Fire Safety Engineering

The Accreditation and Regulatory Reform Report

Report 7 of this Series

THE WARREN CENTRE

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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.

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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.

For enquiries about this report please email: warrenc@sydney.edu.au

The Adelaide Oval is an example of Performance-Based Engineering.

This seventh report in our Professionalisation of Fire Safety Engineering (FSE) series sets a plan for how Australia should assess and accredit engineers who seek to practice fire safety design and take responsibility for public safety in their work. As of issuing this report, the State of Victoria adopted the Professional Engineers Registration Act 2019 (VIC), and in June this year the NSW Parliament passed the Design and Building Practitioners Act 2020 (NSW). Peter Johnson and I testified at the NSW Parliamentary Inquiry on the Professional Engineers Registration Bill in February, and it was honestly a highlight of my career to take the oath and to describe to legislators the role of professional engineers in society.

The final report of the series is written and in late proofing to be typeset. A few from the project team are attending regular meetings with the NSW Government's team on regulations.

As this project is coming to a close, and as The Warren Centre for Advanced Engineering is making a transition from a independent limited liability company owned by the University of Sydney to a centre within the University, I feel the time is right for me to step away from The Warren Centre and pursue new endeavours. I have made some excellent friendships among the colleagues working on this project and so many other Warren Centre efforts, and I will always value those relationships.

We are also in the phase now of transferring the future activities of this project to partners who can carry the torch forward as engineering professionalisation reaches the remaining states and territories, as detailed regulatory processes are established, and as professional bodies adopt new accreditation practices. If you or your organisation would like to support ongoing development and professional advocacy, please reach out to me, to Peter Johnson of Arup, or to Dr David Lange of the University of Queensland.

The cracking incident at the Sydney Opal Tower in December 2018 and the Neo200 / Lacrosse Building fires in Melbourne were wake-up alarms that change needed to be made. It should be seen as a mark of pride that engineers mounted a strong case for why greater professionalisation was essential to re-establish the engineer's role in building modern infrastructure, delivering economic growth, and ensuring public safety. This project has clearly demonstrated that performance-based design

principals undertaken by competent professionals open a remarkable range of design flexibility, unique aesthetics, superb functionality and high value to building owners and occupants.

This was an industry-led project initiated to define the standards for professional practice and to lift performance in the industry to meet the expectations and needs of society for excellent buildings with whole of life cycle amenity, value and safety.

The Warren Centre thanks the project sponsors, the Executive Steering Committee members, the Technical Committees and Working Group members, the research authors, and so many reviewers and contributors to the reports, papers and conference proceedings. We give special thanks to Warren Centre directors Richard Kell and Ian Dart, to Peter Johnson of Arup, to Professor Jose Torero at University College London, to Dr David Lange and to the UQ team for their tireless support.

J. Ashley Brinson

Ashley Brinson
Executive Director

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AUSTRALIAN ENGINEERING EXCELLENCE AWARDS 2020

Pathfinder software is an agent-based fire evacuation simulator.
Screenshot by Holmes Fire.

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Executive Summary

THIS REPORT ON THE ROLE OF STATE AND TERRITORY GOVERNMENTS AS WELL AS THE PROFESSIONAL ENGINEERING ACCREDITATION BODIES SETS THE SCENE WITH RECOMMENDATIONS FOR REGULATORY REFORM OF FIRE SAFETY ENGINEERING PRACTICE ACROSS AUSTRALIA.

It is critical that fire safety engineers are engaged in the building design process from concept design through to construction inspections and commissioning, as well as producing fire safety manuals for building owners. For this to be possible state and territory governments as well as the professional engineering accreditation bodies need to undergo this regulatory reform.

- In relation to professional accreditation, this report builds on the findings of the Professional Development Report, which sets out the processes fire safety engineers will need to follow to be professionally recognised for their competencies based on their qualifications and on-going training and experience.

Specific issues and recommendations are raised in relation to the two professional bodies practicing in Australia which cover professional accreditation of fire safety engineers, namely Engineers Australia (EA) and the Institution of Fire Engineers (IFE).

Detailed recommendations are made on Stage 1 and 2 competency assessments that should be applied uniformly and consistently by both EA and IFE and included in all state and territory professional engineering registration schemes.

While the ultimate aim of the profession of fire safety engineering may well be to control all aspects of the profession and practice, like lawyers and doctors, this report advocates the co-regulatory model which is supported by Engineers Australia and is already widely adopted by state and territory governments for a range of professional practice areas.

In this co-regulatory model, professional accreditation bodies, such as EA and IFE, act as "assessment bodies" to control the qualifications and competency standards of

It is critical that fire safety engineers are engaged in the building design process.

fire safety engineers, with systems established for assessing the professional competency, experience and continuing professional development (CPD) of practitioners. Professional bodies also need to develop monitoring and disciplinary procedures.

This leaves government regulators to monitor the "assessment bodies", their systems, and the standards being applied to practitioners. Government agencies would control authority or permission to practice, review professional practice of engineers and performance of projects, undertake audits and enforcement, and apply legal and other sanctions where required, with penalties as appropriate. It is clear, that the appropriate government structures need to be defined so as to enable government regulators to adequately monitor the "assessment bodies." These structures currently do not exist in Australia.

This report sets out strong recommendations on the regulatory reforms that state and territory governments should undertake, including the aforementioned professional registration schemes, monitoring structures, as well as formally defining the roles of fire safety engineers within the building regulations.

Additional recommendations are made for professional accreditation bodies in relation to training on the National Construction Code (NCC) and local building regulations, engagement with Professional Indemnity (PI) insurers, and other measures to create a sustainable profession of fire safety engineering.

Warringtonfire undertakes testing, inspection and certification of building materials to verifiy compliance for fire safety applications.

1. Introduction

The research at the Warren Centre on "Professionalising Fire Safety Engineering" has delivered six major research reports, namely:

- The Regulation Report[1]
- The Education Report[2]
- The Methods Report[3]
- The Roles Report[4]
- The Competencies Report[5]
- The Professional Development Report[6]

All six reports, which can be downloaded for free from the Warren Centre website (*https://thewarrencentre.org.au/state-of-fire-safety-engineering-australia/*), have recommendations which contribute to the professionalisation of Fire Safety Engineering in Australia, an objective which is aligned with the findings and recommendations of the Shergold/Weir "Building Confidence" Report (BCR)[7].

This report will distinguish between professional recognition of fire safety engineers by professional bodies such as Engineers Australia (EA) and the Institution of Fire Engineers (IFE) contrasted to permission to practice by state and territory governments on the other hand. In the former case, the terms accreditation, registration and/or chartered are used to refer to professional recognition but not always in a consistent fashion. EA uses the terms Chartered Engineer (CEng) to refer to general engineering competency but refers to registration in their National Engineering Register (NER) scheme which relates to assessment of competency in specific practice categories, such as fire safety engineering. In contrast, IFE uses Chartered Engineer (C.Eng) in their scheme that is linked to competency in selected areas such as fire safety engineering. In the latter case, governments across Australia have tended to use the word registered or licensed to indicate authority or permission to practice under the relevant legislation and building regulations.

In this report, the term "accreditation" is used in relation to professional competence and assessment bodies such as EA and IFE. The term "registration" generally refers to the authority to practice given by governments under legislation and building regulations.

In order to complete this project and provide governments and professional bodies with the strong evidence they need for regulatory reform, and to elevate fire safety engineering practice to a full and proper professional level, the original research plan in respect of the

[1] Kip et al., "The Regulation Report" short title, "The State of FSE Regulation, Control and Accreditation in Australia", 2019, at *https://www.sydney.edu.au/content/dam/corporate/documents/faculty-of-engineering-and-information-technologies/industry-and-government/the-warren-centre/the-regulation-control-and-accreditation-report-fire-safety-engineering-the-warren-centre.pdf*

[2] Torero et al., "The Education Report" short title, "Current Status of Education, Training and Stated Competencies for Fire Safety Engineers", 2019, at *https://www.sydney.edu.au/content/dam/corporate/documents/faculty-of-engineering-and-information-technologies/industry-and-government/the-warren-centre/the-education-report-fire-safety-engineering-the-warren-centre.pdf*

[3] Lange et al., "The Methods Report" short title, "Comparison of International Fire Safety Engineering Guidelines, Fire Safety Verification Methods and Practice Guides", 2020, at *https://www.sydney.edu.au/content/dam/corporate/documents/faculty-of-engineering-and-information-technologies/industry-and-government/the-warren-centre/the-methods-report-fire-safety-engineering-the-warren-centre.pdf*

[4] Lange et al., "The Roles Report" short title, "The Roles of Fire Safety Engineers", 2020, at *https://www.sydney.edu.au/content/dam/corporate/documents/faculty-of-engineering-and-information-technologies/industry-and-government/the-warren-centre/the-roles-report-fire-safety-engineering-the-warren-centre.pdf*

[5] Lange et al., "The Competencies Report" short title, "Fire Safety Engineering Competencies", 2020, at *https://www.sydney.edu.au/content/dam/corporate/documents/faculty-of-engineering-and-information-technologies/industry-and-government/the-warren-centre/the-competencies-report-fire-safety-engineering-the-warren-centre.pdf*

[6] Lange at al., "The Professional Development Report" short title, "Professional Development and Resource/Skill Constraints", 2020, at *https://www.sydney.edu.au/content/dam/corporate/documents/faculty-of-engineering-and-information-technologies/industry-and-government/the-warren-centre/the-education-training-professional-development-and-skill-constraints-fire-safety-engineering-the-warren-centre.pdf.pdf*

[7] 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

final recommendations included the following four research tasks:

