero-carbon energy was positioned to blend in with the bespoke envelope. The naturally ventilated undercroft was identified as an acoustically acceptable position to install the external plant-like condensers, while retaining the appearance of an uninterrupted facade.

These innovations were key to achieving one of the project's sustainability goals – to minimise energy use from the grid – without jeopardising lighting and thermal comfort requirements of the client.

The visitor experience was always kept at the forefront of the build team’s considerations. The heating and cooling systems achieve a 32% energy saving compared to the national calculation methodology target identified by the notional building in Part L. In combination with the PV array and other energy innovations, the centre outperforms this notional building by 37%, achieving an A-rated energy performance certificate with a score of 15.

For the pre-application discussions with London Borough of Hillingdon building control, VolkerFitzpatrick and the design team were instrumental in proposing solutions and ensuring agreements for the means of escape and the associated works.

Close monitoring as the project progressed then ensured each team was on site in a timely manner and fully briefed before commencing work. The borough’s building control team attended the site at key stages of the project to ensure that any issues and potential problems were dealt with immediately, and to reduce the need for any trade to repeat work.

The centre also represents what turned out to be a significant learning experience for Pattern Design’s RIBA Part 2 architectural assistants. As most of the practice's projects are located in the Middle East and South America, regular site visits are not always practical; however, the close location in this case meant that they were possible.

The opportunity to understand the architect’s role on site in collaboration with others is critical to the professional development of all young architects. This proved to be a rare chance to witness a complex venue of historic significance take shape under the supervision of an exemplary, open and collaborative build and building control team.

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Safe from the start

Through its experience of fire engineering, Arup has identified common problems that can arise when safety is not considered comprehensively from the design stage onwards, as Nick Troth outlines.

The first concern in fire safety design and specification should be understanding material performance during fire. This is obviously topical, but Arup has considered it important for many years: the founder of Arup Fire Engineering was Prof. Margaret Law, a scientist who understood the significance of this knowledge and instilled it in our business.

The way a material's fire performance is tested and then classified is not properly understood by designers, specifiers, contractors or approvers. There is confusion about the terminology, with different terms being used to describe the way materials behave in fire. A "surface spread of flame test" and "fire propagation test" are not the same; neither is a "combustibility test" a "fire resistance test".

Better understanding of a material's fire performance is required, and the profession must ensure the correct terminology is used and that what these terms signify is appreciated. It is also important to understand exactly the configuration of a sample used in fire tests: we see fire-stopping products that have only ever been tested in a blockwork wall and never in a ceiling or plasterboard, but which are then still used in plasterboard ceilings. Product manufacturers should be much clearer on what tests their products have undergone, and what limitations their testing has.

"Competent fire engineers need to ensure that the buildings they design are sustainable and sufficiently flexible."

New construction methods

Increasing pressure to reduce construction costs and time is seeing moves towards prefabrication, and non-traditional methods of construction are being brought to the marketplace. Yet we find insufficient research is being undertaken into the fire performance of such systems, or the products used in them. One such example is cross-laminated timber: we have found that very few fire-stopping products made of this have been tested.

We also have experience in modular buildings where there has been insufficient attention to detail to ensure fire compartmentation and stopping. A significant issue with this type of construction is extensive voids. Careful attention is needed in the design and product selection for fire performance in modular buildings to ensure that fire and smoke spread is adequately controlled, and that products have been tested in this kind of lightweight construction. If not, there are significant challenges in demonstrating that an appropriate level of safety can be achieved.

Complex systems

As building systems become more complex, the fire system requirements also increase in complexity. There are often a considerable number of systems that need to interact in the event of a fire: the alarm and detection system may have many interfaces, and these can be linked to access control systems that unlock doors on escape routes, or to lifts, either to prevent or enable their use in a fire.

