IAFSS Workshop on Education 2023 – Perspectives on the need for competence in Fire Safety Engineering

R.J. Bray[1,2], N. Fernandez-Anez[3], C. Maluk[4], B. Merci[5], Y. Wang[6] and M. Woodrow[7]

[1] Belfast School of Architecture and the Built Environment, Ulster University, Belfast, Northern Ireland, BT15 1AP, UK

[2] Hydrock Consultants Ltd, Merchants House North, Wapping Road, Bristol, BS1 4RW, UK

[3] Western Norway University of Applied Sciences, Bjørsonsgate 45, 5525, Haugesund, Norway

[4] Semper, London, UK.

[5] Dept. of Structural Engineering and Building Materials, Ghent University – UGent (Belgium).

[6] FM Global, Research Division, Norwood, MA, USA

[7] Dept. Of Civil, Environmental and Geomatic Engineering, University College London (UCL), UK

Abstract

This letter contains opinions, statements and perspectives as expressed during a workshop on education, held on 21st October 2023 in conjunction with the 14th International Association for Fire Safety Science (IAFSS) Symposium. These resulted from a panel discussion in an interactive manner with the audience, focusing on competence in Fire Safety Engineering (FSE) as a central theme in the context of the built environment industry. The panel represented industry, consultancy, academia and PhD students as different stakeholders related to FSE.

Drivers for holding a workshop on competence during IAFSS2023

A motivation for having this theme for the workshop has been the efforts by multiple organisations and associations worldwide (SFPE [1], Warren Centre [2], IFE [3], European Commission [4]) finding a proper answer to the question of 'competence in FSE'. The first question raised, though, was "What is the role of the fire safety/protection engineer in the built environment?". This was taken as the starting point to discuss 'competence in FSE' [5]. Setting the bar for competence sufficiently high and creating a globally accepted accreditation mechanism for professionals would allow for all stakeholders involved to identify a fire safety engineer having the minimum required competence. Moreover, it would provide a clear identity to the FSE profession, not only recognised by other stakeholders, but also by society in general. This said, it was acknowledged that there is often a significant difference between the reality of the profession as it is (delivering engineering/design services to get buildings approved), and the work that a fire safety engineer could potentially do (effectively assist architects in designing a fire safe building). Hence, the question raised today ('*Can you make sure the building gets approved?*') should be changed into: '*Can you help me, and work with me, to design an innovative and cost-effective fire safe building?*' Hence, fire safety engineers should be able to work in tandem with the creative visions of designers and find comprehensive solutions to complex problems rather than simply acting as analysts of guidance standards. Otherwise, not only is an enormous potential left unused, but additionally, a prescriptive approach remains the dominant perception of FSE. A prescriptive approach, reliant on regulations, codes and standards, can be conservative and often evolve only slowly.

This implies that FSE cannot be vocational; it must be professional, so that regulations, codes and standards can be challenged technically when they are inadequate. Fire Engineers need skill, courage, experience (learning by doing) and classroom education to do this.

Related to this, it is indeed recognised that critical thinking is a key attribute for a competent fire safety engineer, who should be capable of resourcing FSE principles rather than the application of prescribed design/engineering solutions. However, as it is today, most often there is little incentive to engage in in-depth technical discussions and to take up responsibility for decisions made (which are currently effectively made by the broader design team). It is deemed important to introduce accountability into the profession, so that high-level professionalism, and along with it, professional integrity, is rewarded. As of today, a competent fire safety engineer who, through the mastering of first principles and critical thinking, is capable of identifying relevant problems that are left unnoticed by others, could actually lose the bid (and possibly future bids). In the absence of a clear, and agreed upon, competence framework for fire safety engineers, the other stakeholders might indeed perceive the competent fire safety engineer as a person creating problems and generating additional costs, rather than the person who effectively provides a meaningful and valuable contribution in the overall fire safe design process. Moreover, there is a higher risk of issues resulting from poor fire engineering design going unnoticed and remaining a dormant risk long into the life cycle of a building. Hence it is deemed important to create a professional framework and culture where competence can be challenged in a clear and transparent manner, which is rarely (if ever) the case for FSE today [5]. As such, a situation is created where fire safety engineers are reduced to the person that tries to get the building to comply with the relevant building regulations, rather than a person that creates added value through an improved fire safe design.

