Fire Safety Engineering

Roles Report

Report 4 of this Series

THE WARREN CENTRE

ACKNOWLEDGEMENTS

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We conducted a total of **two consultative meetings** (19 March and 29 May 2019), and a **major draft report review meeting** on 14 August 2019, with the following experts involved in one or more of these meetings:

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SPONSORS

Peter Johnson of Arup spoke at The Warren Centre 04 Feb 2020 FSE Conference.

THE WARREN CENTRE

ABOUT THE WARREN CENTRE

The Warren Centre brings industry, government and academia together to create thought leadership in engineering, technology, and innovation. We constantly challenge economic, legal, environmental, social and political paradigms to open possibilities for innovation and technology and build a better future.

The Warren Centre advocates for the importance of science, technology and innovation. Our 30 years' experience of leading the conversation through projects, promotion, and independent advice drives Australian entrepreneurship and economic growth.

The Warren Centre promotes excellence in innovation through delivering collaborative projects, supporting and recognising innovators across the profession, and providing independent advice to government and industry.

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FIRE SAFETY ENGINEERING PROJECT

This is the second research project of The Warren Centre at the University of Sydney relating to Fire Safety Engineering. The first project in 1989 paved the way for the creation of the Fire Code Reform Centre to co-ordinate fire research nationally in 1994 and gave major impetus to the development of the performance-based Building Code of Australia, published in 1996. This current Warren Centre Project on fire safety engineering will address many of the major challenges facing governments, regulatory authorities and practitioners in relation to fire safety engineering and community safety in buildings.

OUR PROJECT SPONSORS

The Warren Centre thanks our project sponsors who made this research and these reports possible. This report represents the technical judgment and opinions of expert authors in the field of Fire Safety Engineering and the building design industry. These views are not necessarily endorsed or adopted by the sponsors.

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Definitions and Acronyms

DEFINITIONS

The word “services” is part of the preferred term of AFAC and the agencies for the “fire services” rather than “fire brigades” given that their role extends much more broadly than just responding as fire fighters to a fire incident. However, the word “services” is also commonly used for “fire services engineers” who design and install fire services or fire protection systems such as sprinklers and detection systems. To ensure clarity in this report, the project team representatives involved in this research have agreed to use of the terms “fire brigades”, “fire protection engineers” and “fire protection systems” throughout the report.

The National Construction Code (NCC) 2019 has introduced new terms for the two major reports typically prepared for building projects.

The new terms are:

- Performance Based Design Brief (PBDB) – formerly the Fire Engineering Brief (FEB)
- Performance Based Design Report (PBDR) – formerly the Fire Engineering Report (FER)

Throughout this report, where reference is made to the building code in Australia, the designated term used is the National Construction Code (NCC).

In this report reference is made to Stage 1 and Stage 2 competencies as set out in the competency frameworks of Engineers Australia. In this project’s earlier Education Report and in some other jurisdictions, these two stages are referred to as Tier 1 and Tier 2 competencies, which are effectively the same two stages.

ACRONYM	EXPLANATION
ABCB	Australian Building Codes Board
AFAC	The National Council for Fire & Emergency Services (formerly the Australasian Fire and Emergency Service Authorities Council)
AS	Australian Standards
BCA	Building Code of Australia (part of the NCC related to buildings)
DHHS	Department of Health and Human Services (Victorian Government agency)
DTS	Deemed to Satisfy
EA	Engineers Australia
ESM	Essential Services Measures
FIP	Fire Indicator Panel
FPA Australia	Fire Protection Association Australia
FPAS	Fire Practitioners Accreditation Scheme
FSE(s)	Fire Safety Engineer(s)
MBIE	Ministry of Business, Innovation and Employment (New Zealand Government Department)
NCC	National Construction Code
PBDB	Performance Based Design Brief
PBDR	Performance Based Design Report
PS	Performance Solution
SFPE	Society of Fire Protection Engineers

Executive Summary

A research team including fire safety engineers (FSEs), certifiers, regulatory consultants, and representatives of the fire brigades and AFAC (the National Council for Fire & Emergency Services, formerly the Australasian Fire and Emergency Service Authorities Council abbreviated as “AFAC”) has developed some detailed descriptions of the future potential roles for FSEs that can be incorporated in new building regulations and controls being developed in response to the recommendations of the Shergold/Weir report.

This research into the future roles for FSEs is part of the reform roadmap being developed by the Warren Centre for Advanced Engineering which is conducting evidence-based research into the future role, competencies, education, accreditation, audit and enforcement and regulatory controls for FSEs in Australia. These role descriptions articulate how design FSEs, FSEs acting as peer reviewers, and FSEs within the fire brigades should create design deliverables and independently review designs to ensure quality fire safety engineering reports under a robust future regulatory regime.

These roles are written assuming that FSEs are involved from very early in a building project in planning and concept design through to construction, commissioning, and ultimate property handover to the building owner/ manager. This approach responds directly to the “chain of responsibility” concept espoused in the Shergold/Weir “Building Confidence” report.

These role descriptions will form the basis for addressing the competencies needed to undertake these FSE roles, which is the next stage of this project’s efforts. It is recognised that to meet the recommendations of Hackitt and Shergold/Weir, the role of the FSEs working on a holistic fire strategy from concept design through to handover, including new requirements in most jurisdictions for inspections, documentation and a fire safety manual, will increase the costs for engaging a competent FSE.

However, Hackitt argues, *“More **rigour and oversight at the front end of the process** can lead to significant increases in productivity, reduction in ongoing costs, and to better*

outcomes for all in the latter and ongoing stages of the process". Such involvement meets Hackitt's strong recommendation for FSEs and others to ensure the "golden thread of information" on documentation of safety matters from original design through to building handover and operation.

Anecdotal evidence from some building developers and owners suggests high quality fire safety engineering design from early in a building project can allow for greater innovation as design proceeds, better "buildability" of design solutions, and lower whole of life asset management costs.

Of course, in addition to the overall life cycle cost analysis improvements in productivity, enhancing the effective design of fire safety systems greatly reduces losses to property and risk to human life as witnessed by the Grenfell Fire tragedy in London, the litigation surrounding Lacrosse fire in Melbourne, insurance uncertainties currently in the professional indemnity markets across Australia and the recent Neo200 fire. As governments across Australia react to recent failures such as the Sydney Opal Tower cracking incident in late 2018 / early 2019, there are renewed pressures from the public to correct deficiencies in design, construction and handover of residential buildings. It is clear from the recent history in Australia and globally that competent design and construction is critical for confidence in the building industry.

This Roles Report will lead into the next research task of the Warren Centre Project which is to develop the competencies required to ensure FSEs can undertake the proposed new roles set out in this report. It may well be that in developing the FSE competencies and seeking wider feedback from the broad building design and construction community, some adjustments to the specifics of the future roles of FSEs may be required.

In addition, a plan is being developed by the Warren Centre to survey a wide range of FSEs across Australia, and potentially internationally, to identify the current status of education, accreditation and professional experience amongst FSEs. Again, the survey results may indicate that some aspects of the roles and competencies need to be reviewed and possibly modified in some way in the light of further evidence.

> More rigour and oversight at the front end of the process can lead to significant increases in productivity, reduction in ongoing costs, and to better outcomes for all in the latter and ongoing stages of the process.
>
> ~ Dame Judith Hackitt

UK Final Report of the Independent Review.

1. Introduction

A "chain of responsibility" is essential.

The Hackitt and Shergold/Weir reports[1, 2] into the building regulatory control systems and the building design and construction industry more broadly have highlighted the need for greater competence among building practitioners, including fire safety engineers (FSEs).

The first reports of this Warren Centre Project on regulation[3], and education and accreditation[4], have similarly identified these concerns over a lack of competency amongst FSEs due to:

- No requirements for professional registration or licensing in some states and territories;
- Two professional accreditation schemes which differ, with competencies which have not been updated in 20 years or more;
- Some education programs in Australia for FSEs which lack the rigour and standards to meet any reasonable academic accreditation requirements; and
- A lack of audit and enforcement of professional practice by governments or accreditation bodies.

A key concern expressed by Hackitt and Shergold/Weir has been the fact that the role of FSEs in building projects has often been limited to design stages up to the issue of building permits only. Furthermore, the FSE role has often been restricted through contractual scope to simple involvement in conducting FSE analysis for a limited number of Performance Solutions identified by the certifier or others, rather than adopting a holistic fire safety design approach. As a result, many FSEs have been restricted to just reviewing and analysing these departures from the DTS provisions of the National Construction Code (NCC)[5] and not all aspects of fire safety in a holistic manner. This has been expressed as a failure to establish a "chain of responsibility" to ensure all elements of a fire strategy work together. This essential chain of responsibility should also ensure that all parts of the fire safety design have been appropriately incorporated in the final construction and function correctly.

