The development of competency in fire engineering

Mostyn Bullock BEng(Hons) CEng FIFireE and Adam Monaghan BSc(Hons) CEng MIFireE introduce a series of articles focussing on competency in fire engineering

In 1996 the world became a very different place for the field of Fire Engineering. In April of that year, as a result of joint work by the Institute of Fire Safety (IFS) and Institution of Fire Engineers (IFE), the IFE was awarded nominated body status from the Engineering Council. With the ability to register professional engineers, which it began doing in 1997, the profession took perhaps its greatest ever step forward in terms of its recognition as an engineering discipline.

This is the Engineering Council's Mission Statement and its reference twice to competency is no accident: 'To maintain internationally recognised standards of competence and commitment for the engineering profession and to license competent Institutions to champion standards'.

The timing was right. Design and construction in the built environment was in a period of significant change and relative well-being. Many large scale projects were underway or in the pipeline where design requirements demanded significant freedoms from hitherto closely prescriptive approaches. The fire engineering profession flourished and prospered in this environment. The time when fire safety engineering was principally the reserve of academics, scientists and insurance surveyors had passed.

In 2008, with its policies and procedures regarded as an example of good practice by the Engineering Council, the IFE's Engineering Council Division became a Registrant's Group and today, the Institution of Fire Engineers Registrant's Group is home to 250 Chartered Engineers, 26 Incorporated Engineers, 174 Engineering Technicians and 28 Interim Graduate Registrants practising all around the world.

The rigorous processes carried out by professional engineering institutions are designed to deliver the demanded standard of competency. Registered fire engineers are bound to work under the code of conduct of both the IFE, as a condition of membership, and the Engineering Council, as a condition of registration. Continuing Professional Development is also a mandatory requirement and it is understood that the Engineering Council expects all Professional Engineering Institutions to introduce monitoring of Registrants' CPD by 2017.

The profession has been relatively good at focussing on matters of competency relating to fire engineering design but, generally, much poorer at engaging with other matters that are just as important in respect of proper project delivery

Who can argue with the sense of that?

It would therefore seem obvious to expect that practising fire engineers are competent.

So why are we taking up journal space introducing a series of articles on competency in fire engineering?

Engineers are involved in all aspects of design, construction, commissioning and operation of the built environment and the delivery of competent Fire Engineering therefore covers the entire process defined by RIBA stages of works as shown in Fig 1.

The profession can do all it can to produce Fire Engineers of the highest calibre but the domain in which these engineers operate presents serious challenges to competent and ethical practice that cannot be ignored.

This domain isn't just the technical nuts and bolts of fire engineering (ie using up to date research, employing the right standards, analysis methods, science and computational techniques etc). Rather, it is those aspects of professional conduct which relate more to ethical practice in fire engineering project management. These aspects are summarised in Figure 2, apply across all stages of project delivery and are of equal importance to the engineering methods. ie they must also be delivered according to the aforementioned codes of professional conduct. Indeed, the Engineering Council's Standard for Professional Engineering Competence (UK-SPEC) requires that applicants for registration demonstrate personal roles and responsibilities in this regard.
It is the intention of the authors to focus on these aspects and to discuss the relevant issues, challenges,