Wider and 'better' awareness of who the Fire Safety Engineer is?

For this potential (of the fire safety engineer bringing added value) to be recognised by the other stakeholders, it is considered key for these other stakeholders to realize the added value the fire safety engineer can bring: a great fire safe design is a win for the profession. Through the misconception that FSE would reduce design ingenuity to compliance with building regulation using prescribed guidance, the added value for the client or society at large is currently missed. Hence, it is suggested that the FSE community should try and reach the other stakeholders and society far more proactively than is the case today. For example, post-graduate fire engineering educational programs often train students with a diverse range of graduate backgrounds. Educational practitioners have the opportunity to capitalise on this by including group project work where inter-disciplinary backgrounds can be encouraged to work together towards a broader fire engineering goal, thereby replicating the cohesion necessary in a post-educational setting.

Educational programs and access to continuing professional development (CPD)

The general lack of awareness of fire safety engineering as a field is also considered a missed opportunity to attract more students into the field of FSE, as many talented young people should be interested in creating value for a safer and more sustainable world. One option could be expanding micro-credentials courses, but whereas CPDs are considered very valuable for professionally active fire safety engineers, there is an inherent danger in offering such courses to 'entry-level' students or other stakeholders in the built environment as this may create the wrong impression that successful completion would imply mastery of the principles of FSE. A much more promising approach seems to be teaching FSE through case studies, so that the students experience that they cannot properly perform the function of fire safe designer without significantly more fundamental knowledge. As such, the importance of FSE and being a competent fire safety engineer would receive greater recognition. It was stressed that of all the stakeholders involved in the built environment industry, only the fire safety engineer truly understands combustion and fire behaviour, the inherent risks and their impact on people, facilities/structures, business operations and the environment.

Although FSE education is no guarantee for competence, it is considered a quintessential building block. Yet, it is well-recognised that not everything can be taught within the context of an MSc or BSc+MSc program at a university level. Not everything can be learnt within a time span of 1 or 2 years and many job or application related skills are learnt on the job and are accumulated with experience. Hence it is key to prepare fire safety engineers for lifelong learning. This emphasizes the importance of focusing on first principles in academic FSE curricula, very much in line with the model curricula as developed in the nineties of the previous century [6] and the required minimum core competencies for fire engineers as published by the SFPE [1]. These invariably include fire dynamics, heat transfer, fire-induced flow and modelling, egress analysis, smoke control, fire brigade intervention, active and passive fire protection, etc., but moreover should also include: critical thinking, problem solving and information seeking (because problems of today will not necessarily be the problems of tomorrow); how to perform a holistic (integrated) fire safety strategy development and design; and good FSE communication and ethics.

It does also imply that the instructors must be competent and raises the question on uniformity in contents and level of teaching across different programs. This is particularly the case because there are relatively few programs worldwide with a limited number of graduating students. As such, whereas university level MSc education in FSE is considered essential and necessary, it is no guarantee for competence. Adding X years of experience and CPD still does not guarantee competence, as design skills, creativity and a holistic view would be key. It is acknowledged this should be considered at team level, rather than individual level, and different fire safety engineers could have different specialties. The broad scope of fire engineering design also emphasises the importance of teaching ethics in engineering. This encourages students to recognise personal limitations, their responsibility to promote integrity, and ultimately, encourages fire engineers to work collaboratively in teams rather than claiming primacy over the entire field such that personal recognition would be put before competency. Nevertheless, it is important that university education focuses on generalists, who are capable of specialising on the job afterwards. In that sense a competent fire safety engineer should also have the skill and mindset of knowing their own limits.