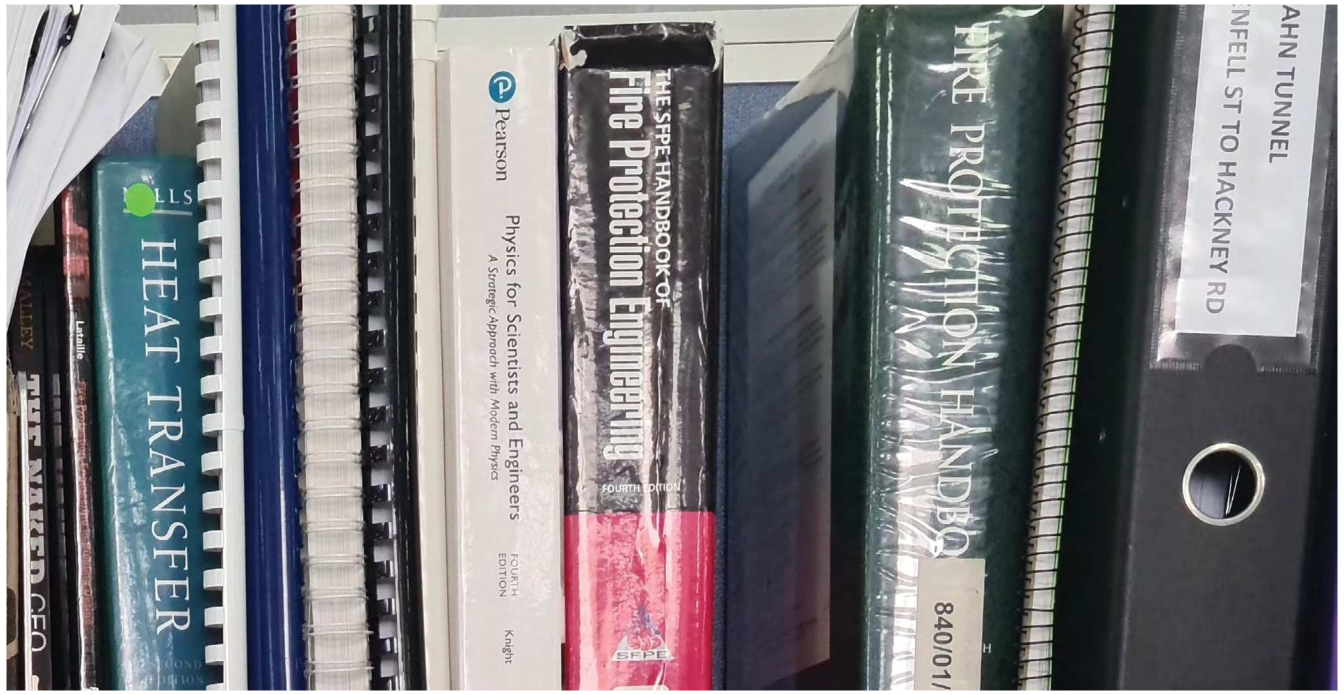
- Develop remedies and initiatives and means to address resource and skill constraints;
- Report on the education and training requirements for professional Fire Safety Engineers (FSEs);
- Report on professional accreditation of FSEs, including ongoing continuous professional development (CPD); and
- Define the role and regulatory implementation of accreditation of FSEs in state and territory building regulations with national consistency.

In the light of recent developments, such as the Building Ministers Forum / Australian Building Codes Board (BMF/ABCB) Implementation Team work on responding to the Shergold / Weir "Building Confidence Report", and various state and territory regulatory reform initiatives, the remaining research activities have been consolidated into two closely related research tasks, together with a final report which is intended to detail proposed transitional arrangements as Project recommendations are implemented.

These three final research activities may be further summarised as follows:

- Initiatives to address resource and skill constraints, including education and training needs, professional career development, and requirements for professional body accreditation of fire safety engineers in the "Professional Development Report".
- The implementation of roles and accreditation into state and territory regulations with national consistency, including the relationship between Engineers Australia (EA) and the Institution of Fire Engineers (IFE) accreditation in state and territory licensing/registration. This report, to be known as the "Regulatory Reform Report".
- A pragmatic final report and transitional plan on how to get from the current situation, which differs across all states and territories in relation to regulation, registration, and other practice controls, to the full and proper profession for FSEs seen as required to meet the Shergold/Weir recommendations and professional ambitions.

The requirement for a competent FSE profession is particularly critical as building



A busy fire safety engineer's bookshelf.

There is a need to clarify and update the requirements for professional accreditation of fire safety engineers by the professional bodies.

codes set technical provisions for the design and safety of buildings throughout the world. However, building codes are just tools used by professionals to design. A building code on its own is insufficient to yield consistent and safe building outcomes as the design of fire safety provisions for a building requires from the designer competencies and attributes consistent with the engineering profession. In delivering buildings and associated infrastructure which are fit for purpose, the following are essential requirements:

- Competent professionals who maintain the currency of their competency;
- Nationally consistent regulations and procedures for licensing of professionals and registration to control practice;
- Well defined roles for the various categories of practitioner;
- Clear standards and positive action on auditing and enforcement to deal with poor practice;
- Lifelong continuing professional development (CPD); and
- A well supported and sustainable career structure driven by professional engineers.

This report refers to the requirements for professional body accreditation of fire safety engineers and implementation of roles and registration of fire safety engineers in state and territory regulations with national consistency. The report also addresses the relationship between Engineers Australia (EA) and the Institution of Fire Engineers (IFE) accreditation and state and territory registration.

TASK BRIEF

There is a need to clarify and update the requirements for professional accreditation of fire safety engineers by the professional bodies (EA/NER and IFE) and to ensure the implementation of the roles and accreditation requirements established through this Warren Centre Project into the state and territory regulations with national consistency for registration.

So, the following were considered in the research and final recommendations:

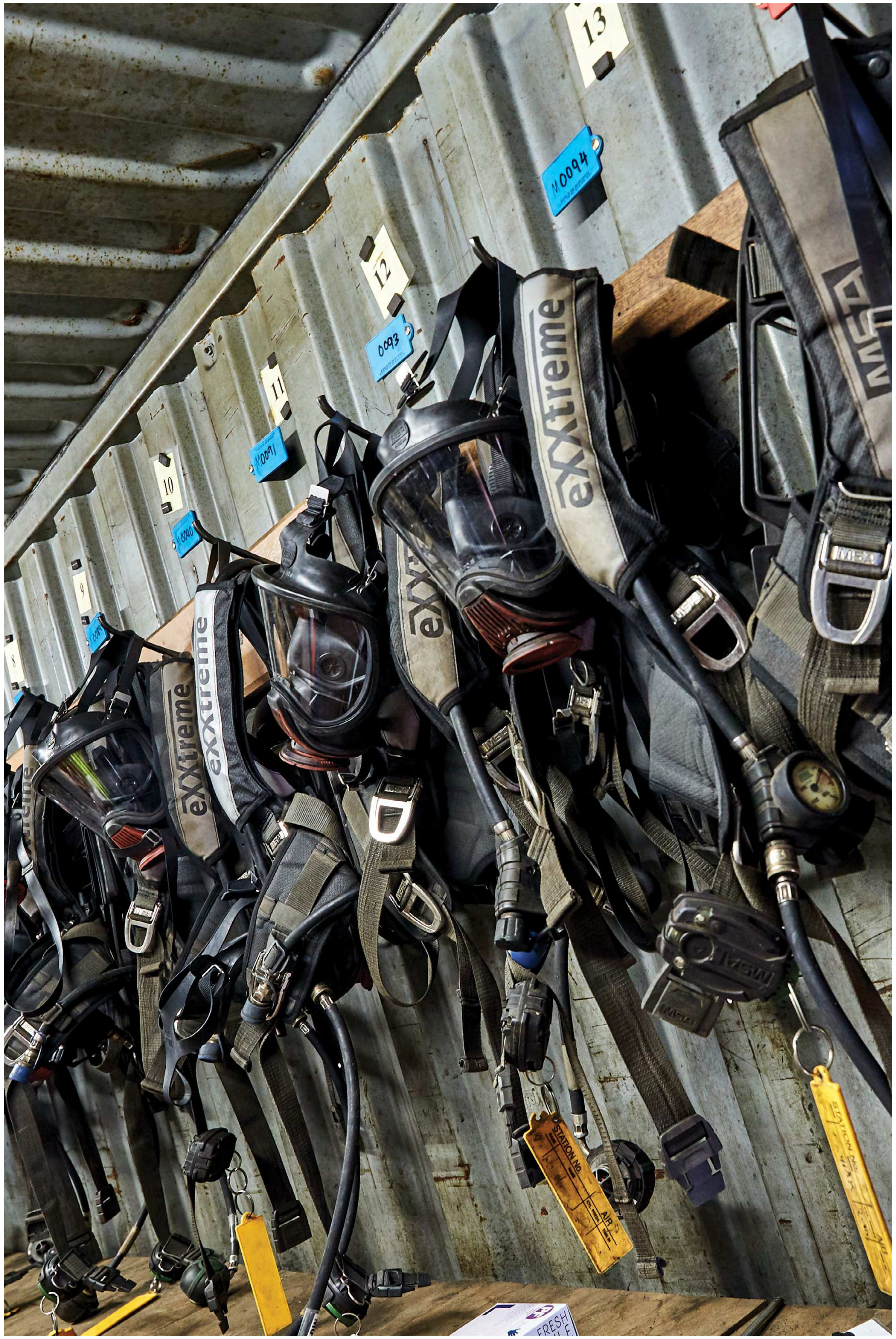
- The **Roles Report**[8] has set out new roles for fire safety engineers which respond directly to the recommendations of the Shergold/ Weir "Building Confidence" report.
- This **Competencies Report**[9] has set out new Stage 1 competencies to be typically gained through academic education and Stage 2 competencies to be gained through supervised professional experience for fire safety engineers to match the expected future roles as defined.
- In Australia, accreditation schemes for professional recognition through EA/NER and IFE need to be based on assessment of these new competencies in a consistent manner to ensure these schemes meet national registration agenda being led by the ABCB Implementation Team for the Building Minsters Forum (BMF).

[8] Ibid, footnote 4.
[9] Ibid, footnote 5.

- It is required that the EA/NER and IFE schemes deliver rigorous individual applicant assessments, based on the new competencies, including the personal attributes and ethics of a full and proper profession.
- In terms of on-going professional body accreditation, it is critical that requirements for CPD, including seminars, short courses, etc, are verified, and the schemes have comprehensive audit and enforcement provisions with disciplinary procedures for dealing with poor practice or unethical behaviour.
- The relationship between professional body accreditation and separate registration by state and territory governments needs to be detailed within this present report, with recommendations for national consistency which enable proper and sensible mutual recognition provisions between states and territories.
- In addition to the expected state and territory registration provisions for fire safety engineers, it is important to note that state and territory building regulations should be revised to include the future roles and requirements for fire safety engineers on building projects. This should include the provision that design fire safety engineers have a mandated role to look at all fire safety related requirements, be involved from concept design through to commissioning and handover, produce an owners/manager manual, etc, as set out in the **"Roles Report"**.[10]
- This work on state and territory regulations should include the need for fire safety engineers to be registered, how that links to professional accreditation, on-going state and territory/NCC requirements training, the requirements for PI insurance, the requirement for audits and enforcement, and penalties for practice violations or poor performance.

> This report refers to the requirements for professional body accreditation of fire safety engineers and implementation of roles and registration of fire safety engineers in state and territory regulations with national consistency.

[10] Ibid, footnote 4.



Respirators used by NSW Fire & Rescue.

2. Accreditation of Fire Safety Engineers

2.1 STAGE 1 – ACCREDITATION BY PROFESSIONAL BODIES

The National Engineering Register (NER)[11] of Engineers Australia (EA) is a register of engineers who have met the required standards of competency and professionalism and in the case of Fire Safety Engineering, have been awarded the title of Chartered Engineer (CEng) by EA. Listing on the NER indicates that any engineering services provided will truly reflect the standards expected of an engineer who has gone through the full Stage 1 and 2 accreditation processes outlined by EA and summarised in their competency standards.[12, 13]

The CEng accreditation scheme of the Institution of Fire Engineers (IFE) has the same intention, however is aligned with the Engineering Council UK (ECUK) accreditation process.[14] Both Australia and the UK are signatories to the Washington Accord of the

Dr Bronwyn Evans, CEO of Engineers Australia, spoke at TWC's FSE Conference in February 2020.