Some building users focus on minimising disruption in the event of a fire alarm, which may result in phased and zoned evacuation. What happens during a fire and the expectations of how these systems will react to that fire are not always clearly documented, however. These must be considerations at the design stage. It is extremely important that the principles of the systems’ function in any given fire scenario are then carried through into the specification, construction and commissioning stages. Improved communication is also needed so end users clearly understand the systems, and know what they are expected to do and when. This is a basic requirement under Building Regulation 38, but we encounter many buildings where it is not happening. It is important that emphasis is placed on proper commissioning at handover stage, and this should be overseen by the fire engineer to ensure the systems operate in line with the fire strategy requirements.

Occupancy restrictions

A fire strategy should not place onerous or unrealistic dependence on building fire safety management. Approved Document B section 0.13 is clear on this, but we still see an increased reliance on building management controls to support fire safety measures.
We often help occupants deal with constraints and limitations placed on them by the building designs they have inherited, too. Often these designs restrict occupants' ability to use the buildings; for instance, numbers can be limited by inadequate escape provisions.

There are also difficulties in dealing with evacuations of those who are mobility-impaired, if the design team has failed to account realistically for the possible number of occupants needing assisted escape.

Competent fire engineers need to ensure that the buildings they design are sustainable and sufficiently flexible. Wherever possible, end-user engagement should take place early enough during design to make certain that the fire strategy addresses the way they will occupy and operate the building. Where this is not possible, the fire strategy should be very clear on the limitations that it imposes on the end user.

Updating guidance
Fire safety guidance will always be playing catch-up in respect of new materials, technologies, construction techniques and society. When we are aware of issues, potential flaws or deficiencies in our guidance, a proactive process of amendment, clarification and updating is essential.

As an example, several current measures relating to external walls and firefighting provisions in Approved Document B are controlled by the reference to an 18m building or storey height. This measurement originates with the fire brigade's capability to fight a fire externally using a 60ft (18.3m) ladder, based on an old wheeled-ladder vehicle of the sort one might see in a 1950s movie. These have not been in use for more than four decades, but we design to the height of the ladders carried on such vehicles.

Another example is in the previous version of BS 9999, which stated that a void passing through a structural floor should be designed as an atrium. When this was published in 2008, it was questioned on the basis that Approved Document B only applied the same design measure for a void passing through compartment floors.

It took until the 2017 edition of BS 9999 for the description of an atrium to be aligned with that of Approved Document B, and it now refers to compartment floors rather than structural floors. In the meantime, though, how many buildings were constructed in accordance with the earlier version of BS 9999 with provisions that may have been unnecessary?

Test standards and ductwork
Approved Document B refers test standards for fire-rated ductwork to BS 476–24: 1987 and BS EN 1366, the former being superseded by the latter in 2014. The BS and EN standards use the same time–temperature curve, although the measurements differ, meaning that BS EN 1366 uses a higher temperature and more onerous test criteria.

There are also differences between fire-rated and smoke-extracting ductwork in the tests. Only rectangular smoke-extracting ductwork up to 1,250mm by 1,000mm in cross-section and circular ductwork of up to 1,000mm diameter can be tested to BS EN 1366.

Larger ductwork has to rely on an extended field of application assessment. The maximum sizes of fire-rated rather than smoke-extracting ductwork that can be tested under BS EN 1366 are up to 2,500mm by 1,500mm for rectangular configurations or 1,250mm diameter for circular. Again, there is no provision to test ductwork beyond these sizes.
This then leads to incorrect specifications and confusion regarding manufacturer’s certification and fire performance of products. To resolve this, better education and understanding of ductwork fire performance requirements is necessary, as is more transparency in relation to the limitations of the current UK and EU testing regimes. A single test standard would also be beneficial.

**Fire resistance specifications**

Specifications and fire strategies often say a product should have 60 minutes’ fire resistance, but this fails to identify the actual fire performance required.

Fire performance is made up of three qualities: stability, integrity and insulation. Table A1 in Appendix A of Approved Document B outlines these requirements clearly, setting out minimum provisions for each of the three qualities, along with the method of exposure. However, the table in Approved Document B is underused as a reference source.