This element of the research program, which relates to future roles of FSEs and the

[1] Dame Judith Hackitt, *Independent Review of Building Regulations and Fire Safety: Final Report,* Cm 9607 (2018).
[2] Peter Shergold and Bronwyn Weir, Submission to Building Ministers' Forum, *Building Confidence — Improving the effectiveness of compliance and enforcement systems for the building and construction industry across Australia,* 30 April 2018.
[3] The Warren Centre for Advanced Engineering. (2019) *The State of FSE Regulation, Control and Accreditation in Australia,* Sydney.
[4] The Warren Centre for Advanced Engineering. (2019) *Current Status of Education, Training and Stated Competencies for Fire Safety Engineers,* Sydney.
[5] Australian Building Codes Board. (2019). *National Construction Code.* Retrieved from https://ncc.abcb.gov.au.

competencies required for good practice, has been divided in two parts as follows:

- Task 2.3.1 - A report on the range of practice or roles of FSEs required in relation to design, analysis, verification, as well as construction/ inspection, commissioning, post-occupancy evaluation, and for peer review, certification and authority approvals *(The Roles Report)*
- Task 2.3.2 - A report on the range of competencies required to undertake these roles effectively. *(The Competencies Report)*

This current report covers the development of the FSE roles of the future, based on a much more integrated and holistic approach to fire safety design and review, from planning and concept design through to building commissioning and ultimate handover to the building owner/manager.

The report covers FSEs working within design teams, those undertaking independent peer reviews, and those FSEs working in fire brigades.

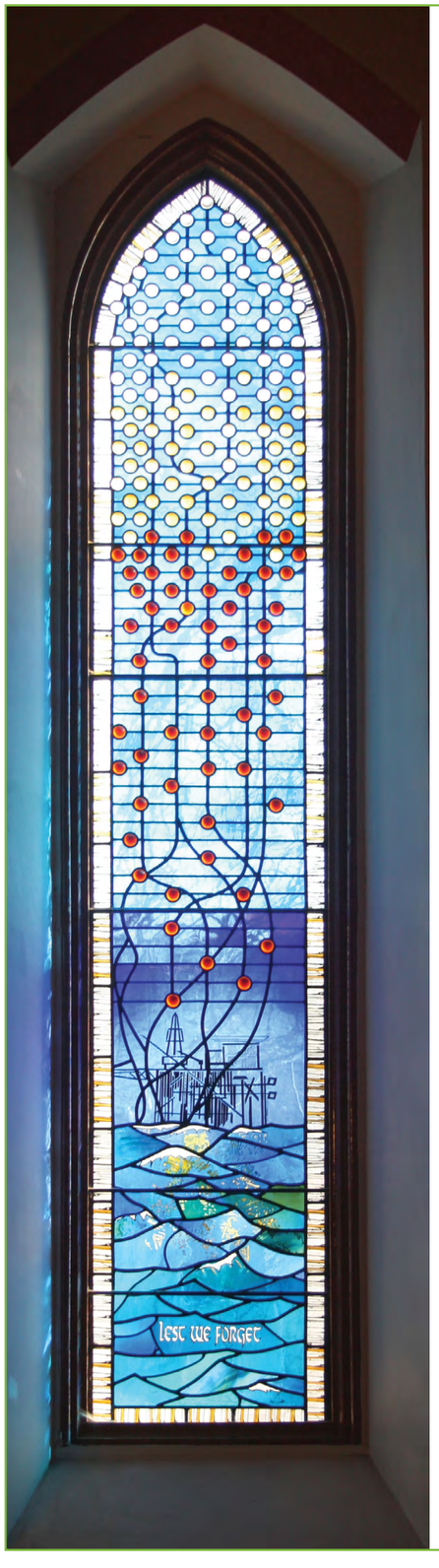
The full scope of the task on roles and competencies is set out in the Task 2.3 Brief which is included in this report as Appendix A.

The University of Sydney's School of Computer Science is the "home" of the Warren Centre.

2. Background

This report on the future roles of FSEs in Australia has been driven directly as a response to the findings and the recommendations of the Hackitt and Shergold/Weir reports which have some distinct parallels. As Hackitt (p6) has said, Australia *"published its own report, 'Rebuilding Confidence: An Action Plan for Building Regulatory Reform' since I wrote my interim report – it tells a story which could just as easily be applied to us".*

Hot smoke test at a university laboratory.



The Piper Alpha accident, thirty years before the Grenfell Tragedy, changed thinking in Britain about systems safety and individual responsibilities. That same kind of thinking is changing attitudes within the buildings professions to improve overall performance.

The Piper Alpha Window, Ferryhill Church, Aberdeen, Scotland. Photo by Bob Embleton, CC-BYSA 2.0.

A SUMMARY OF THE KEY ELEMENTS OF THE HACKITT AND SHERGOLD/WEIR REPORTS ARE PROVIDED BELOW. THE FULL SET OF FINDINGS AND RECOMMENDATIONS CAN BE FOUND BY GOING TO THE ACTUAL REPORTS.

HACKITT REPORT

In her Executive Summary, some of the major findings relate directly to performance based (outcomes based) building codes and design processes. As stated by Hackitt, these directly affect fire safety engineering:

> *"This approach also acknowledges that **prescriptive regulation and guidance are not helpful in designing and building complex buildings,** especially in an environment where building technology and practices continue to evolve and will prevent those undertaking building work from taking responsibility for their actions."*
>
> *"An outcomes-based framework requires people who are part of the system to be competent, to think for themselves rather than blindly following guidance, and **to understand their responsibilities to deliver and maintain safety and integrity throughout the life cycle of a building".***
>
> *"We must also begin thinking about **buildings as a system** so that we can consider the different layers of protection that may be required to make that building safe on a case-by-case basis".*

This emphasises the need for holistic performance-based design needed for fire safety design and assessment, particularly for high risk buildings. Hackitt stresses:

> *In the past, the "approach can lead to a situation where changes are made to one aspect of a building without sufficient consideration of the secondary effect (e.g. on fire safety). Instead the building must be considered as a **single, coherent system".***
>
> *"Each of these layers of protection form part of an **integrated safety strategy** for the building."*

Some of the other key points made by Hackitt in her report, which again apply directly to fire safety engineers and structural engineers as highlighted in the report, include:

- The regulatory system covering high-rise and complex buildings was **not fit for purpose**;
- There has been a **lack of clarity on roles and responsibilities**;
- There has been **inadequate regulatory oversight** and enforcement tools;
- These factors have helped to create a cultural issue across the sector, which is described as a **'race to the bottom'**;
- This report recommends a very **clear model of risk ownership**, with clear responsibilities for the Client, Designer, Contractor and Owner; and
- **Transparency of information and an audit trail** all the way through the life cycle of a building from the planning stage to occupation and maintenance is essential.

Hackitt makes the case for an increased role for fire safety engineers and other designers from concept design through to handover and operation of the building, and the importance of a well-developed document trail when she states:

> *"More **rigour and oversight at the front end of the process** can lead to significant increases in productivity, reduction in ongoing costs and to better outcomes for all in the latter and ongoing stages of the process".*
>
> *"The review heard almost unanimous concern surrounding the **ineffective operation of the current rules around the creation, maintenance and handover of building and fire safety information.** Where building information is present, it is often incomplete or held in paper form and is not accessible to the people who need to see it".*
>
> *"The interim report identified the need for a **'golden thread' of information** for all higher risk residential buildings (HRRBs), so that their original design intent is preserved and changes can be managed through a formal review process."*

The whole Chapter 5 of Hackitt is devoted to competency, including:

- The interim report established that **a lack of skills, knowledge and experience** and a lack of any formal process for assuring the skills of those engaged at every stage of the life cycle of higher risk residential buildings as a major flaw in the current regulatory system.
- **Increased levels of competence** are an integral part of the proposed new regulatory framework.
- As well as addressing technical competence, there is a pressing need to see the leadership that is required within the construction industry and fire safety sector to **drive the shift in culture.**
- The interim report tasked professional and accreditation bodies to work together to propose **a robust, comprehensive and coherent system** covering all disciplines.
- Levels of competence required should be maintained and subject to continuing development, continuing education, or **meaningful continuing professional development.**
- As a minimum, **any body which accredits competence** in any trade or profession associated with the built environment **should themselves be accredited** by a rigorous, publicly recognised and accepted method of accreditation.

All of the recommendations relate to fire safety engineers as one of the six key disciplines that Dame Judith determined to be crucial to improved fire safety outcomes.

Finally, the reader should recognise the era of the previous phase of fire safety design reforms implemented in the deregulatory phase of the late 1980s and early 1990s was highly aligned between the UK and Australia, just as they are today. Many of the same features exist in the built environment of the UK and Australia, and many of Dame Judith Hackitt's recommendations describe the same situations in Australia.