11 https://www.engineersaustralia.org.au/Engineering-Registers/National-Engineering-Register/NER-Info Accessed 9th June 2020
12 Engineers Australia Stage 1 competencies, "Stage 1 Competency Standard for Professional Engineer", at *https://www.engineersaustralia.org.au/sites/default/files/resource-files/2017-03/Stage%201%20Competency%20Standards.pdf*
13 Engineers Australia Stage 2 competencies, "AUSTRALIAN ENGINEERING COMPETENCY STANDARDS STAGE 2 - EXPERIENCED PROFESSIONAL ENGINEER", at *https://www.engineersaustralia.org.au/sites/default/files/2018-03/competency_standards_june.pdf*
14 ECUK accreditation process at https://www.engc.org.uk.

International Engineering Alliance (IEA), and so the two processes should be expected to be substantially equivalent.

There are two issues with the above mechanism, in the context of its application to Fire Safety Engineering:

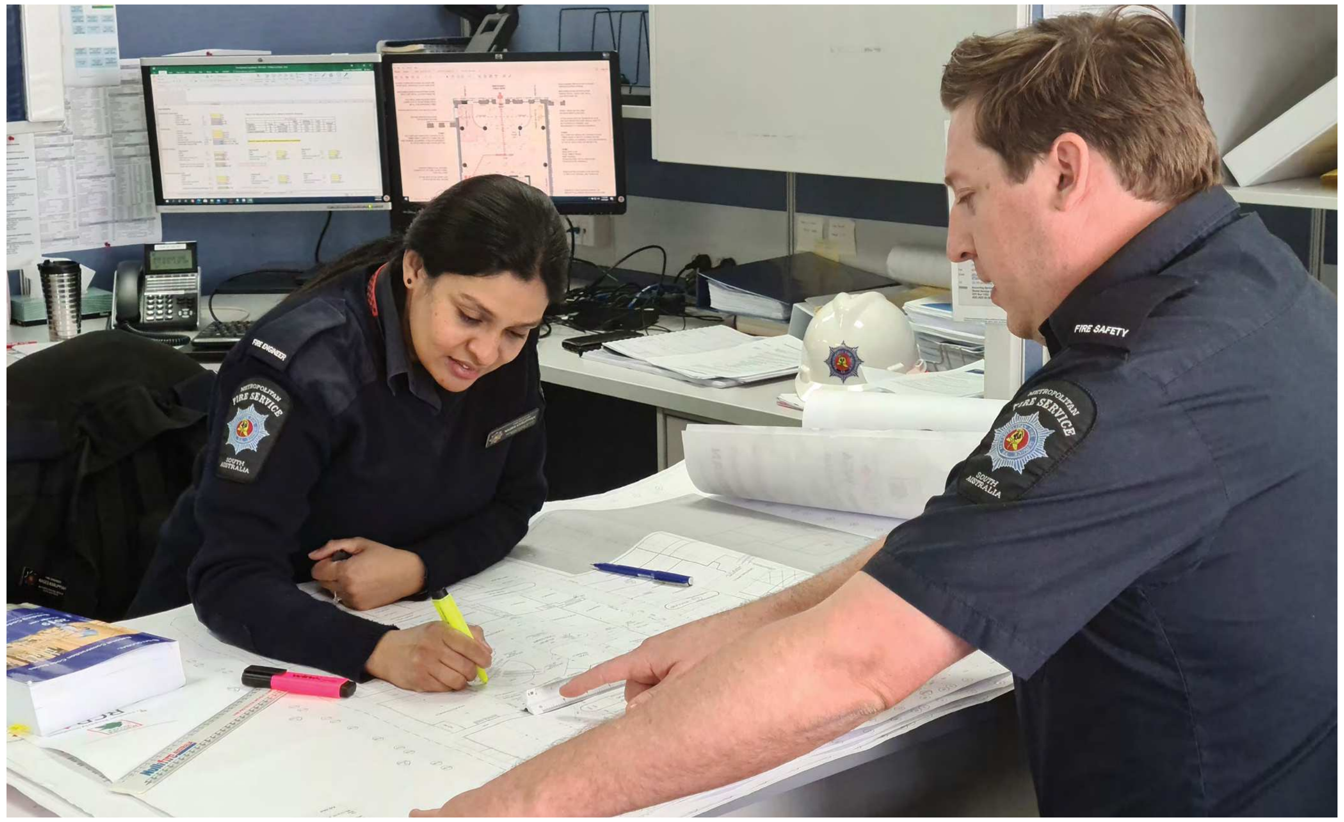
1. Both the National Engineering Register and Chartered Engineer title are based on a framework that requires a two-stage accreditation process for individual fire safety engineers. First, is the achievement of competencies as result of successful completion of an accredited degree granting programs in institutions of higher education. Second is a personal experience demonstration. Separately, is the accreditation of the education programs themselves, typically by EA. As explained in detail in the Competencies Report, the former does not exist in the context of fire safety engineering.
2. Neither EA nor the IFE presently have a full and proper set of discipline specific competencies against which to assess fire safety engineers for professional practice for Stage 1 and Stage 2 competencies. Most competency frameworks for Fire Safety Engineering choose to focus on the body of knowledge that underpins the practice, as opposed to a full set of competencies, including knowledge, skills, personal attributes, and professional attributes, that are expected of Fire Safety Engineers as design professionals in the modern built environment.[15]

Given the relatively small size of the profession, its anticipated growth, and the critical responsibility for providing buildings which are fit for purpose and safe from fire, it is clear that there is a need to properly structure the accreditation process for Fire Safety Engineering. This includes the definition of competencies which adequately address the proper role of fire safety engineers. Continued accreditation without a set of well-defined competencies risks propagating a widely varying range of standards in Fire Safety Engineering, and thus diminishing the overall quality of fire safety outcomes in the built environment. The route to achieving this is to develop a comprehensive accreditation framework as well as adopting one set of competency standards which adequately represent the aspirational standard for practice that the industry expects of itself.

Responding to the lack of a well-defined competency standard for Fire Safety Engineering, the Warren Centre project on **"Professionalising Fire Safety Engineering"** published a detailed competency proposal5 which outlined the competencies that would be required in order to fulfill the expected role of the Fire Safety Engineer in the built environment post implementation of the recommendations of the Shergold / Weir report. These competencies have been mapped to the generic competency standard of Engineers Australia, which facilitates their future adoption for the accreditation of the profession. Planned publications map these against the International Engineering Alliance (IEA) competency standards, facilitating their possible future adoption by other professional organisations in other jurisdictions, including the IFE.

> Listing on the NER indicates that engineering services provided will truly reflect the standards expected of a professional engineer.

[15] Ibid, footnote 5.



Nages Karuppiah, a Senior Fire Safety Engineer at the South Australian Metropolitan Fire Service, is the Branch Vice President of IFE Australia. Her collegue, Damien Roland, is a Fire Safety Engineer in the SA MFS Community Safety & Resilience Department.

This new competency standard should form the basis for the development of an accreditation process for degrees in Fire Safety Engineering, as a route to Stage 1 competency. This forms the most basic and direct route to Stage 1 accreditation as a Fire Safety Engineer which addresses the first of the key shortcomings of the current process.

In addition to the above process of institutional accreditation, it may also be possible to recognise certain degree programs for their quality and structure to be equivalent to Washington Accord signatory institutions. Given that the current number of programs in Fire Safety Engineering is quite limited, this is a natural and simple process. In such instances, where the program is accredited according to one of the other international engineering education accreditation accords, then the checks and reviews that form a part of that accreditation process may be taken in lieu of the accreditation process of the Washington Accord, if appropriate. (A number of high reputation overseas programs were reviewed in **The Education Report**.[16])

Regardless, for degree exit level graduates from universities with a program in Fire Safety Engineering which is not accredited by one of the Washington Accord signatories, and cannot be recognised as described above, then it is necessary to establish a competency assessment. This is a complex and detailed process that should be limited to a minimum by the organisation responsible for professional accreditation. Given that the global diversity

[16] Ibid, footnote 2.

of higher education programs is such, in this particular scenario, the focus should be on the individual's competencies and attributes and not on the program. For this to happen there needs to be a competency assessment carried out of the individual seeking first stage accreditation. This process requires a clear, consistent and transparent statement of the expectations of an individual before admission to practice and should be equivalent to the expected competencies of graduates from Stage 1 accredited or recognised institutions.

The exact process will need to be carefully defined to meet professional expectations. As a result of the degree of rigor required of this process as an alternative route to the normal accredited degree route, it seems likely that a combination of examination followed by interview may need to be carried out where the degree is not accredited or where it has not been otherwise vetted. This places requirements on identifying those individuals who have the capacity and expertise for setting and reviewing the examination, and the body representing the profession may need to outsource this responsibility to specialist fire safety engineers who themselves are highly experienced and are recognised as having the full range of competencies.

2.2 STAGE 2 – ACCREDITATION OF FIRE SAFETY ENGINEERS BY PROFESSIONAL BODIES

Assessments of candidates at Stage 2 normally at present consist of a written report and interview to evaluate the competencies required for Stage 2 accreditation as a result of the required period of supervised professional experience. This process should remain largely the same as the current process for NER and CEng registration. However, there are a number of features that need to be put in place to ensure that the process is transparent and effective for Fire Safety Engineering.

A proposal for these second stage competencies has also been given in the Competencies Report. The assessment of these for a specific discipline should be done by a professional organisation which represents the interests of the engineering profession nationally and is likely to be recognised by state and territory governments as an appropriate "assessment body" in the assessment of competency and monitoring of CPD for engineers, including fire safety engineers. In Australia, the national engineering peak body is Engineers Australia. States and territories may also choose to recognise IFE as an "assessment body". Nevertheless, this delegation should only be done through a harmonisation/standardisation process of the two organisations' divergent processes. The RPEQ scheme administered by the BPEQ in Queensland defers to EA on professional accreditation and assessment of competency, which is likely to be similar to pending schemes in both Victoria and New South Wales as a result of recent legislation.[17, 18]

[17] *Professional Engineers Registration Act 2019 (VIC)*, at https://www.legislation.vic.gov.au/as-made/acts/professional-engineers-registration-act-2019.
[18] *Design and Building Practitioners Act 2020 (NSW)*, at https://www.legislation.nsw.gov.au/view/html/inforce/current/act-2020-007.

For admission of an individual to practice, any assessor must be competent in the field of practice in order to make a suitable judgement on the competency of the individual being assessed. This places a need for competency on the assessor. This means that, as for the case where there may need to be an assessment of Stage 1 competencies, Engineers Australia, for example, may need to defer to a third-party professional body of fire engineers (which could be the body of professional FSEs within the EA Society of Fire Safety). Alternatively, a group of suitably qualified and experienced practicing fire engineers could oversee the process of professional accreditation. The definition of this process will require broad consultation. This is further discussed in the **Professional Development Report**.[19]

As part of the proposed transition to a full profession there is a need to address the registration of existing practitioners. It must be recognised that many existing practitioners in Fire Safety Engineering will have come from backgrounds which are not easily aligned with the above processes for accreditation. Changes in regulations will also mean that many practitioners will need to submit themselves for assessment against both the Stage 1 and the Stage 2 competencies. In such instances, while any assessment of current practitioners should remain flexible in terms of evidence provision – allowing evidence to be submitted in the form of engineering reports, career episodes, examination, interview etc. – it must not compromise on the competencies that are expected from any member of the profession.