As a result, there are projects where a contractor purchases fire-rated ductwork, for instance, but has not understood the full fire resistance requirements for it. The insulation criteria have often been missed, and for the ductwork then to fulfil this quality it needs additional fire-rated cladding, protection or wrapping to the outside, and invariably no space has been allocated for this.

**Penetrations and stopping**

Fire strategies usually require some form of compartmentation; that is, a fire-resisting element. For fire compartmentation to be effective, anything that penetrates it must be suitably protected.

If fire-stopping is not considered during the design and specification phase, the contractor is only able to work with the substrate installed. Spacing around services is critical, but we have found on-site fire-stopping that has been installed where services are in such close proximity that its performance can no longer correspond to that under test conditions. Design teams must start allowing realistic provisions that enable fire-stopping to be installed.

**Received wisdom**

The fire strategy should be the single point of reference that sets out how a safety measure is to perform during a fire. But this strategy is often implemented without proper consideration of what it requires. One reason for this seems to be that contractors, installers and so on are simply taking the approach they have done on other projects, without questioning whether this is the right one or identifying whether improvements could be made.

A typical example of this is smoke control systems in common corridors or lobbies in single-staircase residential buildings. It is essential that these systems are installed, commissioned and maintained correctly, in accordance with the fire strategy’s requirements; but our experience is that we cannot always rely on the contractors ensuring this happens.

**Total fire engineering**

The final challenge – one we continually face – has also been raised in Dame Judith Hackitt’s review of the Building Regulations and fire safety: specifically, the lack of information transfer throughout the various project stages.

The fire strategy document should demonstrate the way in which regulatory compliance is to be achieved; advise the design team of the fire safety performance requirements of their design; tell the contractor what has to be fabricated, procured and built; and advise the client or end user about any limitations that the strategy imposes, and what they need to maintain throughout the life of the building.

There are key stages in the design and construction process where clear fire safety information needs to be passed from one party to another. Without such clear communication, the fire strategy may be misunderstood or misinterpreted in the design or specifications.

One solution could be to increase the use of building information modelling in fire engineering. At the time of writing, it is not mandated that the fire safety strategy is incorporated into a building information model, and this is something the construction profession should address, because it would provide consistency across the design and construction process. Building Regulation 38 mandates that relevant fire safety design and construction information is handed over to the relevant end users to help operate and maintain the building safely, though again our experience is that this is not being conducted properly. We would welcome building control surveyors being more active here.

For instance, the “responsible person” is often handed either a RIBA Stage 4 fire strategy or a set of operation and maintenance manuals, an approach that doesn’t help the end user understand or manage fire safety in the building.

On many projects the role of the fire engineer ends at an early design stage, with clients not engaging them to check that what has been specified and installed meets the requirements of the fire strategy.

The fire strategy has to do much more than this. For a number of years, Arup has been advocating the concept of total fire engineering as a way of addressing this by involving the fire engineer throughout the design, construction and occupation of a building.

This would align with the golden thread for fire safety and the role of building safety manager in high-risk residential buildings recommended by Dame Judith (see pp.4–5 of this issue): with this in place, digital safety case files would be deployed, and there would be gateway approval points from inception to handover to management in use.

Nick Troth is an associate director at Arup. nick.troth@arup.com

Related competencies include

Fire safety
Researchers assess knotweed harm

Ecologists from global infrastructure services firm AECOM and the University of Leeds have carried out the most extensive research to date comparing the potential of Japanese knotweed (*Fallopia japonica*) to cause structural damage with that of other plants.

As well as setting out to test the accuracy of the so-called 7m rule, which considers buildings within that distance of the plant to be liable to damage, researchers examined the risk from multiple lines of evidence. As part of their research, they:

- looked for evidence of the perceived threat in previous research literature
- surveyed invasive species control contractors and property surveyors
- assessed 68 residential properties where Japanese knotweed was found
- examined data collected when knotweed was removed by excavation from an additional 81 sites.

The research was led by Dr Mark Fennell, Principal Ecologist at AECOM, who said: “We found nothing to suggest that Japanese knotweed causes significant damage to buildings – even when it is growing in close proximity – and certainly no more damage than other species that are not subject to such strict lending policies.”