Figure 1

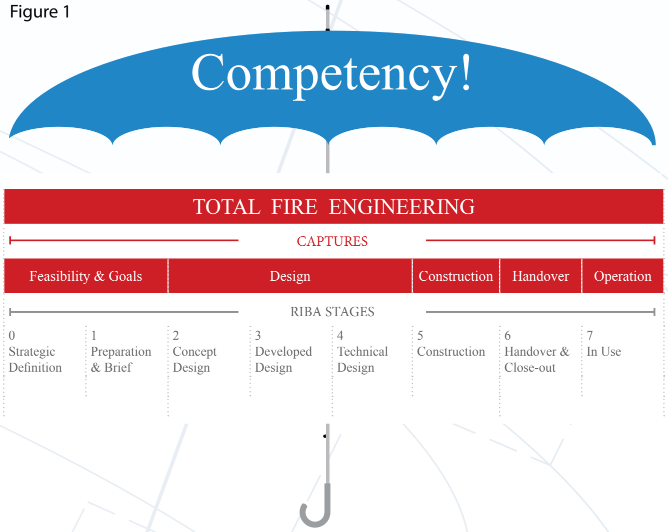
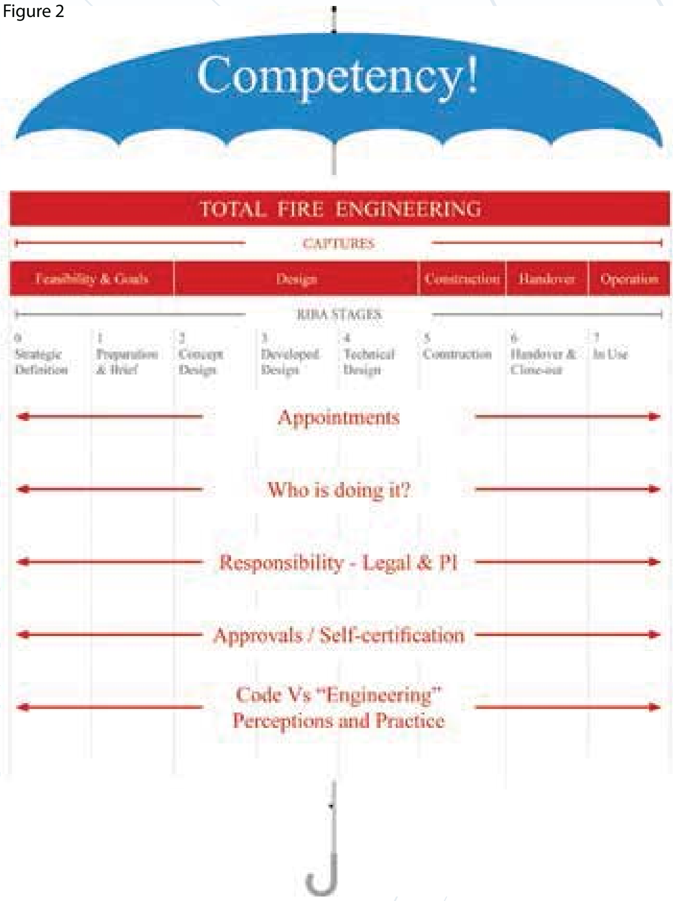


Figure 2



opportunities and conflicts presented by them.

It is also crucial to recognise that the thing that sets Fire Engineering apart from the majority of other engineering disciplines in the built environment is that fire is an accidental loading condition (ie there is a significant probabilistic aspect to its application), whereas other areas of design such as structural, acoustic and thermal performance are all 'normal' day-to-day service conditions.

Failure to design and construct a building properly in terms of 'normal' service conditions tends to lead to a situation where resulting problems manifest themselves pretty quickly in terms of customer dissatisfaction. This is in marked contrast to defects in relation to fire safety that may not become apparent until there is a significant fire, (in itself, a probabilistic event).

We have to be honest with ourselves to acknowledge that this can lead to an apathetic approach to fire safety or the perceived need to engage a competent fire safety professional being given second billing in comparison to more pressing concerns.

If a criticism was to be justifiably levelled at the fire engineering profession, it would be that it has not been active enough in collectively identifying, debating and shaping responses to the particular challenges that evolve from this most important difference between our discipline and others. Perhaps this failure has resulted from reticence in respect of avoiding upset to the generic client base, or perhaps it is because the industry has historically convinced itself that it has been busy enough not to worry about the things which aren't quite right with it. Or perhaps it is a mixture of both.

However, things have changed and continue to change in tougher commercial times and the need to address these matters together as a profession has become greater.