For the full report go to:
https://www.gov.uk/government/publications/independent-review-of-building-regulations-and-fire-safety-final-report.

Fire & Rescue NSW.

SHERGOLD/WEIR

The rationale for the Shergold/Weir inquiry and report is set out in the Executive Summary to the report as follows:

> *"In mid-2017 the Building Ministers' Forum (BMF) asked us to undertake an assessment of **the effectiveness of compliance and enforcement systems** for the building and construction industry across Australia".*
>
> *"We believe that compliance and enforcement systems that incorporate our recommendations represent **a national best practice model** that will strengthen the effective implementation of the NCC."*
>
> *"After having examined the matters put to us, we have concluded that their nature and extent are significant and concerning. The problems have led to **diminishing public confidence** that the building and construction industry can deliver compliant, safe buildings which will perform to the expected standards over the long term."*

Much of the Shergold/Weir report addresses fire safety and fire safety engineers and their role and competency as well as more general concerns. Key issues identified include:

> *"We have heard suggestions that large numbers of practitioners operating in the industry either **lack competence**, do not properly understand the NCC and/or have **never had proper training** on its implementation".*
>
> *"We have been told that oversight by licensing bodies, state and territory regulators and local governments can be weak due either to inadequate funding or a lack of skills and resources to undertake **effective enforcement".***
>
> *"The building and construction industry needs to actively participate in **lifting standards, competency and integrity** if it is to produce safe and reliable buildings."*
>
> *"The building and construction **industry is evolving fast.** As the technology of building construction changes and innovative practices are introduced, **new forms of expertise are emerging."***

Key recommendations in the Shergold/Weir report of relevance to fire safety engineering and drivers for this Roles Report include:

- *"….each jurisdiction requires the **registration** of the following categories of building practitioners involved in the design, construction and maintenance of buildings": This includes "Fire safety practitioner" (including fire safety engineers)* ***– Recommendation 1.***
- *"Consistent requirements for registration nationally with **additional competency and experience requirements."***
- *"Building practitioners operate in a dynamic environment. New products, technologies and practices are actively encouraged through the performance-based NCC …. The introduction of nationally consistent mandatory registration requirements provides a mechanism to **ensure currency of competencies"*** ***– Recommendation 2.***
- *All practitioners to undertake **compulsory Continuing Professional Development** on the National Construction Code* ***– Recommendation 3.***
- *That, consistent with the International Fire Engineering Guidelines[6], each jurisdiction requires developers, architects, builders, engineers and building surveyors to **engage with fire authorities** as part of the design process."* ***– Recommendation 8.***
- *"That each jurisdiction requires **building approval documentation** to be prepared by appropriate categories of registered practitioners, demonstrating that the proposed building complies with the National Construction Code."* ***– Recommendation 13.***
- *"That each jurisdiction sets out the information which must be included in performance solutions, **specifying in occupancy certificates the circumstances in which performance solutions have been used** and for what purpose."* ***– Recommendation 14.***
- ***"Approval of documentation throughout the construction process".*** *"That each jurisdiction provides for a building compliance process which incorporates clear obligations for the approval of amended documentation by the appointed building surveyor throughout a project."* ***– Recommendation 16.***
- *That each jurisdiction requires genuine **independent third-party review** for specified components of designs and/ or certain types of buildings (depending upon the level of risk)* ***– Recommendation 17.***
- Engineers Australia were quoted *"There [should] be **mandatory inspections for fire safety in buildings** during the construction process, especially where an alternative solution has been provided. Such inspections should be undertaken by registered fire safety engineers."*
- *"Where there are **performance solutions** on fire safety performance requirements, a registered fire (safety) engineer should be required to **certify that the work complies with the fire safety engineering design.** The registered fire (safety) engineer may need to **inspect the building** at various stages in order to be able to issue a final certificate. At the time that the fire safety engineering design is prepared, the building surveyor should be advised of the required notification stages for inspection by the fire (safety) engineer."* ***– Recommendation 19.***
- *"That each jurisdiction requires that there be a **comprehensive building manual** for Commercial buildings that should be lodged with the building owners and made available to successive purchasers of the buildings"* ***– Recommendation 20.***

For the full report go to:
https://www.industry.gov.au/sites/default/files/July%2020 2018/document/pdf/building_ministers_forum_expert_ assessment_-_building_confidence.pdf

[6] National Research Council of Canada, International Code Council, United States of America, Department of Building and Housing, New Zealand and Australian Building Codes Board. (2005). *International Fire Engineering Guidelines*. Retrieved from https://www.abcb.gov.au/.

As can be seen from both the Shergold/Weir and Hackitt reports, the need for a holistic approach to fire safety engineering design and assessment, involvement from concept design through to handover and beyond, consultation with fire authorities, requirements for inspections, peer reviews, controls over design changes, controls on documentation and the provision of a fire safety manual are all necessary for a robust regulatory system and the fire safety of buildings.

THESE REPORTS AND THEIR FINDINGS SET THE CONTEXT FOR THE FUTURE ROLES OF FIRE SAFETY ENGINEERS, BE THEY DESIGNERS, PEER REVIEWERS, OR INVOLVED THROUGH FIRE BRIGADES.

> The building and construction industry needs to actively participate in lifting standards, competency and integrity if it is to produce safe and reliable buildings.
>
> ~ Shergold-Weir Report, *Building Confidence*.

Bronwyn Weir spoke at the 2019 Warren Centre conference on Fire Safety Engineering held at the University of Sydney.

3. Methodology

The development of the future role of FSEs as has been developed through this research has considered a number of circumstances that are emerging in Australia and internationally, including evidence from our earlier Education[7] and Methods[8] reports. These include:

- As suggested by Hackitt and Shergold/Weir, FSEs should be engaged to look holistically at all aspects of fire safety of a building from as early in the design phase of the building as possible.
- The design FSE should develop a complete fire safety strategy that addresses all fire safety related Performance Requirements in the NCC as recommended in our Methods Report. This may consist of any combination of Performance Solutions and DTS Solutions, as well as any fire safety objectives, such as asset protection and business continuity which fall outside the realm of the NCC.
- In addition, Shergold/Weir and Hackitt suggest the FSE should be involved in detailed design and documentation, construction stage site inspections, and commissioning to ensure the fire safety strategy and design have been implemented correctly and certified as consistent with original design or with documented approved changes.
- The determination of essential services for maintenance and other aspects such as fire safety management consistent with the fire safety strategy for the buildings should also be included in the scope and role of the FSE as highlighted by Hackitt.
- Other FSEs may be involved in peer review, certification or in fire brigade reviews for fire safety designs and analysis, all of which have been highlighted by Shergold/Weir. They will need to have at least the same competencies as the design FSEs.
- It is recognised that FSEs and other personnel in the fire brigades bring special knowledge and skills in relation to real fire behaviour, fire-fighting and operational matters, given that this is their operational environment and workplace.
- It is also recognised that many other fire safety practitioners are involved in the design and construction process besides FSEs, including fire protection engineers and others involved in detailed design of fire protection systems such as sprinklers, fire detection and passive systems, contractors involved in installation of such systems, and those who inspect, test and undertake other maintenance activities for fire safety systems.

It is recognised that FSEs and other personnel in the fire brigades bring special knowledge and skills in relation to real fire behaviour, fire-fighting and operational matters.

[7] The Warren Centre for Advanced Engineering. (2019) *Current Status of Education, Training and Stated Competencies for Fire Safety Engineers*, Sydney.
[8] The Warren Centre for Advanced Engineering. (2019) *Comparison of International Fire Safety Engineering Guidelines, Fire Safety Verification Methods and Practice Guides*, Sydney.

3. Methodology

- The competency and accreditation of many of these fire safety practitioners other than professional FSEs are covered by the Fire Practitioners Accreditation Scheme (FPAS) operated by the Fire Protection Association of Australia (FPA Australia). This research in relation to professional FSEs does not impinge on that FPAS scheme, as the roles of the professional FSEs and FPAS practitioners are seen to be complementary.

The approach or methodology adopted for this task of developing a comprehensive future role for FSEs has been as follows to:

- Convene a team of FSEs who undertake design of fire safety for buildings as well as individuals who are or have been regulatory consultants, certifiers, peer reviewers and FSEs at the fire brigades;
- Identify the other consultants with whom design FSEs work on typical building design projects, as well as those responsible for independent checking and approval of fire safety designs, showing this diagrammatically;
- Prepare a matrix table for design FSEs, peer reviewers, and FSEs in the fire brigades, setting out the detailed aspirational future roles or tasks for FSEs in each of the three categories, including the key deliverables in terms of reports and other documentation to be prepared by the FSEs; and
- In the same matrix table, identify the much more limited roles currently undertaken by many FSEs in many projects across Australia.