He added that although the 7m rule was based on the best information previously available, it was not a statistically robust tool for estimating how far the plant’s rhizomes are likely to extend underground.

RICS is reviewing its guidance in view of this and other recent research to determine the most appropriate means of assessing and reporting the risk posed by the plant. After the review, which will include consultation with stakeholders, RICS will issue updated advice.

https://bit.ly/2OG3ID0

www.rics.org/knotweed

Female professionals set up virtual summit

A group of female RICS built environment professionals have joined forces to run a new virtual summit known as the Surveying Sisterhood.

One of their opening conversations addressed the urgent need for personal protective equipment that fits female professionals in the construction industry.

Too often women are finding that safety equipment – including gloves, trousers, jackets and boots – does not fit, because it is designed for the average male and leaves them feeling excluded, and even worse, putting their safety at risk.

www.rics.org/surveyingsis

www.womeninsurveying.com

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The day last year I told my parents I wanted to change career was a bit of shock. For the first time in 23 years, I felt as if I didn’t have their complete backing – that was, until I explained myself.

For six years I had been forging a career in electrical engineering that had taken me from being a 17-year-old school leaver to becoming one-third of the best engineering team in the country, with which I was representing the UK at the Worldskills competition in Abu Dhabi, while also having a bright future with a major manufacturing firm at home.

Looking back now I can understand my parents’ pessimism, but my heart was set. I no longer wanted to go to work with the sole purpose of improving the bank balance of a large US corporation; I wanted to make a difference and feel that my work would benefit people every day.

Despite my success as an engineer I had decided I needed a change, and a career in building control seemed an attractive option. I had a family member in the profession who talked me through the job, its requirements and responsibilities, and we planned what I would need to do to make the change.

Work experience
I quickly found out that I would have to start from the bottom again. So, to make sure this was definitely what I wanted to do with my life, I decided that I should have some work experience in a building control environment.

I set about ringing around local authorities and approved inspectors who had offices within driving distance, asking whether any of them could offer me a placement. Staff at Assent Building Control immediately said they would be more than happy to show me what the profession is all about.

I agreed to start the next week. I still wasn’t sure exactly how approved inspectors operated and had some reservations, but by lunch on that first day I was sold. This was the career for me.

Entry paths
The two entry paths for the career are either two years full time at university or three years part time while working. I have always felt that the best way to learn is to do, so when the opportunity arose to work at Assent alongside studying building surveying at Sheffield Hallam University, I had no qualms about making the jump.

The first few months have been an absolute whirlwind, learning the basics of construction and gaining an understanding of our roles as approved inspectors. Meanwhile, at university, we have covered various topics such as surveying commercial buildings and contract administration.

However, it is the construction technology module that has been the most valuable to me as a building control surveyor because it has given me a deeper knowledge of the materials and processes I will see daily when carrying out inspections and reviewing plans.

The module itself has been delivered very differently to the others we have completed: instead of having two large assignments at the end of each semester, we have been given a specific building element to study, and completed assignments every other week on topics such as that element’s sustainability or modern methods of construction.

I have thoroughly enjoyed these past six months of combining my studies with the work at Assent. However, if I were to change anything it would be having the opportunity to study a specific building control degree as opposed to a general building surveying one. I understand that this is going to be an option for students in the future, which will no doubt greatly benefit the profession.

By the time you read this, I will have been given my own patch to carry out solo inspections that I am competent to do; for more complex inspections, I will attend site with a qualified colleague.

I have also recently enrolled on my APC. I am on the Building Control pathway, which requires a minimum 24 months’ structured training while completing my part-time degree. I am excited to start this process to see just how much I am learning as I tick off the competencies, fill out the diary and plan and structure my training with the aid of my mentor.

I look forward to sharing my progress in subsequent articles, and hope that they might prove useful for any aspiring students in future.
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28 November 2018
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Learn more at: rics.org/fireconference
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