For this process, the accreditation body (be this EA, IFE or a registration board appointed as an "assessment body" on behalf of an individual state or territory) may also wish to appoint a number of highly respected professionals to oversee and audit the process. A suitable transition plan needs to be put in place that enables a fair and efficient transition process including a broad consultation among current practitioners.

This FSE report series builds upon over a century of academic and industrial research aimed at preventing fires.

[19] Ibid, footnote 6.

At this point it is worth reiterating the fact that the bar cannot and should not be lowered to accommodate existing practitioners who are unable to provide evidence of the required competencies. So, there needs to be sufficient opportunity put in place for existing practitioners to upskill where needed. These issues are discussed in more detail in the **Professional Development Report**,[20] including recommendations for courses to be offered to address skills shortages in the profession.

Roof over the Adelaide Overal Redevelopment. Performance-Based Engineering techniques were used on the project.

The above is all in line with a full and proper response to the Shergold/Weir "Building Confidence" report. There is a need to establish a nationally consistent registration/licensing systems for fire safety engineers, resulting in an arrangement, where from a competency standpoint, the requirements are the same across all states and territories. There may be different professional indemnity (PI) insurance requirements, or specific requirements with regards to, for example, local legislation and regulations related to planning and construction (in order to be registered/licensed). This points towards the co-regulatory model for Fire Safety Engineering, which is discussed in more detail in section 3. However, the basic registration requirements related to professional competencies must be nationally consistent, in part to allow fair and equitable mutual recognition arrangements between states and territories.

2.3 ONGOING PROFESSIONAL DEVELOPMENT

One of the attributes that is expected of all professions is an ability of the practitioners to recognise the bounds of their own knowledge and skills. Professionals must upskill when necessary, maintaining currency of their competencies. This must be a feature and a continuing requirement for ongoing professional accreditation of Fire Safety Engineers by professional bodies in the future. This requirement for ongoing professional development must be based on the demonstration of acquired competencies and attributes.

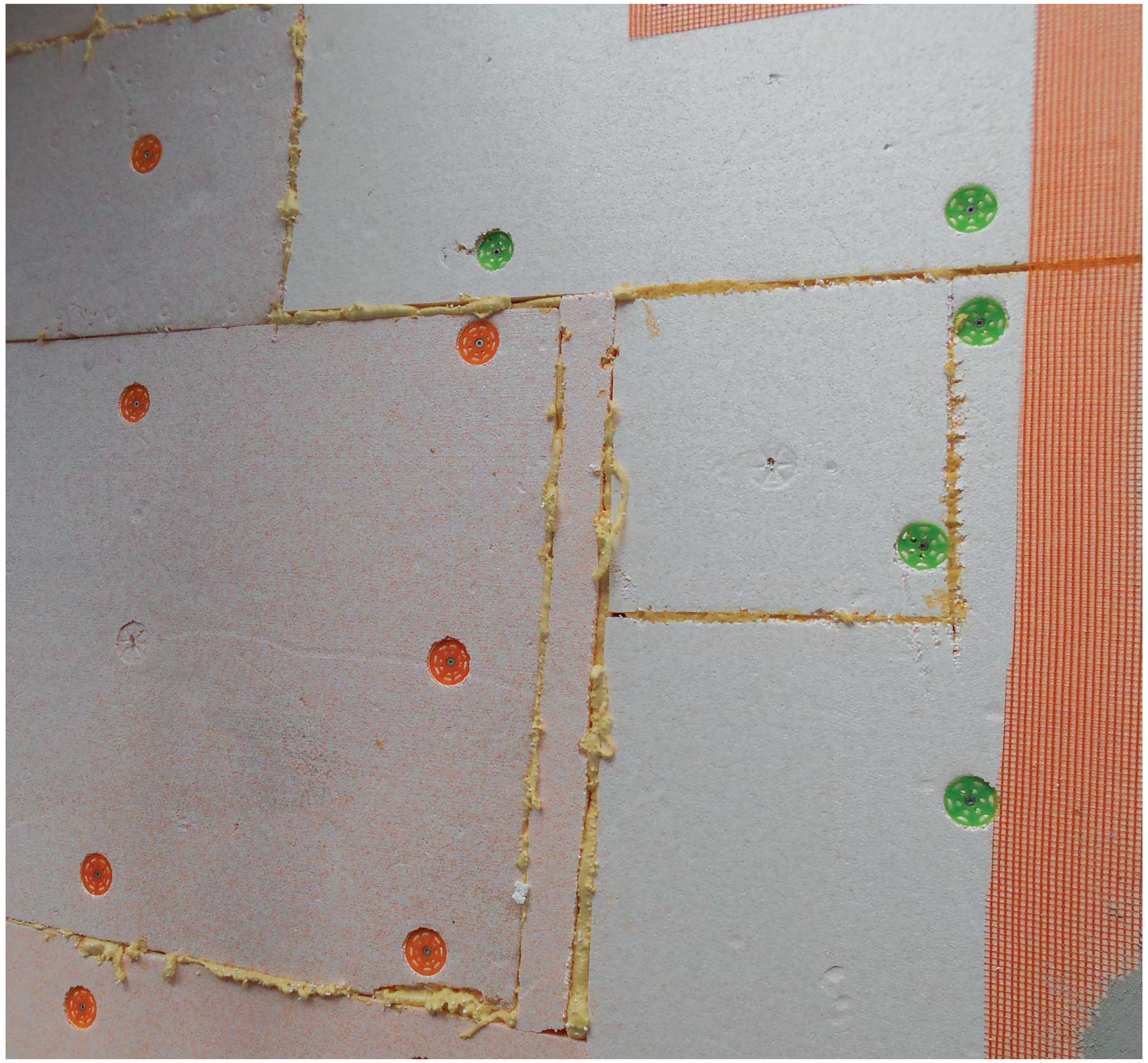
One of the attributes that is expected of all professions is an ability of the practitioners to recognise the bounds of their own knowledge and skills.

[20] Ibid, footnote 6.

2.4 MONITORING THE "ASSESSMENT BODIES"

Organisations designed as "Assessment Bodies" need to be carefully monitored by governments. Given that these organisations are assessing professional competencies and attributes, the monitoring needs to be undertaken by individuals with demonstrated competencies and attributes consistent with the professional definitions. Furthermore, these individuals should be recognised as leading professionals in the discipline of Fire Safety Engineering. Given that this is a unique and extremely important designation, this process is expected to be rigorously structured, and global leaders are expected to be invoked by governments to conduct the monitoring of the "Assessment Bodies."

Non-compliant and poorly built expanded polystyrene (EPS) external cladding applied to a fire-rated wall within 3 m of an allotment boundary of a three storey building. Examples like this demonstrate the need for greater vigilance.



3.
Link Between Accreditation & Registration
- The Co-Regulatory Model

THERE ARE VARIOUS MODELS FOR EVALUATING THE COMPETENCY AND CONTROLLING THE PROFESSIONAL PRACTICE OF FIRE SAFETY AND OTHER ENGINEERS AND THEIR LICENSING OR REGISTRATION AROUND THE WORLD. THESE MODELS ARE EXAMINED IN SOME DETAIL IN APPENDIX B. THEY INCLUDE TOTAL CONTROL BY GOVERNMENT REGULATORY BODIES, AS IN SINGAPORE AND NORWAY, TO COMPLETE MANAGEMENT BY THE PROFESSIONAL ENGINEERING BODY IN A SIMILAR MANNER TO THE MEDICAL AND LEGAL PROFESSIONS AS IN THE UK.

In Australia, current practice for the control of engineers and other professions is based on the co-regulatory model. This means the professional bodies set the required competencies, carry out the professional competency assessment, monitor CPD and accredit fire safety engineers. The states and territories role is to register/license and give authority to fire safety engineers to practice within the local jurisdictions, including requirements for PI, as well as a role in audit and enforcement of good practice with appropriate penalties and sanctions.

This co-regulatory approach for engineers, including fire safety engineers, is the one now adopted in Queensland, Victoria, NSW and Tasmania.

The Warren Centre position supports and is consistent with the Engineers Australia approach,[21] which is based on this co-regulatory model of professional accreditation and registration for engineers which provides national consistency on competencies and competency assessment. This involves statutory bodies (state and

[21] Engineers Australia, Registration of Engineers – The Case for Statutory Registration, May 2020.

The Warren Centre position supports and is consistent with the Engineers Australia approach.

territory regulators) and professional bodies undertaking complementary roles. It also fits with the recommendations of the Shergold/Weir Building Confidence Report recommendations.

The co-regulatory model allows the professional bodies to control competencies and governments to control authority to practice. This approach would improve practice standards across all jurisdictions in Australia, a number of which still have no registration requirements to control the practice of fire safety or other engineering disciplines. This approach would lead to better engineering design and construction practices, safer buildings, and a reduction in the risk of physical and financial harm to the public and fire authorities.

This approach allows professional bodies to control the qualifications and competency standards of engineers, including fire safety engineers, given assessment bodies such as Engineers Australia have the design and technical expertise through their Society of Fire Safety, and the long experience and systems established for assessing the professional competency, experience and CPD of practitioners. This approach also allows government regulators to monitor the assessment bodies, their systems, and standards being applied to practitioners. It allows government regulators to control authority or permission to practice, to undertake audits, to enforce rules on building projects, to oversee statutory processes, to refer matters of professional practice to the professional bodies for investigation, and to apply legal and other sanctions where required, with penalties as appropriate.

On this basis it is recommended that the relevant state and territory Building Acts and Regulations be updated, in a nationally consistent manner as urged by Shergold/Weir, to recognise the competency assessments and other functions of the professional bodies, such as Engineers Australia for fire safety engineers. Any local professional accreditation schemes for engineers should be removed. All state and territories should legislate the registration requirements of their functions (e.g., recognition of assessment bodies, PI insurance, audit and enforcement, penalties etc.) for fire safety engineers in a nationally consistent manner.

The implementation of this co-regulatory system does not impact on the fire safety engineering competencies proposed by the Warren Centre, which include a "local regulatory" knowledge and NCC knowledge requirement. This "regulatory knowledge requirement" is typically viewed as an understanding of the National Construction Code (NCC)[22] and the local legislation and regulations controlling building design and approvals in any given jurisdiction, necessary to properly develop and implement fire safety designs within the operating statutory requirements and local approval mechanisms.

[22] Australian Building Codes Board. (2019). National Construction Code (NCC). Retrieved from https://ncc.abcb.gov.au.

One great advantage of the co-regulatory model is that assessment bodies such as EA operate nationally. Therefore, in theory and hopefully in practice, the assessment of competencies of fire safety engineers and monitoring of CPD should yield professionals with the similar knowledge, skills and attributes who can practice with similar performance standards across all states and territories. This will much better facilitate mutual recognition among states and territories than has occurred in the past.

Currently and in the new proposed system someone professionally accredited (registered) by EA in Western Australia is still professionally accredited by EA in Victoria as the EA NER scheme is a national scheme, despite different local regulations. However, under the proposed new arrangements for state and territory registration, fire safety engineers will have to demonstrate knowledge of the NCC and the local building regulations.