Appointments

A consultant selection process rightly considers the cost of the service to be provided, but does it adequately consider the timing, and competency of those bidding? How is this measured? How does a client, architect, project manager, building owner etc. KNOW that persons are adequately competent other than a simple CV that conveys fire safety experience?

Indeed, if cost is the only driver then there is a real danger that fire engineers are only considered cost cutters and not enablers of design, or the solution that costs the least money is deemed the right one.

But neither of these is true. The person has to be competent for the role and the solution has to be right for the project irrespective of what prescriptive codes say. But that is kind of the point is it not?

Who is doing it and who takes responsibility for it?

Bearing in mind the absence of any regulatory requirement for minimum professional qualifications for practising Fire Engineers, it is hardly surprising that there has been a shift in tougher commercial times to cheaper providers using staff without professional qualifications or 3rd party accreditation, or who offer 'added value' products or services. What qualification or experience does a 'fire engineer' actually need? What would stand up in a court of law?

Are clients clear on their responsibilities under CDM Regulations to ensure that persons contracted to provide design are competent and properly resourced to do so?

Are contractors fully aware of how far their responsibility under CDM and the Fire Safety Order extends to adequately protect relevant persons who are not on their site? This includes parts of premises shared with the site that are still under occupation, persons in adjacent premises and also the public at large. What do they do about this? What do fire engineers tell them?

Beyond design, such client responsibility also extends to the management of fire safety in operational premises including the appointment of competent persons to comply with fire safety law (eg the Fire Safety Order in England and Wales and similar). Are clients properly aware of this responsibility?

Are clients properly aware design and approval/ enforcement should be sufficiently separate to avoid conflict of interest? Such conflict can negatively impact on solution competency and result in unethical practice.

Legal responsibility for adequacy of design rests with the designer, not the approver. This is as true for the design of fire safety arrangements as it is for the other engineering disciplines involved in the project. It is also true irrespective of whether the design is for a simple single storey industrial unit or for a complex building such as an airport or hospital.

So who is taking on the responsibility for the fire strategy design and is it a question that is even properly considered on the many projects where a qualified fire engineer is not engaged? Who takes on the design responsibility for feedback or advice from an enforcing body that is acted upon by the project team?

Approvals and Certification

Do clients properly understand the approvals process and what it offers in terms of legal protection? Commonly, the fact that sign-off of the project has been provided by Building Control is the response when aspects of poor construction are identified at handover or through future Fire Risk Assessment of the premises. Why does this happen so often?

The absence of awareness and proper compliance with Regulation 38 can justifiably be described as endemic. Why is this? Is it due to inadequate change control process to account for deviation from the approved design during construction delivery, a reticence to enforce it at a time when emotions are invariably running high at project handover, or absence for clearly defined responsibility to ensure that the necessary handover of complete and accurate information takes place?

Should our profession be pushing the Regulators to explore the option of making the designer legally responsible for certifying that the design has been properly implemented (as is the case in the Republic of Ireland)?

The perception and practice of 'fire engineering' as an alternative to code approaches

The term 'fire engineering' is clearly embedded in the psyche of the architectural profession as a technique or service that is required when the design has departed from compliance with statutory guidance. The reasons for such departures are numerous but often include achieving aesthetic objectives, saving construction costs, constraints presented by the site, constraints presented by the client brief, conflict with security and, sometimes, genuine mistakes in terms of achieving basic code compliance that cannot be easily rectified. The term 'fire engineering' is also sometimes tainted with a degree of suspicion and negatively perceived in some quarters as a euphemism for pulling the wool over the eyes of the enforcement body.

Particularly in complex buildings, the chances of the design team arriving at a compliant design without the input of a qualified fire engineer are scant to say the least. So, why is it that a correct and cost effective interpretation and application in design of statutory fire safety guidance and fire design codes is not also widely considered as 'fire engineering'?

Is it because fire safety design according to statutory guidance is viewed by the client's project manager as something that should be within the capability of the lead designer or M&E consultant?