Finally, it was also noted that being competent in FSE (or even being a chartered fire safety engineer) does not imply for an individual to be competent in all and very diverse areas of practice in FSE in buildings (human response, smoke control, structural response, fire service access, to name a few) nor in all areas of the built environment (residential, commercial, infrastructure, oil & gas, nuclear, wildfires, transport applications, aerospace applications, etc.). However, the competent fire safety engineer should be capable of using first principles knowledge, supplemental research or training, as well as consultation with other specialists to go in depth in any of these aspects when needed.

Fire Safety Engineering for all

A final angle to the discussion was triggered by the question, starting from the assumption of insufficiency of competence in FSE to date, who or what would drive the evolution towards a higher level of competence. This holds in particular for countries with built environments with less developed fire safety industries, and, more generally, differences in societal acceptance on loss of life or damage to property. It is recognized that fire safety engineers should remain technical experts, and that there might be significant added value to communicating not only on the importance of FSE in very prestigious buildings, but much more on ‘mid-range’ buildings, i.e., buildings that are complex enough to apply FSE, but not considered as exceptional. It was noted that ‘mid-range’ buildings may undergo less scrutiny than very prestigious buildings. This presents a unique challenge since, although many of the same risks are present, the influence of tight profit margins can result in a reduction in scrutiny not only on the quality of the engineering solutions proposed, but also the competency and

credentials of the design team members involved. Emphasising the importance of FSE to 'mid-range' buildings would make clear that FSE has a huge potential in added value to many stakeholders involved and to society in general.

Outlook

As can be expected in a workshop, there was a variety of opinions and statements on the topics as described above. Nevertheless, one outcome of the workshop was the expressed need for a globally recognized accreditation body that recognises the adequacy of fire safety engineers based on a minimum required competence. The minimum required competence and accreditation mechanism should be adequate so that any other stakeholder, and society at large, would have confidence that such a fire safety engineer would do their best, being equipped with the strongest possible combination of FSE knowledge and skills. This is considered a very urgent and vital task, and without this, the perspective is that an endless number of workshops on education in FSE can be organised in the future, but essentially the fire safety engineers would only convince themselves, and not the stakeholders and society that need to be convinced.

Acknowledgements

The authors are grateful for the very active participation at the workshop. Special thanks to Peter Johnson (Arup) for sharing his notes and thoughts.

References

[1] SFPE, *Recommended Minimum Technical Core Competencies for the Practice of Fire Protection Engineering* (2018). https://www.sfpe.org/advocacy-qualifications/core-competencies

[2] D. Lange, J.L. Torero, C. Maluk, J.P. Hidalgo, *The Competencies Report points towards an accreditation framework for professional engineers in fire safety* (2020). https://doi.org/10.25910/4arc-py02

[3] IFE, *Competency is key to establishing confidence in new fire safety regimes* (2022). https://www.ife.org.uk/ife-blog/competency-is-key-to-establishing-confidence-in-new-fire-safety-regimes

[4] A. Athanasopoulou, F. Sciarretta, M.L. Sousa, S. Dimova, *The status and needs for implementation of Fire Safety Engineering approach in Europe*, EUR 31383 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-76-61624-5, JRC131689. (2023). https://dx.doi.org/10.2760/031591

[5] D. Lange, J.L. Torero, G. Spinardi, A. Law, P. Johnson, A. Brinson, C. Maluk, J.P. Hidalgo, M. Woodrow, *A competency framework for fire safety engineering*, Fire Safety Journal, Vol. 127, 103511 (2021). https://doi.org/10.1016/j.firesaf.2021.103511

[6] S.E. Magnusson, D.D. Drysdale, R.W. Fitzgerald, V. Motevalli, F. Mowrer, J. Quintiere, R.B. Williamson and R.G. Zalosh*, 'A proposal for model curriculum in fire safety Engineering',* Fire Safety Journal, Vol. 25 (1), pp. 1 - 88 (1995). https://doi.org/10.1016/S0379-7112(95)00038-0