An example of the updated legislation is the Professional Engineers Registration Act 2019 in Victoria.[23]

Recent NSW legislation requires all fire safety engineering work to be only undertaken by registered fire safety engineers.[24]

NSW Building Commissioner David Chandler has been charged with the duty to reform the state's building industry. Mr Chandler previewed his plans at the 2020 FSE conference at the University of Sydney Business School.

[23] Ibid, footnote 12.
[24] Ibid, footnote 13.

4. Key Government Roles

4.1 INTRODUCTION

As stated in the previous section of this report, governments at the state, territory and the Commonwealth levels, particularly through the ABCB, have a significant role to play in implementing the recommendations of the BCR and improving the practice of fire safety engineering across Australia through regulation reform.

4.2 STATE AND TERRITORY GOVERNMENTS – BUILDING REGULATIONS

In line with the co-regulatory model, legislation and regulations should be developed in all states and territories as follows:

- A professional engineers registration scheme should be developed, including for fire safety engineers, in a nationally consistent fashion which ensures fire safety engineering work is only undertaken by professional registered fire safety engineers.[25]
- Well structured, rigorous requirements should be incorporated into the processes of the professional bodies, such as EA and IFE, to be "assessment bodies" for establishing initial professional competence to practice and to maintain that ongoing competence through monitored CPD.
- Requirements should be established for all registered professional engineers to hold a required level of Professional Indemnity (PI) insurance, personally or through their employer.
- Effective project and practitioner audit and enforcement procedures should be developed with appropriately resourced inspection arms, with provisions for referral of professional practice issues to the appropriate professional body for investigation and reporting.
- Sanctions should be incorporated into legislation or regulation for unsatisfactory practice, with appropriate penalties.

4.3 REGULATION OF FSE ROLES

Apart from registering fire safety engineers, the state and territory governments should also regulate the roles of fire safety engineers, as recommended in the Warren Centre **Roles Report**, for the three different categories: design fire safety engineers, independent peer reviewers, and fire safety engineers at the fire brigade. Their roles and the extent of their involvement in projects should be reinforced. The danger of not regulating these roles is that some or all parts of the roles may be taken by others, such as certifiers or other practitioners, perpetuating the unsatisfactory fire safety outcomes on projects in the past.

[25] National Registration Framework for Building Practitioners – Discussion Paper, Australian Building Codes Board (ABCB), June 2020.

Detailed recommendations of specific roles for fire safety engineers, which are strongly linked to the Shergold/Weir report recommendations, should be included in state and territory building regulations as set out in the Roles Report.

This report highlights these important recommendations:

- Design fire safety engineers should be involved from planning and early concept design stages, through construction inspections and commissioning, to the project handover stage;
- Where fire safety engineers are appointed as peer reviewers, they need to be competent, registered and totally independent of the design and construction team and certifier; and
- Where fire safety engineers within fire authorities have a role in review, they need to be competent and registered as fire safety engineers.

4.4 SANCTIONS FOR POOR PRACTICE

There is very limited documentation in Australia of poor practice by fire safety engineers, apart from the paper by Stratton et al.[26] at the 2011 international fire safety engineering conference held in Sydney and the Lacrosse Building fire litigation findings.[27]

This is likely due to:

- the limited circulation of fire engineering reports by various consultants in the public domain, often trying to protect intellectual property;
- the culture of the fire engineering fraternity in Australia not "dobbing in" one's peers; and
- the lack of information or well-developed processes from professional engineering bodies on the method of reporting poor practice and for associated whistleblower policies.

In order to facilitate the reporting of poor practice, it is recommended that all state and territory governments implement a

> A professional engineers registration scheme should be developed, including for fire safety engineers, in a nationally consistent fashion.

[26] Stratton, B., Johansson, U.C., and Olsson, P. "On the current quality and depth of fire safety engineering analysis in Australia – A statistical review of recent designs." Fire Safety Engineering International Conference "Raising the Bar", Sydney, Australia, 2011, Society of Fire Protection Engineers and Engineers Australia Society of Fire Safety.

[27] Owners Corporation No.1 of PS613436T v LU Simon Builders Pty Ltd (Building and Property) [2019] VCAT 286.

sanction process, linked to strict audit and enforcement procedures, such that fire safety engineers who have acted unethically and/or unprofessionally can be disciplined to an extent that is commensurate with the degree of wrongdoing.

Where there are matters of unsatisfactory professional practice in relation to fire safety engineering, these matters should be referred to the professional bodies for investigation and reporting using accredited and registered professional fire safety engineers qualified to asses such matters.

Currently Victoria and NSW have some sanction processes in place.[28]

In Queensland, the Board of Professional Engineers Queensland, an independent statutory body responsible for regulating the vast and multi-faceted engineering profession across the state, is responsible for the sanction process.[29]

In Tasmania, there is a complaint process, but it is not specifically developed for engineers and building practitioners.[30]

In ACT, there is a complaint process which is not just for engineers but individuals, businesses or industries that the ACT government regulates.[31]

At the time of preparing this report, there appears to be no sanction process for fire safety engineers in Northern Territory, South Australia and Western Australia.

In order to facilitate the reporting of unethical or unprofessional conduct of fire safety engineers or other practitioners in the building and construction industry, a whistleblowing protection policy and procedure, with appropriate safeguards to protect complainants, also needs to be developed and implemented by the state and territory governments. At present, most state/territory whistleblower protection laws only cover the public sector.[32]

Concrete spalling in UQ's Heat-Transfer Rate Inducing System (H-TRIS) test apparatus.

[28] See https://www.vba.vic.gov.au/tools/disciplinary-register and https://www.fairtrading.nsw.gov.au/trades-and-businesses/business-essentials/building-certifiers/certifier-disciplinary-register respectively.

[29] See https://www.bpeq.qld.gov.au/professional-discipline-decisions/.

[30] See https://www.cbos.tas.gov.au/topics/products-services/problems/resolve-problem-complaint/complaint-process.

[31] See https://www.planning.act.gov.au/build-buy-renovate/disputes-and-complaints/making-a-complaint.

[32] See for example *Public Interest Disclosure Act 2013 (Cth)* for public servants, and see David A Chaikin "What Next in Australia? Reforming Private Whistleblower Protections", (2020) 48 *Australian Business Law Review* 50 for private business. Contrast these to the more developed engineering ethics such as Douglas L. Oliver, "Whistle-Blowing by Engineers and Reverse Whistle-Blowing on Engineers", published by American Society for Engineering Education, 2009 or "Case 88-6: Whistleblowing City Engineer" a university cases study at https://www.cs.cmu.edu/~bmclaren/ethics/cases/foundational/88-6.html.

WHISTLEBLOWERS AND THE CONSEQUENCES OF ADVERSE PERFORMANCE

The Grenfell Tower Inquiry is still ongoing in Phase 2 in London following the tragic June 2017 fire that took 72 lives. Chairman of Inquiry The Rt Hon Sir Martin Moore-Bick found that a number of key fire protection measures failed at Grenfell. The external walls of the building failed to comply with building regulations. Perversely, rather than resisting the spread of fire, the aluminium clad panel walls actively promoted the fire. In Phase 2 of the Inquiry presently ongoing, Sir Martin Moore-Bick will determine who were responsible for the design that led to the terrible fire.

The Lacrosse Building fire has been litigated with the Victorian Civil and Administrative Tribunal. Judge Woodward ordered that the November 2014 damages of over $5million be apportioned 39% to the fire engineer, 33% to the building surveyor and 25% to the architect. There were multiple technical faults rooted in multiple legal strands of responsibility.

Engineering is a broad profession divided among many disciplines. In the case of high profile engineering failures, some of the notorious disasters include the Chernobyl nuclear fire in the Ukraine, the Bhopal cyanide release in India, and the Space Shuttle Challenger explosion. In the 1981 Kansas City Hyatt Regency, 114 people were killed and 200 injured when a hotel "Sky Walk" collapsed during a dance due to a seemingly minor modification made to a steel support during construction. Small engineering errors can have devastating consequences when competence is insufficient or diligence lapses. In these cases, it is essential to investigate, determine the root causes and prevent recurrence. Unfortunately, this is the pattern of engineering failures, and the current international reaction to poor fire safety engineering practices fits with history.

In some cases, there were tell-tale signs or even overt warnings that should have been heeded. In the case of the 1986 Space Shuttle Challenger explosion, engineers within the o-ring supplier, Morton Thiokol, warned against launching on an unusually cold Florida morning. In fact, the warnings had been raised internally for many months that low temperatures might result in a catastrophic failure. The official US inquiry, the William Rogers Commission, found that NASA and Morton Thiokol failed to respond to internal concerns of a design flaw, concluding that the Challenger explosion was "an accident rooted in history". An 01 October 1985 memo by engineer Robert Ebeling was titled, "Help!" On the night before the fateful launch in January 1986, he told his wife that the Shuttle was going to "blow up", and indeed it did, 73 seconds after launch, killing seven astronauts including a civilian teacher. Ebeling said after the disaster, "I could have done more. I should have done more." His conscience, his warnings and those warnings from others at Morton Thiokol were not heeded.

Writing in the July 2020 online edition of Science and Engineering Ethics, American researchers Joseph Herkert, Jason Borenstein and Keith Miller offer a critique: "The Boeing 737 MAX: Lessons for Engineering Ethics". In October 2018 and March 2019, a pair of Boeing jet airplanes crashed, killing 346 passengers and crew. A flawed computer control system appears to be at the root of the design engineers' errors. Seasoned expert pilot, Captain Chesley "Sully" Sullenberger, described the computer system as a "fatally flawed design" and "a death trap" beyond just a training deficiency for the professional pilots. The authors of the paper conclude with an examination of the relationship between engineers and society, the historical cycle of engineering-failure-and-regulatory-control, and the role of professional ethics to bolster "moral courage":

> The 737 MAX case is still unfolding and will continue to do so for some time. Yet important lessons can already be learned (or relearned) from the case. Some of those lessons are straightforward, and others are more subtle. A key and clear lesson is that engineers may need reminders about prioritizing the public good, and more specifically, the public's safety.

Herkert and his co-authors point to the IEEE Code of Ethics and the centrality of ethical design.

From tragic public building fires, civil engineering failures, and the most complex aerospace system failures, it is clear that modern engineering ethics in Australia could benefit from the reminder of lessons learned in history and recent lessons from overseas. How should the profession establish channels for insider whistleblower communication? How should it conduct the engineering design equivalent of a Special Commission of Inquiry Into the Ruby Princess or a Royal Commission into the Home Insulation Program? These matters will need attention as engineering professionalism and engineering leadership advance to its next stage in Australia.

SINCE THE FIRE SAFETY ENGINEERS ARE TO BE ASSESSED FOR ALL ASPECTS OF COMPETENCE BY PROFESSIONAL ENGINEERING BODIES, WHENEVER AN ENGINEER IS SANCTIONED BY A GOVERNMENT, THAT GOVERNMENT SHOULD HAVE A DUTY TO ALERT THE RELEVANT PROFESSIONAL ENGINEERING BODIES OF SUCH A SANCTION, AND VICE VERSA.