Has the profession allowed the perceived differentiation between "code-compliance design" and 'fire engineering' to develop and persist? Is this a flawed but convenient means of managing the differences between simple and more complex projects? How often does this lead to situations where projects are shoe-horned into a design approach using statutory guidance? For instance, Extra Care premises provide self-contained flats as an alternative to traditional care or nursing homes. Fire safety design of buildings containing flats can be approached according to prescriptive recommendations in statutory guidance. But is the use of this guidance sufficient for the additional risks that are presented by this new type of premises?

Code compliance does not necessarily equal safe. Let us not forget the quote right at the front of Approved Document B that states 'the approved documents are intended to provide guidance for the more common building situations'.

Essentially, it is the issues described above that have driven a widening wedge between the competency of the individual fire engineer and the consistent ethical application of competent fire engineering in the built environment.

The absence of regulatory requirements controlling the provision of fire engineering and the fact that fire is an accidental loading condition conspire to generate a marketplace for fire engineering that is at the same time both rewarding and interesting but also presents opportunities for things to be done or bought unethically. For these reasons it is even more important for the qualified fire engineering profession to drive forward an agenda of competency and ethical practice to an extent that other professions may not need to do.

So why are we taking up journal space talking about competency? The intent of forthcoming articles will be to explore the various aspects of competent ethical practice in more detail and to include the relevant experiences and views of other contributors. Are we a fire safety industry operating competently? We should be but are not always. It is our industry and we have the power to shape it, control it and above all ensure it is undertaken with competence.

It is probable that the significant majority of the discussion presented in the articles will be based on the local experiences of authors and contributors but the core issues will likely to be of relevance in other jurisdictions, including those that are much further afield.

It is intended that the articles will prod at some sensitive issues and it is hoped will encourage reflection and generate discussion and debate.

The authors would like to express gratitude to colleagues who have provided assistance with this introductory article. In particular, Neal Butterworth MPhil BEng(Hons) CEng MIFireE who is responsible for the idea of employing the term 'Total Fire Engineering' to describe the complete process of professional fire engineering engagement and who is currently heading the IFE's recently formed Special Interest Group on Competency and Ethics.

For more information on becoming a Registered Chartered Engineer with the IFE visit www.ife.org.uk/engineeringcouncil and email your cv to membership@ife.org.uk for tailored advice.

Legionella in firefighting systems

In an exclusive report Jacky Yeung from Mott MacDonald analyses the risk of Legionellosis outbreak in typical firefighting systems in buildings

Legionellosis is a form of pneumonia infection that can lead to the potentially fatal Legionnaires' disease. Legionellosis can also lead to Pontiac fever, which is a less serious disease and most patients can recover without antibiotic therapy [1]. The bacterium that causes the disease is Legionella and can only be found in favourable aquatic environments, which can easily occur in some commonly installed water systems in both public and private buildings. Human infection is normally through the inhalation of tiny droplets of water, contaminated with Legionella, deep in to the lungs.

This article analyses the risk of Legionellosis outbreak in typical firefighting systems in buildings. It is considered that these systems provide favourable conditions for the bacteria to grow and multiply, but the risk has usually been neglected or ignored from a fire design perspective. A number of publications have been reviewed as part of this study to identify the pathway for Legionella transmission to humans.

Conditions for Infection

The critical pathway for Legionella to be transmitted to the human body is through the inhalation of contaminated aerosolised water droplets of less than 5µm in diameter, deep into the lungs [2, 3]. The optimum water temperature for bacteria population growth and to dangerous levels is between 200°C and 450°C [3, 4]. The bacteria are killed at higher temperatures. The risk of allowing the bacteria to live and grow is particularly high in stagnated or slow flowing water. Sludge, scale, rust and organic materials are nutrients for the bacteria in these environments [2, 4].

These previous studies have identified the following non-exclusive list of water systems as sources of the bacteria:

- Wet cooling system such as air conditioning system [4, 5]
- Humidifiers and water mist system [5, 6]