This report sets out the findings, based on the approach identified above.

Engineer inspects concrete at a Civil Structures Laboratory.

4. Building Project Structure

The structure of any building project differs from job to job, depending upon the size, complexity and other factors, including whether it is a more traditional full design and then construction approach, or a typical design and construction with the design team novated across to the construction company at a relatively early stage of the design.

Figure 1 shows a typical structure for a building project. Not all the consultants, construction trades and other parties to the process are included. However, it shows that if FSEs and their skilled contributions to a project are to be properly recognised, the FSE should be seen as just one of the consultants alongside the architect, mechanical engineer, structural engineer, etc.

The team may also include a disability or access consultant, a regulatory consultant, and/or a fire safety management consultant (AS3745) who may be directly employed by the project manager or are hired through the architect or another party. Like the design FSE, ideally these professionals are employed at the very start of the project planning and concept design stages, although certainly in the past they have often been engaged too late into the project to be able to have a meaningful impact on the building design.

To the right of Figure 1, the roles for independent assessors of the project have been identified. In times past, some of these roles have been blurred across the line, with certifiers getting involved in or directing designs, for example. Fire safety peer reviewers, certifiers and FSEs in the fire brigades should be completely independent from the design and construction team, and they should not interfere in the design process and the role of the design FSE.

However, they may offer advice and make recommendations to the design team, based on their specialist knowledge as stakeholders. They may also identify defects in the design or supporting analysis as a result of their reviews which means the design FSEs must return and remedy the design to make it acceptable. They may also sit at the “design table” as stakeholders but must not in any way get involved as designers.

4. Building Project Structure

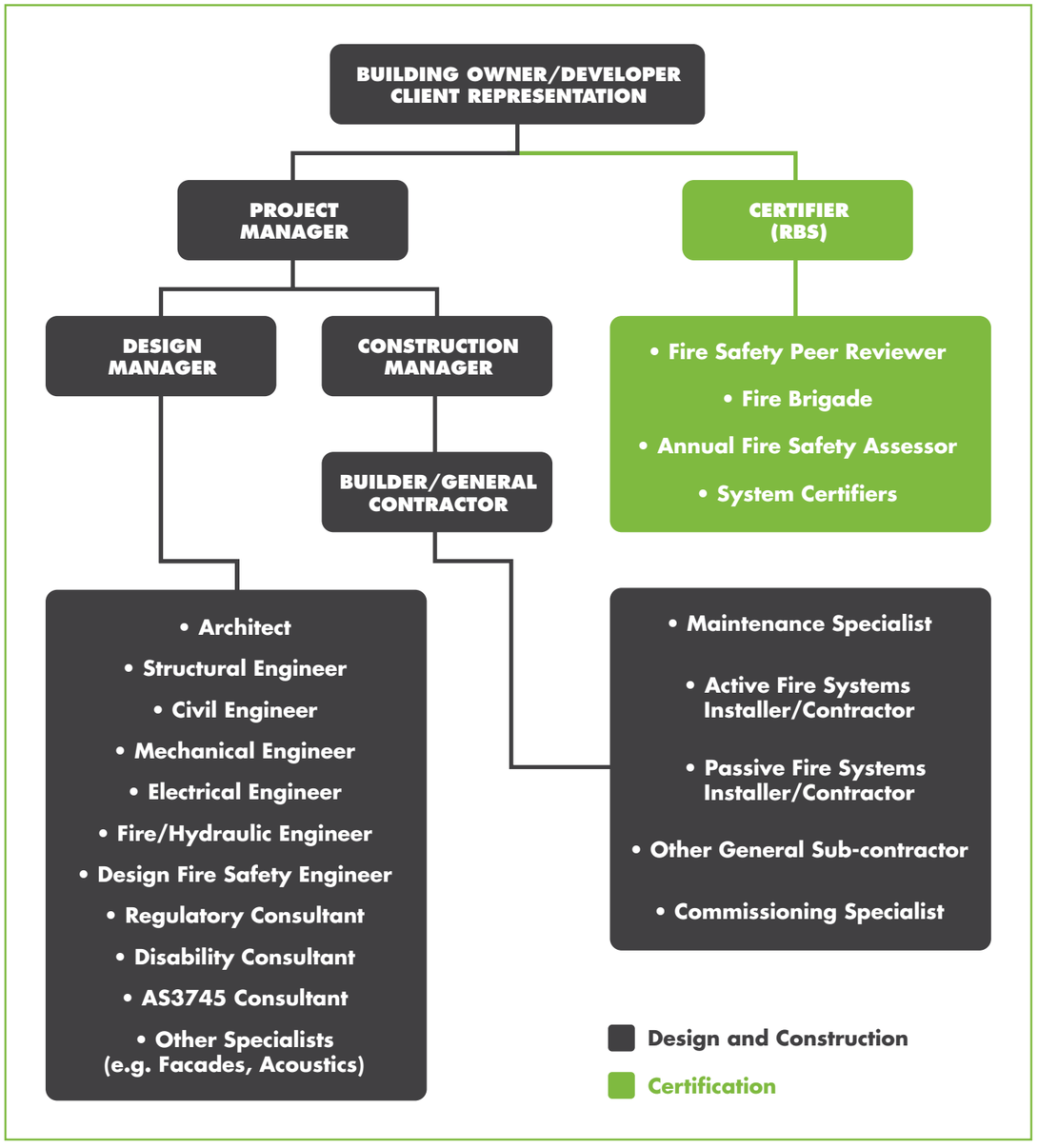


Figure 1: TYPICAL PROJECT STRUCTURE

To recognise the critical role of the FSE is to hold them in the same regard as other consultants such as the structural engineer and architect.

Fire Brigades bring special expertise in the practice of fighting fires, and they have a public safety role to play because their workplace is a building on fire. However, Fire Safety Engineering expertise is distinctly technical and different from the training of fire fighters.

5. Fire Safety Engineering Roles

AS INDICATED, THREE DISTINCT ROLES FOR FSEs HAVE BEEN IDENTIFIED, NAMELY:

1. The “design” FSE who is a member of the design team responsible for the complete fire safety design strategy for a building;
2. The FSE peer reviewer who independently validates the robustness of the fire safety strategy and the reports that support the design decisions; and
3. The FSE who may be part of the fire brigade team that reviews and makes recommendations with regard to the fire safety designs and analysis, as well as on fire brigade operations.

For each of these three roles, this research group has listed the key elements or activities expected to be undertaken in a future aspirational role for FSEs. It is recognised, however, that not every element of the role might be undertaken on any particular project, depending upon the nature of the engagement of the FSE on a particular project and its design complexity.

Matrix tables setting out the FSE activities have been prepared for each of the three separate roles, and they are attached as Appendices B, C, and D to this report.

Peter Shergold spoke at the launch of the Warren Centre project at the University of Sydney in July 2018.

DESIGN FIRE SAFETY ENGINEER

Some of the key aspects to note in relation to the design FSE role as agreed by the research group, based on the Shergold/Weir and Hackitt recommendations, are as follows:

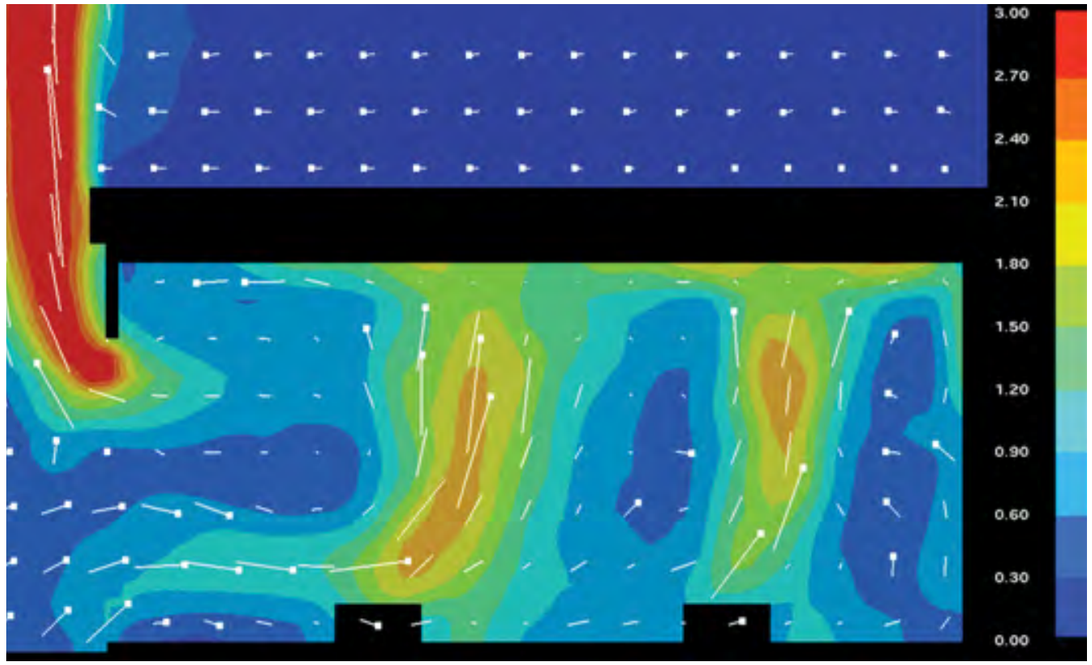
- Design FSEs, as a body of professionals, are the custodians of design practices, standards, guidelines, specifications, etc., and they apply these through the creative design process to deliver safety compliant buildings.
- Design FSEs engage with other design disciplines in the broader project design team to make technical and functionality trade-offs that deliver greater health, safety and amenity to the project developer, the original building owner and subsequent building owners. They balance life-of-asset capital and ongoing maintenance costs to deliver building assets that are functional, that meet safety requirements, and that are practically maintainable through the asset's life.
- Design FSEs should play a role in planning and early concept design, although currently they often do not.
- Design FSEs need to read the client brief for the building project and understand all the fire safety implications, including identification of any fire safety objectives beyond the NCC such as asset protection, business continuity, sustainability, durability, or environmental protection.
- They should be involved with others to ensure the proper NCC classification(s) of the building are identified.
- They need to recognise and manage any bushfire planning restrictions or implications for the building design.
- In concept and schematic design in particular, FSEs should contribute creatively to the design process.