4.5 TRAINING

Although a national building code in the NCC exists, and the building legislation and regulations in each of the states and territories are based on similar principles, in some cases there can be differences in terms of terminology and some process matters. Two examples are building permits versus construction certificates and Registered Building Surveyors (RBS) versus Principal Certifying Authority (PCA).

It is therefore appropriate that fire safety engineers undertake training as part of state and territory registration and on-going CPD in the key elements of the legislation and regulations appropriate to practice in a jurisdiction. This training may be provided by state or territory authorities, Engineers Australia or other government or private providers.

David Lange addressed The Warren Centre's FSE Conference in February 2020.

4.6 COMMONWEALTH GOVERNMENT - ABCB

The Australian Building Codes Board (ABCB) has been given the important task by the Building Ministers' Forum (BMF) of developing the national response to the BCR and assisting the states and territories implement the BCR recommendations as far as possible in a nationally consistent manner.

One issue highlighted has been the lack of education and training of many architects, engineers and other building practitioners, including fire safety engineers, on the basic structure, principles and technical details of the National Construction Code (NCC). This need for NCC training was Recommendation #3 in the BCR.

NCC training is of particular concern for fire safety engineers since some 60% of the clauses in the NCC relate to fire safety provisions. It is good to see that the ABCB has responded with new NCC course offerings soon to be launched. Shergold/Weir suggest that NCC training should be a compulsory CPD requirement of professional bodies such as EA and IFE for all accredited practitioners in building design and construction.

In order to promote professionalism of fire safety engineering nationally, the Australian Building Codes Board should also include in all their guidance documents that fire safety engineering design and peer review only be undertaken by registered professional fire safety engineers as they do in the NCC and FSVM.[33]

[33] Australian Building Codes Board, Fire Safety Verification Method – A Handbook, 2019

The ABCB is working with the Building Ministers' Forum to define training needs for engineers and all professionals in the building industry.

5. Key Roles of Professional Engineering Bodies

IN AUSTRALIA, THERE ARE TWO PROFESSIONAL ENGINEERING BODIES, WHICH ACCREDIT FIRE SAFETY ENGINEERS. THEY ARE ENGINEERS AUSTRALIA (EA) THAT WAS ESTABLISHED IN 1920 AND INCORPORATED BY ROYAL CHARTER IN 1935, AND THE AUSTRALIAN BRANCH OF THE INSTITUTION OF FIRE ENGINEERS (IFE) THAT WAS FOUNDED IN 1918 IN THE UNITED KINGDOM.

To ensure that one or the other of the two professional bodies cannot be judged to be superior or inferior in terms of their approach to professionalism of fire safety engineers, in the view of the Warren Centre and this research, it is essential that both bodies adopt the same competencies, assessment procedures, CPD requirements and other accreditation requirements.

The key roles of EA and IFE as professional engineering bodies are to:

- Act as "assessment bodies" to meet the requirements of the professional engineer registration schemes of the states and territories;
- Adopt the competencies for fire safety engineers as set out in the Warren Centre Competencies Report;
- Develop rigorous and appropriate applicant assessment procedures for professional accreditation as fire safety engineers, as per the Professional Development Report of this Warren Centre Project, including alternate pathways for those with non-traditional career development stages;
- Review and accredit fire safety engineering education programs designed to deliver Stage 1 competencies that can lead applicants to professional accreditation;
- Assess the competencies of fire safety engineering applicants, based on their academic training and supervised professional experience, including those applicants who have not completed or been assessed through Stage 1 accredited educational programs;
- Define CPD requirements and monitor CPD records of all accredited fire safety engineers for compliance with requirements;
- Undertake regular audit programs of all accredited engineers and their practice performance; and
- Establish clear disciplinary procedures and take appropriate action against engineers who have practiced in an unethical or unprofessional manner.

> A strong and effective whistleblowing protection policy and procedure needs to be developed and implemented by the professional bodies.

Given all these changes, it is strongly recommended that the professional bodies put in place training and professional development programs to cover:

- The new competencies and how they may be achieved;
- The new applicant assessment processes and requirements;
- Any new CPD requirements and the required demonstration of acquired competencies;
- Expected performance assessments through audit programs;
- Technical short courses or micro-credentials to assist upskilling of fire safety engineers;
- Code of Conduct and Ethics;
- Code of Practice and new guidance documents; and
- Career development opportunities.

Professional Indemnity insurance (PI) is currently a major issue. Risks due to financial outcomes related to poor practice have caused serious increases in insurance premiums. Risks should be reduced by governments and professional bodies adopting the recommendations of this report and the other Warren Centre reports in the "Professionalising Fire Safety Engineering" series. It is strongly recommended that the professional bodies engage with the insurance industry to demonstrate where and why practice improvements will result from all these reforms, to ensure a sustainable fire safety engineering profession.

In order to facilitate reporting unethical or unprofessional behaviour of fire safety engineers, a strong and effective whistleblowing protection policy and procedure needs to be developed and implemented by the professional bodies. Presently, both EA and IFE have a form of whistleblower policy and procedure. However, these are not currently highlighted to members in the Code of Conduct. These policies should be part of the Code of Ethics, such that all engineers are aware of their existence.

The Lion Air Boeing 737 Max failure is an example of an ongoing investigation into a major engineering catastrophe with ethical dimensions.

ENGINEERING CODES: CLARITY OR CONFUSION?

In various different engineering bodies and organisations, there are:

- Codes of ethics
- Codes of conduct
- Codes of practice

It is worth differentiating these different types of documents to clarify their unique scopes and purposes.

As a general opener, a code of conduct refers to professional behaviours and the boundaries of those behaviours. By contrast, a code of ethics addresses judgment. This is a deeper look into what the profession values and views as fundamentally right and wrong. Ethics are more aspirational, and conduct is more concrete. Conduct is narrower and legalistic with a focus on compliance and rules. Ethics are based in honesty, integrity and guidance for ambiguous situations.

In November 2019, Engineers Australia issued its latest "Code of Ethics and Guidelines on Professional Conduct".[a] The Institution of Fire Engineers has a refreshed 2018 "Code of Conduct" with four "Ethical Principals".[b] Both documents explicitly cover ethics and conduct.

The Master Builders Association of NSW has a combined "Code of Fair Business Practice and Code of Ethics".[c] The Royal Institute of Chartered Surveyors has a formal document of "The Global Professional and Ethical Standards"[d] and is currently updating its "Rules of Conduct".

A Code of Practice is a third category or document title for engineering guidance.The Board of Professional Engineers Queensland has a "Code of Practice".[e] It is aimed at ethics and conduct. By contrast, the NSW "Mechanical Engineering Control Plan – Code of Practice" is a mining engineering document aimed at technical matters of calculation, design, analysis and safety practices, not ethics or personal conduct in a professional setting.[f] The classic engineering example of a code of practice is the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code, a technical design and inspection standard, controlled by the peak professional body itself and adopted into law by governments.[g]

There is overlap in the use of these titles, and there is not a universally clear delineation. However, the use of codes is essential to engineering professionalism and satisfactory outcomes for society.

As engineering professionalism and engineering leadership advance to its next stage in Australia, are the existing codes (for ethics, conduct and practice) sufficient and synchronised to the modern business of engineering, construction and whole-of-life-cycle design analysis? Are codes among the complementary or competing professional bodies aligned or fragmented?

a https://www.engineersaustralia.org.au/sites/default/files/resource-files/2020-02/828145%20Code%20of%20Ethics%202020%20D.pdf

b https://www.ife.org.uk/write/MediaUploads/Documents/IFE_Code_of_Conduct_updated_April_18.pdf

c https://www.mbansw.asn.au/sites/default/files/code_of_ethics_july2018.pdf

d https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/standards-of-conduct/the-global-professional-and-ethical-standards.pdf

e https://www.bpeq.qld.gov.au/resources/code-of-practice/

f http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0011/672671/Code-of-practice-Mechanical-Engineering-Control-Plan.pdf

g https://www.asme.org/learning-development/find-course/bpv-code-section-viii-division-2-alternative-rules-construction-pressure-vessels

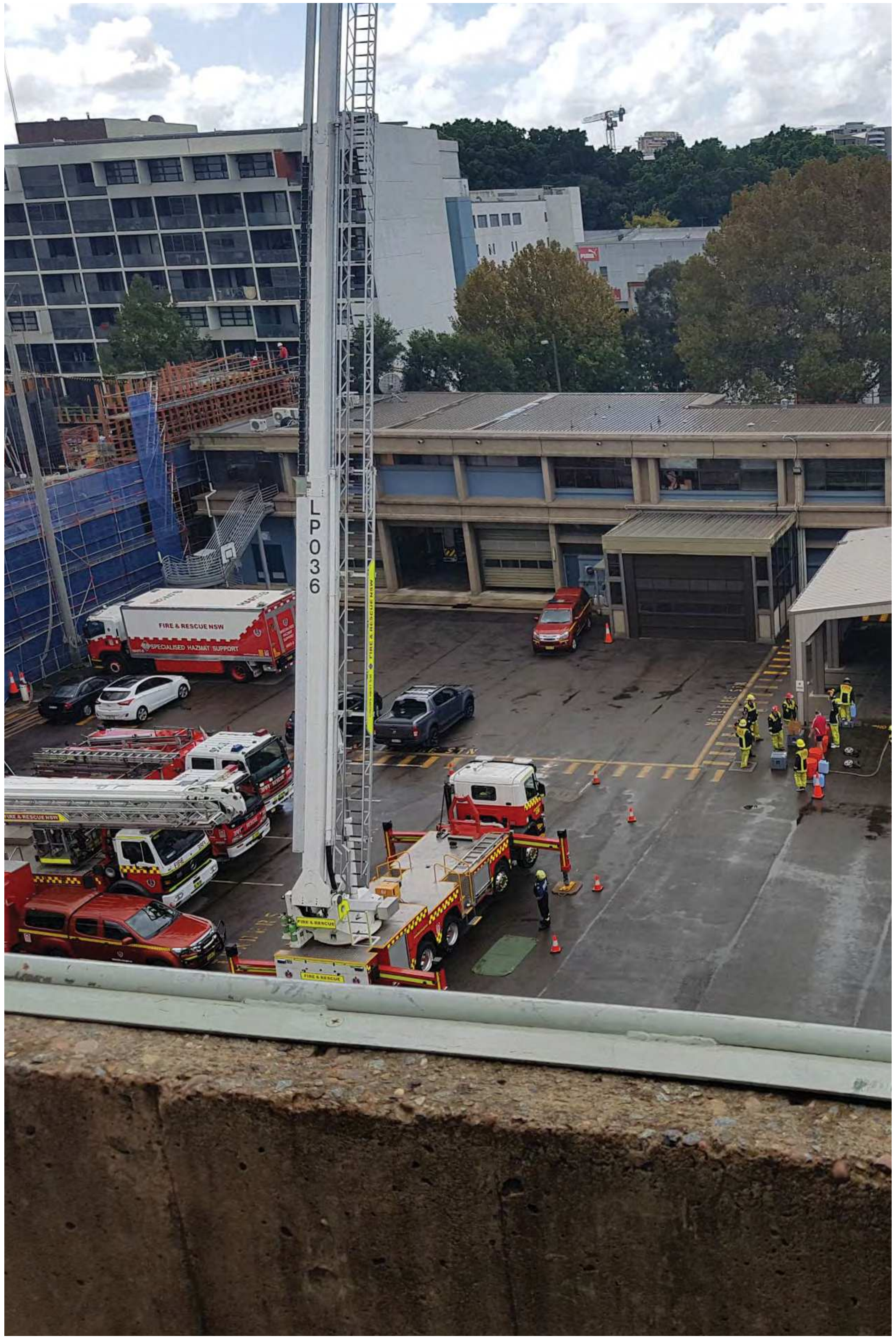
5. Key Roles of Professional Engineering Bodies

While sanctions on practice will largely sit under government, it is critical that professional engineering bodies also take responsibility for their members and have effective means to discipline those behaving inappropriately.