Fire Safety Engineering test on a cross laminated timber compartment.

Design FSEs should play a role in planning and early concept design, although currently they often do not.

- They should develop a top-down holistic fire safety strategy that covers all the building fire safety objectives, including all the NCC fire related Performance Requirements but may also include asset protection, operational continuity and other important objectives.
- The role should encompass choosing the proper mix of Performance and DTS Solutions to suit the project.
- A full and proper stakeholder engagement program should be developed and undertaken as the project progresses from as early a stage of the project as possible. This process should be clearly documented within the PBDB and PBDR, including the documentation of items that are not agreed between the stakeholders if not resolved through stakeholder consultation.
- Design FSEs hand off their designs and also work iteratively with other professionals through the engineering and construction cycles. Reflecting on project experiences over many years, including positive and adverse outcomes, they have a unique capacity to deliver value to the developer, to the initial owner, to subsequent owners, and to the fire brigade and community neighbours through awareness of how initial design and construction quality affect long term maintenance and long term fire safety performance.
- Design FSEs need to understand the hand-over process and how the Performance Based Design Brief (PBDB) and Performance Based Design Report (PBDR) are received by, understood by and used by other professionals in detailed design, construction and asset operation.
- At all stages of the project, and from as early as possible, the design FSE should interact with all relevant consultants, such as the structural, mechanical and hydraulic consultants. They should also encourage the engagement of and interact with the disability/access consultant, fire safety management (AS3745) consultant, and Essential Services/Maintenance (ESM) specialist to ensure these elements are totally integrated into the overall fire safety strategy in a consistent manner.
- The design FSE should review all building materials which may have a major impact on building fire performance and safety. The design FSE should review the test reports/certificates to ensure conformance with NCC requirements and suitability as part of the fire safety strategy. This should be recognised as a thorough, ongoing task that will need to be repeated throughout the design and construction process should the choice of these major materials change.

- They should ideally prepare PBDB and PBDR reports in accordance with the IFEG at the Concept and Schematic design stages of the project respectively, although it is recognised that the exact timing and stage of the project at which these reports are prepared will vary depending upon the nature of the individual project.
- The design FSE should be responsible for identifying what assessment methods and analytical approaches will be used, and how the overall design will demonstrate compliance with the Performance Requirements of the NCC (e.g. through absolute or comparative analyses). Verification Methods and acceptance criteria should be selected to ensure that a holistic assessment process is proposed and ultimately carried out.
- It is also recognised that design is an iterative process, as designs can change, and these changes can occur at any stage of the project, with FSE design advice and reports needing to be revised and updated accordingly.
- The PBDR should be a development of the PBDB and encompass everything in the PBDB document, including fire safety management and essential service plans. Any reader should not need to possess both documents to understand the entire fire engineering strategy.
- The design FSE should be involved in review of detailed design drawings and specifications. During construction, FSEs should be involved, not necessarily to take on the responsibility for the detailed system design and construction/installation which would typically be taken on by other practitioners, but to ensure that all fire safety measures included in the fire strategy are being correctly implemented on site and are being certified as meeting NCC and AS requirements by competent inspectors/ checkers.
- The design FSE should provide written confirmation at detailed design, construction and commissioning stages that the whole fire safety strategy has been correctly applied and incorporated in the completed design and construction of the building. This could be a statement included in the FEB/FER/ construction signoff documentation.
- At the completion of the project, the FSE should be linked with the building owner/ manager and the Essential Services contractor to ensure they fully understand the fire safety strategy, how the building is to function during fire emergencies, and what is expected of occupants. They should be provided with a building fire safety handbook or manual that sets out the fire safety strategy and the list of fire safety measures which go hand-in-hand with the building ESM and AS3745 procedures. This handbook should refer to and be cross referenced to the building PBDR. (The DHHS fire safety handbook 8 is a good example.) These additional elements reflect the recommendations of the Hackitt and Shergold/Weir reports for the ‘chain of responsibility’, the long-term maintenance, and ongoing integrity of the initial design intent. These practices may not be fully reflected on all current projects, but in the life-cycle-cost and life-cycle-safety view, they are return long term value.



Computational Fluid Dynamics is used by Fire Safety Engineers to validate designs.

What is not in the matrix table in this Roles report for the design FSE, but which is needed for the development of a full set of technical FSE competencies, is the specific fire safety engineering roles in design and analysis, working with others in the design team. This includes the following aspects of FSE design and analysis highlighted in the International Fire Engineering Guidelines (IFEG):

- An understanding of the occupant characteristics, including those with a disability or other vulnerability;
- A hazard analysis of likely ignition sources and combustible materials which could lead to a fire;
- The design, and modelling and analysis, of provisions for smoke control;
- The design or selection and analysis of fire detection and suppression systems;
- The design, modelling and analysis of measures for compartmentation and structural fire protection;
- The design, modelling and analysis of the egress provisions for the building, including egress stairways, exits, signage, and emergency lighting;
- The design, modelling and analysis of facilities for fire-fighting, rescue and recovery;
- The overall fire risk assessment or other assessment methodology to determine whether the overall fire safety strategy delivers a satisfactory level of fire safety for the different occupancies and the different occupant types; and
- The development of the key principles of fire safety management, the evacuation procedures, and the ESM/maintenance procedures which fit as part of the overall fire safety strategy. These procedures may of course be developed in detail by other practitioners.

Consultation with fire brigades on fire safety design is highlighted as a critical activity in the Shergold/Weir and Hackitt reports.

FIRE SAFETY ENGINEER - PEER REVIEWER

Some of the key aspects to note in relation to the FSE peer reviewer role as agreed by the research group, again consistent with the Shergold/Weir and Hackitt report and key principles, are as follows:

- Ideally the peer reviewer should be appointed early in the project and involved in review through the development of the PBDB and PBDR as well as the detailed design, construction, commissioning and handover stages of the project.
- The peer reviewer should be independent of the design team and their design decisions but should provide advice to identify errors, inconsistencies or other aspects of the PBDB and PBDR that need re-examination or correction by the design team.
- Ideally, the peer reviewer should be involved in the stakeholder meetings with the fire services.
- The peer reviewer should ensure they seek and review any design changes through the whole design process and review any comments or recommendations provided by the fire brigade.
- It is not expected generally that the peer reviewer will attend site inspections and commissioning during the construction stages of the project, but the peer reviewer should at least review the PBDB and PBDR documents and any other documentation prepared by the design FSE to demonstrate that the inspections and commissioning have been completed satisfactorily. In some cases, it may be appropriate for the peer reviewer to attend on site.

The peer reviewer should generally have essentially the same competencies as the design FSEs. In practice, many FSEs may be part of the design team for some projects but peer reviewers in other projects. On the other hand, sometimes, the peer reviewer will be an expert who is not a regular designer, e.g. an academic who specialises in complex structural fire engineering analysis may be needed to review a particularly complex or innovative structural design and its fire protection.

FIRE SAFETY ENGINEER AT THE FIRE BRIGADE

Consultation with fire brigades on fire safety design is highlighted as a critical activity in the Shergold/Weir and Hackitt reports. Some of the key aspects to note in relation to the role of the FSE at the fire brigade as agreed by the research group are as follows:

- Ideally, the design team sets up arrangements for the stakeholder meetings to include the fire brigade, as early as possible in the process.
- The FSE at the fire brigade, working with their operational fire fighter colleagues, should provide stakeholder advice and recommendations, including in the concept design/PBDB stage and PBDR stage of the project and onwards into inspections in construction, commissioning and handover.
- The role of the FSE in the fire brigade will focus on reviewing the whole fire safety strategy and building fire safety systems.
- In order to interrogate the fire safety strategy and FSE reports, the FSEs at the brigade need to have an appropriately commensurate general level of competency as the design FSEs, at least in relation to the knowledge and skills in fire safety engineering. Engineers Australia and the international engineering organisations define competency as being education plus experience. Although fire brigade FSEs may not have worked in a design team and therefore do not have the same level of design education or experience, it is critical that they possess sufficient competency to understand and interrogate FSE strategy and design reports.
- It is expected that the FSEs at the fire brigade will have specialist competencies in relation to fire brigade response, rescue, firefighting and recovery which they can inject into the design process in the form of advice and recommendations.
- For precision, formality, clarity, ease of transmitting, and longevity of preserving records, ideally the fire brigade should provide written comments in relation to their reviews at the FEB, FER and construction, commissioning and handover stages of the project.
- The FSEs at the fire brigade should be provided with amendments to the PBDB, PBDR and other fire safety documentation if and when significant design changes occur. Also fire brigade FSEs should be prepared to review and provide comment in writing back to the design team and peer reviewer in a timely fashion to ensure the design process proceeds appropriately.

As indicated, the FSEs in the fire brigade should have the same general fire safety engineering competency level as the design FSE and the peer reviewer FSE. They are also expected to have specialist skills and knowledge related to the fire brigade operational roles and procedures.

6. Next Steps

The next stage of this research project on roles and competencies for FSEs is to develop the competencies required for the three different roles of FSEs, being designers, peer reviewers and those in the fire brigades. These competencies will be detailed in a subsequent report as part of this research.

In terms of a framework for development of competencies, there are two different parts to this work. Organisations such as Engineers Australia set out two Stages, (called Tier 1 and Tier 2 in our earlier Education Report) namely:

- Stage 1 – those engineering competencies typically achieved through tertiary engineering education, and
- Stage 2 – those engineering competencies typically gained through application of engineering knowledge, skills and personal attributes through projects as part of professional experience under supervision by established professionals.

There is also another set of competencies that sit within the Stages 1 and 2 which are:

- General competencies expected of all engineers, and
- Competencies specific to the discipline of fire safety engineering.

Sources of other information that may be helpful to competency development are:

- SFPE - Recommended Minimum Competencies for Fire Protection Engineering 2018;
- Competencies being developed by Engineering NZ, MBIE and SFPE in NZ; and
- Competencies being developed by various bodies in the UK

Fire & Rescue NSW.

7. Summary

A RESEARCH TEAM INCLUDING FSES, CERTIFIERS, REGULATORY CONSULTANTS, AND REPRESENTATIVES OF THE FIRE BRIGADES THROUGH AFAC HAVE DEVELOPED DETAILED DESCRIPTIONS OF THE FUTURE ROLES AND DELIVERABLES FOR DESIGN FSES, PEER REVIEWER FSES, AND FSES WITHIN THE FIRE BRIGADES.

These roles will be necessary to meet the recommendations of the Shergold/Weir report and to be consistent with good practice recommendations of the Hackitt report.

These roles as written with FSEs involved from very early in the project in planning and concept design through to construction and commissioning, and handover of the building to the building owner/manager.

These role descriptions should form the basis for writing the competencies needed to undertake these roles, which is the next stage of this task 2.3.

It is very well recognised that these roles are greater than currently practised by many FSEs, especially when in a design role and at the fire brigades. However, anecdotal evidence suggests early involvement of FSEs in building projects and involvement through to project completion will often yield more innovative solutions through the design process, better “buildability” in construction, lower asset management benefits through reduced life cycle costs, and improved owner/occupant/community outcomes.

These roles have been developed to be totally consistent with the recommendations of the Hackitt and Shergold/Weir reports.

It is very well recognised that these roles are greater than currently practised by many FSEs, especially when in a design role and at the fire brigades.

8. References

1 Dame Judith Hackitt, *Independent Review of Building Regulations and Fire Safety: Final Report,* Cm 9607 (2018).

2 Peter Shergold and Bronwyn Weir, Submission to Building Ministers' Forum, *Building Confidence — Improving the effectiveness of compliance and enforcement systems for the building and construction industry across Australia,* 30 April 2018.

3 The Warren Centre for Advanced Engineering. (2019) *The State of FSE Regulation, Control and Accreditation in Australia,* Sydney.

4 The Warren Centre for Advanced Engineering. (2019) *Current Status of Education, Training and Stated Competencies for Fire Safety Engineers,* Sydney.

5 Australian Building Codes Board. (2019). *National Construction Code*. Retrieved from https://ncc.abcb.gov.au.

6 The Warren Centre for Advanced Engineering. (2019) *Comparison of International Fire Safety Engineering Guidelines, Fire Safety Verification Methods and Practice Guides,* Sydney.

7 National Research Council of Canada, International Code Council, United States of America, Department of Building and Housing, New Zealand and Australian Building Codes Board. (2005). *International Fire Engineering Guidelines*. Retrieved from https://www.abcb.gov.au/.

8 Department of Health and Human Services, Victorian Government. (2017). *Fire Safety Handbook*. Retrieved from https://providers.dhhs.vic.gov.au/fire-safety-handbook.

9. Appendix A

Task 2.3 Brief

Task 2.3 - A detailed report on the role or roles for Fire Safety Engineers (FSEs) required in Australia for effective design and construction, peer review, verification approval authority review, and the required FSE competencies required for these roles.

INTRODUCTION

The basic summary of this deliverable for the Warren Centre Project may be summarised as follows:

- 2.3.1 A report on the range of practice or roles of FSEs required in relation to design, analysis, verification, as well as construction/inspection, commissioning, post-occupancy evaluation, and for peer review, certification and authority approvals.
- 2.3.2 A report on the range of competencies required to undertake these roles effectively.

BRIEF DEVELOPMENT

The following should be considered in the research and the report writing for this task 2.3:

- The first step is to set out the roles which a FSE might play in the design and construction process.
- In many cases, the FSE has been engaged for concept and scheme design only leading up to the issue of the building permit, and often has been asked to only look at Performance Solutions (alternative solutions to the Deemed To Satisfy (DTS))
- Increasingly, it is being suggested that FSEs be engaged to look holistically at all aspects of fire safety for a building, and develop a complete fire safety strategy which may consist of Performance and DTS Solutions.
- In addition, reports like Shergold/Weir and Hackitt suggest the FSE should also be more involved in detailed design and documentation, construction stage site inspections and commissioning to ensure the fire safety strategy is being implemented correctly.

- The determination of essential services for maintenance and other aspects such as fire safety management consistent with the fire safety strategy for the buildings might also be included in the scope and role of the fire safety engineer
- Other FSEs may be involved in peer review, certification or in fire service reviews for fire safety designs and analysis, for which they need to have the same competencies as the design FSEs.
- It is recognised that fire safety engineers and others in the fire services bring special knowledge and skills in relation to real fire behaviour, fire- fighting and operational matters given it is their operational environment and workplace.
- It is also recognised that many other fire safety practitioners are involved in the design and construction process including fire services engineers and others involved in detailed design of fire protection systems such as sprinkler, fire detection and passive systems, installation of such systems and inspect and test and other maintenance activities.
- This research task needs to identify all these different roles before deciding what competencies are required for each of them.
- The competencies should be written in detailed and contemporary competency language, addressing knowledge, skills and behaviours or personal attributes
- Consideration should be taken of the Society of Fire Protection Engineers (SFPE) and other competencies written for FSEs
- At the same time, consideration should be taken of the latest writing approach for competencies by Engineers Australia
- Guidance as to whether these competencies could be attained through formal undergraduate and graduate university courses, or short courses or on the job training packages, or professional experience would be helpful.

It is envisaged that the report will:

- Be of the order of 20-30 pages long
- Have more detailed information or sets of competencies in attachments
- Will include a comprehensive set of references
- Have an Executive Summary and some key conclusions
- Be provided initially as a draft report
- After review and comments, be produced as a final report in the Warren Centre format.

It is recognised that fire safety engineers and others in the fire services bring special knowledge and skills in relation to real fire behaviour, fire-fighting and operational matters given it is their operational environment and workplace.