Since the fire safety engineers are to be registered by state/territory governments, any time an engineer is sanctioned by a professional body, the particular body would have a duty to alert the relevant government bodies of such sanction and vice versa. An appropriate sanctions recognition scheme needs to be defined between a government and the professional body to guarantee consistency.

It is recommended that EA/SFS and IFE develop a nationally consistent Code of Practice (as previously) and Code of Conduct (similar to the one developed by ABCB for building surveyors) that can be referenced by state and territory regulators.

> It is recommended that EA/SFS and IFE develop a nationally consistent Code.



A training exercise.

6. A Sustainable Profession

FIRE SAFETY ENGINEERING, LIKE ALL OTHER TECHNICAL DISCIPLINES IS SUBJECT TO CONSTANT EVOLUTION AND THE INTRODUCTION OF NEW TECHNOLOGIES. AS SUCH, ALL ENGINEERING DISCIPLINES RECOGNISE THE NEED FOR CONTINUOUS PROFESSIONAL DEVELOPMENT AND THE OBLIGATION OF ALL ACCREDITED/ REGISTERED ENGINEERS TO KEEP UP TO DATE WITH NEW DEVELOPMENTS IN THE PROFESSION. ACCORDINGLY, FIRE SAFETY ENGINEERS NEED TO UNDERTAKE CONTINUOUS PROFESSIONAL DEVELOPMENT (CPD) ACTIVITIES THAT ARE SUFFICIENT TO MAINTAIN, RENEW OR EXTEND THEIR COMPETENCE THROUGHOUT THEIR WORKING LIFE.

To facilitate growth in the industry, sharing of knowledge, and availability of CPDs, once an engineer has achieved Stage 2 accreditation, a part of their ongoing CPDs should ideally include not only learning, but also teaching and mentoring, such as a presentation in Society of Fire Safety or IFE seminar or conference, a presentation to in-house workshops, a contribution to the forum of the Society of Fire Safety LinkedIn group or the mentoring of incoming graduates and students.

Another important aspect of a sustainable profession is the production of graduates through the appropriate university education programs and their further development through supervised experience in numbers to match the demands of the profession and industry for these graduates. Recommendations on capacity building for a sustainable profession are contained in the Professional Development Report.

It is the responsibility of the profession as a whole to protect the pipeline of graduates. As such, it is incumbent of all members of the profession to promote and support the development of educational programs. This includes working with governments to guarantee financial support as well as with industry to enable relevant research and the evolution of the educational provisions. It is fundamental to recognise that professional educational programs are expensive for universities, and thus professions are responsible for delivering the conditions that makes attractive the development of such activities. Without a pipeline of graduates, Fire Safety Engineering will never be professionalised and sustainable.

It is therefore beholden upon the professional bodies and those already in the profession of fire safety engineering to promote careers in fire safety engineering to secondary and university students, as well as among other engineers who potentially can build on their engineering qualifications and experience to become very successful fire safety engineers.

Lastly, in Australia the body of professionals needs to continue to develop professional leaders as many of the leaders involved in the 1980s and 1990s establishment of the performance-based building code and the fire safety engineering profession are now retired or are soon to enter retirement. It is critical that new leaders drive the professional bodies, the Society of Fire Safety, head up fire research programs, and support university teaching programs for a strong and sustainable profession of fire safety engineering.

7. Summary of Recommendations

The recommendations of this report address changes required to create a real and proper profession for fire safety engineers in Australia. They cover changes required by professional bodies such as EA and IFE in relation to professional accreditation. Regulatory reform measures need to be undertaken by governments to control authority to practice and to improve quality and safety in buildings. These recommendations in their totality would restore the trust and confidence of the public and property industry in fire safety outcomes.

PROFESSIONAL BODIES AND ACCREDITATION

For the professional bodies (EA and IFE) in relation to accreditation (registration) of fire safety engineers, the actions to adopt are as follows:

1. Update their professional accreditation schemes with the new competencies and attributes as established through this project.
2. Establish new registration assessment processes, linked to new competencies and attributes and updated CPD requirements, including NCC training.
3. Develop a professional audit program to regularly evaluate performance and practice of accredited fire safety engineers.
4. Provide a service to assess, investigate and report any occurrences of unsatisfactory professional practice referred by state and territory governments.
5. Provide guidance for applicants for individuals currently practicing FSE and seeking professional body registration. Establish guidance on how they will be assessed for Stage 1 and Stage 2 competencies, including those following alternative career and professional development pathways.
6. Develop a transition plan for those currently registered under any of the available schemes (EA/NER and IFE accreditation schemes) to be re-registered by those professional organisations.
7. EA SFS to develop new design guidance, practice notes, guidance on peer review, CPD sessions, and training courses to drive change in FSE competencies and practice.
8. Provide a pathway towards accreditation of university programs, including those existing activities.
9. Develop a nationally consistent Code of Practice (as previously) and Code of Conduct (similar to the ones developed for building surveyors) that can be referenced by state and territory regulators.
10. Create a long-term strategy through EA/SFS and IFE to develop a full and proper profession and basis for long term FSE careers through promotion of the professional FSE roles available to students at secondary schools and in tertiary institutions.
11. EA SFS to engage with the insurance industry and demonstrate why the reforms to FSE education, new practice arrangements, codes of practice and conduct, professional registration and other reforms should help reduce claims and therefore practitioner rates for PI insurance.
12. Develop a national strategy towards guaranteeing the support of university educational programs.

Regulatory reform measures need to be undertaken by governments to control authority to practice and to improve quality and safety in buildings.

GOVERNMENTS

For the Commonwealth government, state and territory governments, the actions are:

13. The NCC building code and other guidance should be changed by ABCB to require fire safety engineering to be performed only by registered FSEs.
14. All states and territories to introduce Professional Engineers Registration Schemes, including for fire safety engineers, based upon EA and IFE assessment schemes which properly evaluate competencies and their currency through CPD, ethics and on-going accreditation surveillance.
15. Introduce regulatory changes in all states and territories to require all fire safety engineering design and peer reviews for buildings be conducted by state and territory registered FSEs.
16. Develop nationally consistent regulatory guidance in each state and territory to require the roles of FSEs to follow the Warren Centre Roles Report – concept to handover, all Performance Requirements, construction inspections, involvement in commissioning. and preparation of an owners'/occupiers' manual.
17. Establish clear nationally consistent regulations for the role of fire authorities in the building certification and approval processes
18. Establish mutual recognition between states and territories should be addressed so that professional registration requirements have national consistency.
19. Establish Professional Engineering Registration Schemes in the states and territories covering fire safety engineers including requirements for PI insurance and sanctions, with requisite penalties for unsatisfactory performance, fraud or other illegal practices.
20. Introduce provisions for referral of cases of unsatisfactory professional practice to the relevant professional body for investigation, assessment and reporting.
21. Develop an agreement with professional bodies that establishes the roles of "assessment body" and a monitoring framework for accreditation as well as a shared and consistent framework of sanctions applied to malpractice.
22. Adopt mandatory independent peer reviews of all FSE design reports involving a level of complexity deemed necessary.

These actions should ensure only professionally accredited and state and territory registered fire safety engineers undertake fire safety engineering work across Australia.

An example of good fire safety engineering, the emergency warning and intercommunication system for a 5 storey building.

8. References

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3. *Design and Building Practitioners Act 2020 (NSW)*, at https://www.legislation.nsw.gov.au/view/html/inforce/current/act-2020-007.
4. Engineering Council UK accreditation process at https://www.engc.org.uk.
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6. Engineers Australia Stage 2 competencies, "AUSTRALIAN ENGINEERING COMPETENCY STANDARDS STAGE 2 - EXPERIENCED PROFESSIONAL ENGINEER", at https://www.engineersaustralia.org.au/sites/default/files/2018-03/competency_standards_june.pdf
7. Engineers Australia, "Registration of Engineers – The Case for Statutory Registration", May 2020.
8. Engineers Australia, National Engineering Register,at https://www.engineersaustralia.org.au/Engineering-Registers/National-Engineering-Register/NER-Info Accessed 9th June 2020.
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11. Lange, David; Jose Torero; Andres Osorio et al. "The Methods Report" short title, "Comparison of International Fire Safety Engineering Guidelines, Fire Safety Verification Methods and Practice Guides", 2020, at https://www.sydney.edu.au/content/dam/corporate/documents/faculty-of-engineering-and-information-technologies/industry-and-government/the-warren-centre/the-methods-report-fire-safety-engineering-the-warren-centre.pdf.
12. Lange, David; Jose Torero; Cristian Maluk, et al. "The Competencies Report" short title, "Fire Safety Engineering Competencies", 2020, at https://www.sydney.edu.au/content/dam/corporate/documents/faculty-of-engineering-and-information-technologies/industry-and-government/the-warren-centre/the-competencies-report-fire-safety-engineering-the-warren-centre.pdf.

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16. 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.

17. *Professional Engineers Registration Act 2019 (VIC)*, at https://www.legislation.vic.gov.au/as-made/acts/professional-engineers-registration-act-2019.

18. Stratton, B., Johansson, U.C., and Olsson, P. "On the current quality and depth of fire safety engineering analysis in Australia – A statistical review of recent designs." Fire Safety Engineering International Conference "Raising the Bar", Sydney, Australia, 2011, Society of Fire Protection Engineers and Engineers Australia Society of Fire Safety.

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9. Appendix A

Examples of Professional Engineering Registration and Licensure in Other International Jurisdictions

IN THIS APPENDIX, DETAILS ARE PROVIDED OF THE REGISTRATION SYSTEMS OF PROFESSIONAL ENGINEERS, INCLUDING FIRE SAFETY ENGINEERS, IN CANADA, GERMANY, JAPAN, SINGAPORE AND CALIFORNIA, USA.

Internationally, professional engineers have been licensed in some jurisdictions for more than 50 or 100 years, because of their important roles in safeguarding public health, safety and welfare. Governments introduced these strict licensing requirements for engineers generally as a result of fatal accidents and catastrophic engineering failures, and governments maintain them to avoid recurrent events in the future. Codes of practice such as the NCC are only as strong as the competence of professionals applying them in design and construction.

A number of these countries have similarities in their legislated structures and requirements, including:

- "Professional Engineer (PE)" is a protected term.
- Only licensed PEs can provide or undertake engineering services.
- Engineers are licensed on the basis of recognised tertiary education courses, examination of competency, the requisite supervised experience, and on-going CPD.
- Codes of conduct are established with a strong emphasis on professional integrity and ethics.