RESEARCHERS AND REVIEW TEAM

The first task 2.3.1 on roles for FSEs will be undertaken by a selected group of fire safety engineers based in Melbourne led by Peter Johnson and working on a volunteer basis. That group will include:

- Stephen Kip (SKIP Fire Safety Engineer)
- Matthew Wright (FPA Australia)
- Blair Stratton (SFS Vic)
- Jonathan Barnett (SFS National)
- Weng Poh (ULA Fire Engineer)
- Adrian Lee (Arup Fire Safety Engineer)
- Peter Johnson (Principal Research Consultant)
- Brian Ashe (ABCB)
- Samantha Adrichem (VBA)
- SFPE representative
- IFE representative
- AFAC representative
- Warren Centre representative

Engineers Australia have offered strong in-kind support to help write the competencies in a manner that fits with EA policy and likely to be accepted by State and Territory regulators. So, we expect this to be partnership between UQ as our sponsored researchers, EA and the Warren Centre. The key sponsored researchers at UQ/UCL for the task 2.3.2 will be:

- UQ group led by David Lange
- Prof Jose Torero (UCL)

All members of the Technical Management Committee (TMC) and Steering Committee (SC) will be invited to participate in a formal report review session.

10. Appendix B

The Role and Deliverables for Design FSE

Fire systems contractors check and commission systems and issue a compliance certificate.

PROJECT STAGE	ROLE - DESIGN FSEs	ROLE - CURRENT/ TYPICAL FSEs	ROLES FOR OTHER	DELIVERABLES
PLANNING	• Read and understand the fire safety implications and requirements of the Project Brief • Identify with others the NCC/BCA classification for a building project • Identify and agree all the fire safety objectives for the project, including but not limited to those in the NCC/ BCA • Evaluate site fire safety risks and planning requirements, including bushfire planning considerations, where applicable • Develop early concept fire safety design and fire safety strategy • Prepare fire safety section of planning report			• Fire safety section of planning report
CONCEPT DESIGN	• Engage with the design team and contribute to the building design • Make creative design suggestions or suggest any design options related to fire safety • Develop a top-down holistic fire safety strategy for the whole building • Advise on choice of materials and fire safety systems appropriate to the building form and function • Review test certificates for critical materials and equipment for conformance with relevant NCC and AS requirements • Identify potential DTS provisions and components of a Performance Solution • Select the assessment method and appropriate methods of analysis and justification for a Performance Solution (set of alternatives to the DTS provisions) and their relationship to NCC Volume One Section A2.2 • Undertake any preliminary modelling or analysis to address and resolve design options	• Undertake any preliminary modelling or analysis to address and resolve design options related to Performance Solutions		

PROJECT STAGE	ROLE - DESIGN FSEs	ROLE - CURRENT/ TYPICAL FSEs	ROLES FOR OTHER	DELIVERABLES
CONCEPT DESIGN	• Prepare a draft PBDB report as per the IFEG • Meet and engage with key stakeholders, including the local fire service, on the FEB report • Adjust, finalise and circulate a final PBDB report to the design team and all stakeholders, clearly identifying any changes	• Prepare a draft PBDB report as per the IFEG • Meet and engage with key stakeholders, including the local fire service, on the PBDB report • Adjust, finalise and circulate a final PBDB report to the design team and all stakeholders		• PBDB report
SCHEME DESIGN	• Confirm the details of the PBDB and fire safety strategy with the design team • Track, review and address with the design team any design changes or changes in materials which may impact on the fire safety strategy • Confirm the details of the DTS Solutions and the elements of the Performance Solutions with the building surveyor/certifier • Finalise the overall fire safety strategy which sets out all the key fire safety measures for the building and how they achieve the fire safety objectives and assessment criteria (but not detailed drawings and specifications which will be undertaken by others) • Undertake all the necessary modelling and analysis required as part of the assessment method to support the Performance Solution to ensure compliance with the NCC Performance Requirements • Prepare an occupant fire safety management plan and a plan for essential services maintenance • Prepare a draft PBDR report as per the IFEG, including the fire safety management plan and the essential services plan • Meet and engage with key stakeholders, including the local fire service, on the PBDR report • Adjust, finalise and circulate a final PBDR report to the design team and all stakeholders • Ensure the PBDB and PBDR are combined into two parts of a single document to remain a key project document and be updated as the further stages of the project unfold	• Confirm the details of the DTS Solutions and the elements of the Performance Solutions with the building surveyor/ certifier • Undertake all the necessary modelling and analysis to support the Performance Solution to ensure compliance with the NCC Performance Requirements • Prepare a draft PBDR report as per the IFEG • Meet and engage with key stakeholders, including the local fire service, on the PBDR report • Adjust, finalise and circulate a final PBDR report to the design team and all stakeholders	• Fire protection engineers design sprinkler and detection systems, mechanical engineers design smoke control systems, lighting engineers design emergency lighting and exit signage, etc • Regulatory consultants, checking the building for non-compliances to NCC DTS provisions	• PBDR report (including all PBDB details) including a list of fire safety measures and drawings, sketches, and other appropriate information for detailed design, as well as fire safety management and essential services plans

PROJECT STAGE	ROLE - DESIGN FSEs	ROLE - CURRENT/ TYPICAL FSEs	ROLES FOR OTHER	DELIVERABLES
DETAILED DESIGN	• Confirm the overall fire safety strategy and the details of the PBDR report with the design team • Track, review and address any changes to elements of the fire safety strategy or materials which could impact of fire safety to ensure those changes are acceptable • Mark up drawings as necessary with details of the key elements of the fire safety strategy such as fire walls, location of the FIP, fire pumps, occupant assembly areas, etc • Check that all elements of the fire safety strategy are contained in the detailed design/construction specifications		• Fire protection designers prepare drawings and specs for fire systems	• Written confirmation that fire safety strategy has been properly translated into the detailed design drawings and specifications
CONSTRUCTION AND COMMISSIONING	• Track, review and address any changes to elements of the fire safety strategy or materials which could impact fire safety to ensure those changes are acceptable • Undertake inspections at critical stages of construction to ensure the whole fire safety strategy is being implemented correctly and is consistent with the approved PBDR document • Participate in or observe critical stages of fire safety systems commissioning, including checking of interfaces between systems, to ensure the fire safety strategy and PBDR requirements are met • Prepare a report for the design team, and for the fire services where necessary, on the construction inspections and commissioning to confirm the fire safety strategy has been completed satisfactorily • Prepare a Fire Safety Handbook or Manual which outlines the fire safety strategy and the list of fire safety measures/systems in the building along with the plan for fire safety management, evacuation procedures and ESM/maintenance requirements consistent with the PBDR		• Fire protection systems contractors install fire protection systems • Fire systems contractors check and commission systems and issue a compliance certificate	• Written confirmation that the fire safety strategy and required fire safety measures, including any changes since detailed design, have been properly included in the constructed building, and that the interface between fire safety measures has been checked to ensure all measures work together as set out in the PBDR • Fire Safety Handbook

10. Appendix B

PROJECT STAGE	ROLE - DESIGN FSEs	ROLE - CURRENT/ TYPICAL FSEs	ROLES FOR OTHER	DELIVERABLES
POST-OCCUPATION	• Ensure the Building Manager is provided with a copy of the combined PBDR and Fire Safety Handbook document and understands the need to retain it for the life of the building, and update it where necessary • Engage with the Building Manager and their fire safety management team to ensure they understand the overall fire safety strategy and the occupant fire safety management plan • Engage with the Building Manager and their essential services (ESM) contractors to ensure they understand the overall fire safety strategy, the fire safety systems, evacuation procedures and the maintenance requirements as set out in the Fire Safety Handbook and PBDR documentation		• Building surveyor or others review the Essential Services list for checking and relevance and compliance • A fire systems contractor undertakes inspections and tests as part of a regular maintenance schedule	• Written confirmation that the building owner or manager as well as the essential services contractors are familiar with the fire safety strategy and the required fire safety measures, and are aware of their obligations to ensure fire safety management and emergency procedures are developed appropriately as well as essential services maintenance requirements as set out in the Fire Safety Handbook

Concrete spiral staircase in Melbourne - Photo by Mitchell Luo from Pexels.

11. Appendix C

The Role and Deliverables for Peer Reviewer FSE

Meet and engage with key stakeholders, including the local fire service.

FSE designs should account for life cycle costs and the ability to maintain assets.

PROJECT STAGE	ROLE – PEER REVIEWER FSEs	ROLE FOR OTHER FSE PRACTITIONERS	DELIVERABLES
PLANNING	• Assumes the peer reviewer, while working independently of the design team, is engaged from Concept Design/ PBDB stage of the project onwards to final construction, commissioning and handover		
CONCEPT DESIGN	• Read and understand the fire safety implications of the Project Brief for the building • Agree all the fire safety objectives for the project, including but not limited to those in the NCC/BCA • Confirm the NCC/BCA classification for a building project • Engage with the design team as necessary to fully understand the fire safety strategy and the building design • Check test certificates for critical materials and equipment for conformance with relevant NCC and AS requirements • Check the selected DTS provisions and components of a Performance Solution • Review any preliminary modelling or analysis undertaken to resolve design options • Review the draft PBDB report • Meet and engage with key stakeholders, including the local fire service, on the PBDB report		• Prepare a report to confirm the acceptance of the PBDB or identify errors, inconsistencies or other aspects of the PBDB which need re-examination or correction by the design team

PROJECT STAGE	ROLE – PEER REVIEWER FSEs	ROLE FOR OTHER FSE PRACTITIONERS	DELIVERABLES
SCHEME DESIGN	• Review the final PBDB report as received from the design team • Confirm the details of the DTS Solutions and the elements of the Performance Solutions are consistent with the PBDB report, or if changes that there are reasonable reasons for any changes • Review the overall fire safety strategy • Review all the modelling and analysis, as well as the selected assessment method, used to support the Performance Solution to ensure compliance with the NCC Performance Requirements and that all Performance Solutions are consistent with the DTS provisions where there is a mix of DTS and PS in the design • Review any comments or correspondence on the fire safety strategy or the PBDB or draft PBDR by the fire services • Review the occupant fire safety management plan and a plan for essential services maintenance. • Review the draft PBDR report • Meet and engage with key stakeholders, including the local fire service, on the PBDR report • Review the final PBDR report and check the PBDB and PBDR are combined into two parts of a single document to remain a key project document and be updated as the further stages of the project unfold, or design changes occur	• Fire protection engineers design sprinkler and detection systems	• Prepare a report or letter as to whether or not the PBDB is acceptable in terms of the project brief and all NCC requirements • Prepare a report to confirm the acceptance of the PBDR or identify errors, inconsistencies or other aspects of the PBDR which need re-examination or correction by the design team • Prepare a report or letter as to whether or not the PBDR is acceptable in terms of the project brief and all NCC requirements
DETAILED DESIGN	• Review any changes to the overall fire safety strategy or individual elements of fire safety strategy • Review marked up drawings as necessary with details of the key elements of the fire safety strategy such as fire walls, location of the FIP, fire pumps, occupant assembly areas, etc • Check that all elements of the fire safety strategy are contained in the detailed design/construction specifications	• Fire protection designers prepare drawings and specs for fire systems	• Letter or certification as to whether or not the fire safety strategy has been properly translated into the detailed design drawings and specifications

PROJECT STAGE	ROLE – PEER REVIEWER FSEs	ROLE FOR OTHER FSE PRACTITIONERS	DELIVERABLES
CONSTRUCTION AND COMMISSIONING	• Review the report of the design team, and from the fire brigade where provided, on the construction inspections and commissioning to confirm the fire safety strategy has been completed satisfactorily	• Fire protection systems contractors install fire protection systems • Building surveyor or others review the Essential Services list for relevance and compliance	• Letter or certification as to whether or not the building has been properly constructed and fire safety measures installed in accordance with the fire safety strategy and PBDR requirements
POST-OCCUPATION	• Review the correspondence between the design team and the Building Manager and their fire safety management team to confirm they understand the overall fire safety strategy and the occupant fire safety management plan • Review the Fire Safety Handbook and ESM documentation to ensure it is consistent with the fire safety strategy and the PBDR		• Letter or certification as to whether or not the design team has properly informed the building owner or manager as well as the essential services contractors with the required information on the fire safety strategy and the required fire safety measures, and all are aware of their obligations to ensure fire safety management and emergency procedures are developed appropriately as well as essential services maintenance requirements

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12.
Appendix D
The Role of the FSE in the Fire Brigades

> This approach also acknowledges that prescriptive regulation and guidance are not helpful in designing and building complex buildings, especially in an environment where building technology and practices continue to evolve and will prevent those undertaking building work from taking responsibility for their actions.
>
> ~ Dame Judith Hackitt

Assumes that the FSE at the fire brigade, working with their operational fire fighter colleagues, is providing stakeholder advice but not working as part of the design team, and is involved as a key stakeholder from the Planning stage through Concept, Schematic and Detailed Design of the project and onwards to Final Construction, Commissioning and Handover.

PROJECT STAGE	ROLE – FIRE BRIGADE FSEs	ROLE - CURRENT/ TYPICAL FSEs	DELIVERABLES
PLANNING	• Review site fire safety risks and planning requirements, including bushfire planning requirements, where applicable to fire brigade operations	• Provide advice to planning departments on fire brigade requirements in the planning approval stage	• Written advice at the planning stage
CONCEPT DESIGN	• Read and understand the fire safety implications of the Project Brief for the building • Review and agree all the fire safety objectives for the project, including but not limited to those in the NCC/ BCA • Confirm the NCC/BCA classification for a building project • Engage with the design team through stakeholder or other meetings as necessary to fully understand the fire safety strategy and the building design • Provide advice and confirm the policy and procedures in relation to fire services operations. • Check the selected DTS provisions and components of a Performance Solution to check that they all work together as an integrated building solution and fire safety strategy, and meet fire services requirements • Review any preliminary modelling or analysis undertaken to resolve design options • Review the draft PBDB report • Meet and engage with the design team and other key stakeholders to review the draft PBDB report	• Provide advice during PBDB consultations • Prepare written correspondence on PBDB reports	• Prepare written correspondence with comments on the draft PBDB and matters requiring attention

PROJECT STAGE	ROLE – PEER REVIEWER FSEs	ROLE FOR OTHER FSE PRACTITIONERS	DELIVERABLES
SCHEME DESIGN	• When the final PBDB report is received from the design team, check that it is acceptable to the fire services • Review the overall fire safety strategy • Review all the modelling and analysis used to support the fire safety strategy and the Performance Solution to ensure compliance with the NCC Performance Requirements and check that all elements of the Performance Solution and the DTS provisions are properly integrated and aligned with one another, particularly where there is a mix of PS and DTS in the design • Review the occupant fire safety management plan and a plan for essential services maintenance • Review the fire brigade intervention model analysis, assembly areas, access, hydrants, and fire safety measures essential to response, rescue, firefighting and recovery to ensure they fit with current operational firefighting tactics • Review the draft PBDR report which should incorporate the full PBDB report • Meet and engage with other key stakeholders on the draft PBDR report • Once forwarded by the design team to the fire services, review the final PBDR report	• Review FER reports and other documents as necessary and provide written comments	• Once the final PBDB has been received by the fire services, prepare written correspondence on whether or not the PBDB is acceptable to the fire services in terms of the project brief and all relevant NCC requirements as well as operational firefighting matters • Prepare written correspondence with comments on the draft PBDR and matters requiring attention • Once the final PBDR has been received by the fire services, prepare written correspondence on whether or not the PBDR is acceptable to the fire services in terms of the project brief and all relevant NCC requirements as well as operational firefighting matters
DETAILED DESIGN	• Review any changes to the PBDR during detailed design that impact on the fire safety strategy and fire brigades' operations • Note: All changes should be clearly articulated in detail by the design FSE	• Review PBDR and other documents as necessary and provide written comments	• Provide written comments in relation to any changes to the fire safety strategy or fire services operational matters

PROJECT STAGE	ROLE – PEER REVIEWER FSEs	ROLE FOR OTHER FSE PRACTITIONERS	DELIVERABLES
CONSTRUCTION AND COMMISSIONING	• Attend the building site and based on a review of the PBDR report prepared by the design team, and any earlier fire services reports, or correspondence where provided, undertake construction inspections and witness commissioning to confirm that the fire safety strategy has been implemented satisfactorily and all fire safety measures have been constructed or installed in accordance with the requirements of the PBDR report • On site, inspect, and test as necessary, all measures required for fire brigade response, rescue, firefighting, and recovery to ensure all measures meet the operational requirements of the fire services	• Undertake inspections and witness commissioning tests and provide written comments	• Provide written confirmation as to whether the building meets the requirements of the PBDR and satisfies the fire services operational requirements
POST-OCCUPATION	• As part of a stakeholder team, meet with the Building Manager and their fire safety management team to ensure they understand the overall fire safety strategy, the essential services (ESM) plan, and the occupant fire safety management plan (AS3745) as set out in the Fire Safety Handbook, as well as ensuring the Building Manager understands the operational requirements and tactics of the fire services in the event of a fire		• Written confirmation to the Building Manager as to whether or not they have participated in the post-occupation handover, with any special recommendations in relation to fire services response, rescue, fire fire-fighting and recovery procedures • Written confirmation as to whether or not they agree with the list of ESM critical to proper maintenance

Sue Eddy, CEO of the Victorian Building Authority, and Ashley Brinson at the 2020 FSE conference at University of Sydney.

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The Roles Report

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