Interestingly, in Ontario, Canada, as well as requiring the common technical National Professional Practice Exam (NPPE), another examination is required which is spilt into two parts, namely Part A (professional practice and ethics) and Part B (engineering law and professional liability). There are a number of international models offering common and unique features relevant to Australia's reform efforts.

CANADA – ONTARIO

In Canada, professional engineering licensure is legislated by each province. The criteria in Ontario requires that to be granted a professional engineering (PE) licence the candidate must meet academic requirements, pass a professional practice exam, and satisfy requirements relating to past experience in the industry. Professional Engineers Ontario (PEO) is the board who sets these standards and registers engineers.

Professionalisation in Ontario began in 1922, when the Professional Engineers Act was passed, stating that certain work must be completed or approved by an individual who holds the title of "Professional Engineer", giving ultimate responsibility to the engineer. This was faced with protest from those in the mining industry, as engineers did not want to be forced to join the Engineering Institute of Canada in order to practice. Mine owners felt that the legislation was restrictive of whom they could hire and feared that it would discourage foreign investment. Universities were also concerned that regulatory bodies would have too much power in validating different degrees. Because of these concerns, the Act was amended in 1937, and the engineering profession was closed to non-qualified individuals.

Internationally, professional engineers have been licensed in some jurisdictions for more than 50 or 100 years.

The process for licensure in Ontario is quite similar to other countries which have a standardised process, such as Japan or Singapore. Nevertheless, one major point of difference is found in the professional practice exam. While other countries have the exam tailored to the specialisation the candidate has applied for, with questions based heavily on the technical side of their engineering discipline, in Ontario, the engineering exam is based on professional engineering ethics. Questions involve having the examinee comment on different workplace scenarios and apply codes of ethics and professional misconduct guides to come to the best course of action for those circumstances. The exam is split into Part A (professional practice and ethics) and Part B (engineering law and professional liability). The Ontario exam is also is separate from the more common National Professional Practice Exam (NPPE). The format of the national exam is a multiple choice exam, whereas the Ontario format requires essay and short answer responses, showing that the test also requires effective communication skills from the candidates.

These procedures are strongly justified by the PEO, with the main benefits being that engineers are exposed to better education, are policed by their peers, and have more experience and qualifications to embark on engineering projects. This promotes better safety, health and welfare for the public.

Further references on the Ontario Professional Engineering system:

- Professional Engineers Ontario at *https://www.peo.on.ca/public-protection/working-professional-engineer*
- Erik R Girard and Harald Bauder, "Assimilation and Exclusion of Foreign Trained Engineers in Canada: Inside a Professional Regulatory Organization", 01 February 2007, Wiley Online Library at *https://doi.org/10.1111/j.1467-8330.2007.00505.x*.
- Tracey L. Adams, "Regulating Professions in Canada: Interprovincial Differences across Five Provinces", Journal of Canadian Studies/Revue d'études canadiennes, University of Toronto Press, Volume 43, Number 3, Fall 2009, pp. 194-221, at *https://muse.jhu.edu/article/390309/pdf*
- Erik R Girard and Harald Bauder, "The making of an 'arcane' infrastructure: immigrant practitioners and the origins of professional engineering regulation in Ontario", 17 May 2007 *https://doi.org/10.1111/j.1541-0064.2007.00176.x*.

GERMANY

A leader in chemicals and automobiles, Germany is often synonymous with high quality manufacturing and state of the art engineering. The first representative body for engineering was founded in 1856, known as the *Verein Deutscher Ingenieure* (Association of Germany Engineers). However, the profession was often discriminated against by other faculties, which thought of engineering as a lesser profession.

During the first half of the 20th century, technology played an important part in the World Wars. The immediate reaction post-WWII was widespread cynicism of the development of technology and a condemnation of engineering, as they were seen as contributing to the devastation of war. At this point, the VDI took more action in trying to alleviate the criticism of engineering, encouraging discussions such as the responsibility of engineers, the role of technology in everyday life, and engineering ethics. This was summarised in a document called the "Engineer's Confessions", which acted as a moral pledge for engineers. One of the more distinct changes was that there was an explicit commitment to humanity as a whole. Overall, professionalism of engineering was significant in enforcing the social responsibility of engineers. Development of these codes led to a recognition of eight values vital to engineers.

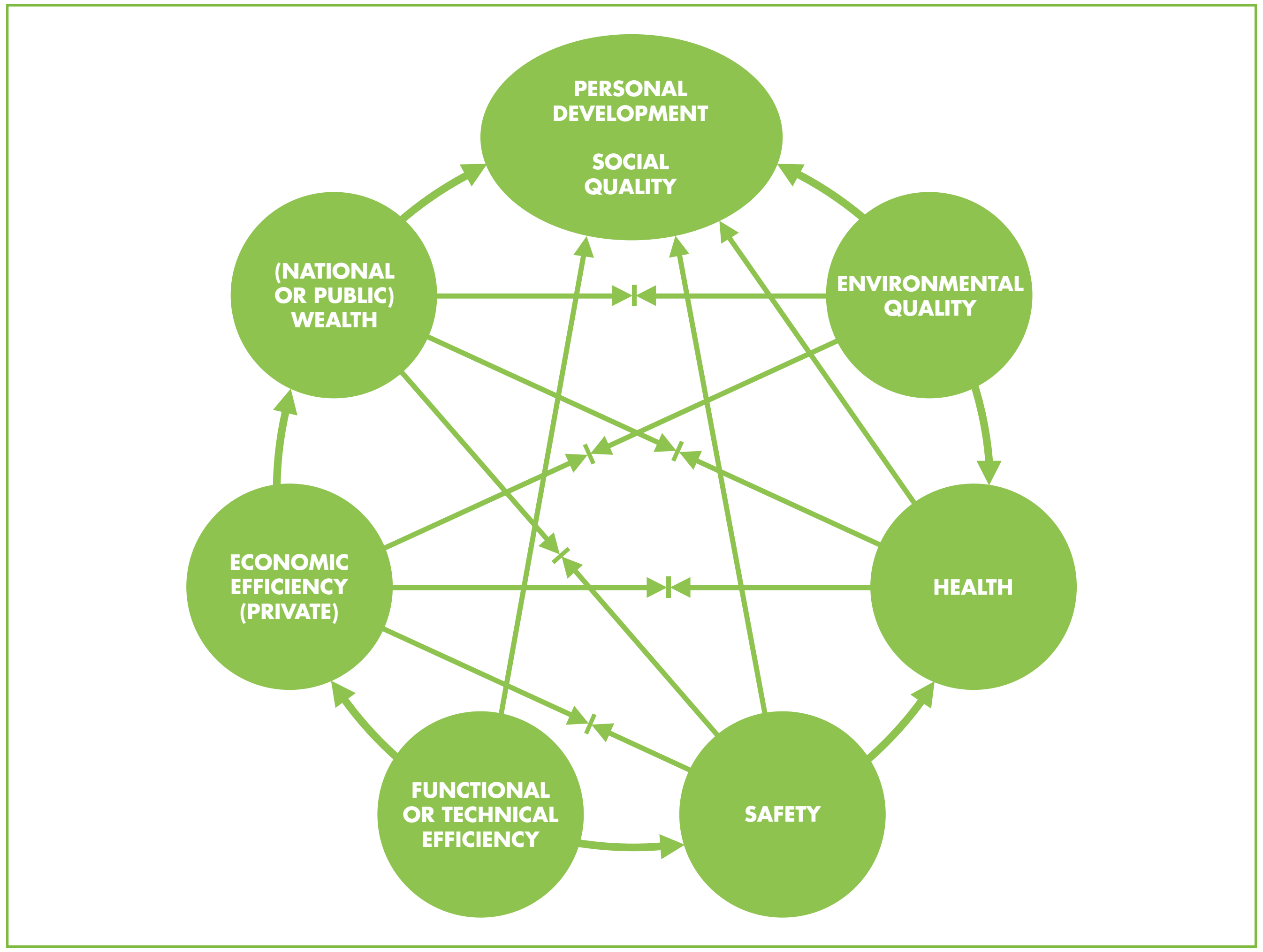


Figure 1: Pillars of engineering, as summarised by the VDI. (Hunning, 1993)

The modern process in Germany for becoming an engineer starts at university, where the professional qualifications are obtained. The title "engineer" is a protected professional title—it may only be used by persons whose professional qualification is recognised in Germany. The recognition procedure takes place at the Chamber of Engineers. There are 16 chambers of engineers in Germany, one in each federal state.

The application process begins with the provision of certain documents in support of the candidate, which prove the following requirements:

- Successful completion of studies or the accordance, approval or confirmation of notification in accordance with the Engineers' Law of Baden-Württemberg
- The candidate's personal reliability:
    - If in Germany – certificate of good conduct (Führungszeugnis)
    - If residing abroad – documents from the country of residence that testify to personal reliability
- Proof of two or four years of successful professional practice as an engineer

While authorisation is required to use the professional title, working within the profession is generally permitted. Graduates may apply for jobs on the German labour market without having obtained proper recognition of being an engineer. A "consulting engineer" is another title which refers to a person who works independently and is a step above the regular engineer title. They work analytically and offer a high degree of professional competence, working in the development, planning, supervision, control and inspection of projects.

Further references on the German Professional Engineering system:

- Hunning, Alois, and Carl Mitcham. 1993. "The Historical and Philosophical Development of Engineering Ethics in Germany." Technology in Society 15 (4): 427–439, at *https://doi.org/10.1016/0160-791X(93)90014-F*; *https://www.sciencedirect.com/science/article/pii/0160791X9390014F*.
- The Federal Ministry of Education and Research, *https://www.anerkennung-in-deutschland.de*.
- Ingenieurkammer Baden-Württemberg, The Service Portal of the Chamber of Engineers, "Registration in the list of consulting engineers", at *https://www.service-bw.de/en/web/guest/leistung/-/sbw/Chamber+of+Engineers++Registration+in+the+list+of+consulting+engineers-971-leistung-0*.

> In Germany, the title "engineer" is a protected professional title, and it may only be used by persons whose professional qualification is recognised in Germany.

JAPAN

At the start of the 20th century, engineers were not seen as important roles in Japan, which was distinctly different to the continental European viewpoint. The structure of the profession was that people working in a technical field around 1900 were divided into five ranks:

- Shokutaku – temporary worker
- Joshu – assistant
- Yatoi – skilled worker
- Gite – technician
- Gishi – engineer

University trained engineers were usually given the rank of gite, while vocational or technical high school graduates were employed as yatoi. Direct employment as gishi was rare. Generally, engineers were not well respected. During the Edo period (1600-1868), Japanese society considered that the study of outside knowledge and technology went against the lifestyle of a noble man. After much pushback from engineers demanding more rights, they achieved some greater political influence in the 1930's, with a role to guide the public opinion on technology. This was seen as a stepping stone for greater acknowledgement, but it ultimately was not helpful in changing the status of engineers. Little power was given to engineers to make decisions. This issue was further ignored throughout the period of WW2 as administrative bodies were militarised. Only from 1957 to 1972, when there was high economic growth in Japan, were engineers appointed to top-level positions and social recognition was attained by the profession.

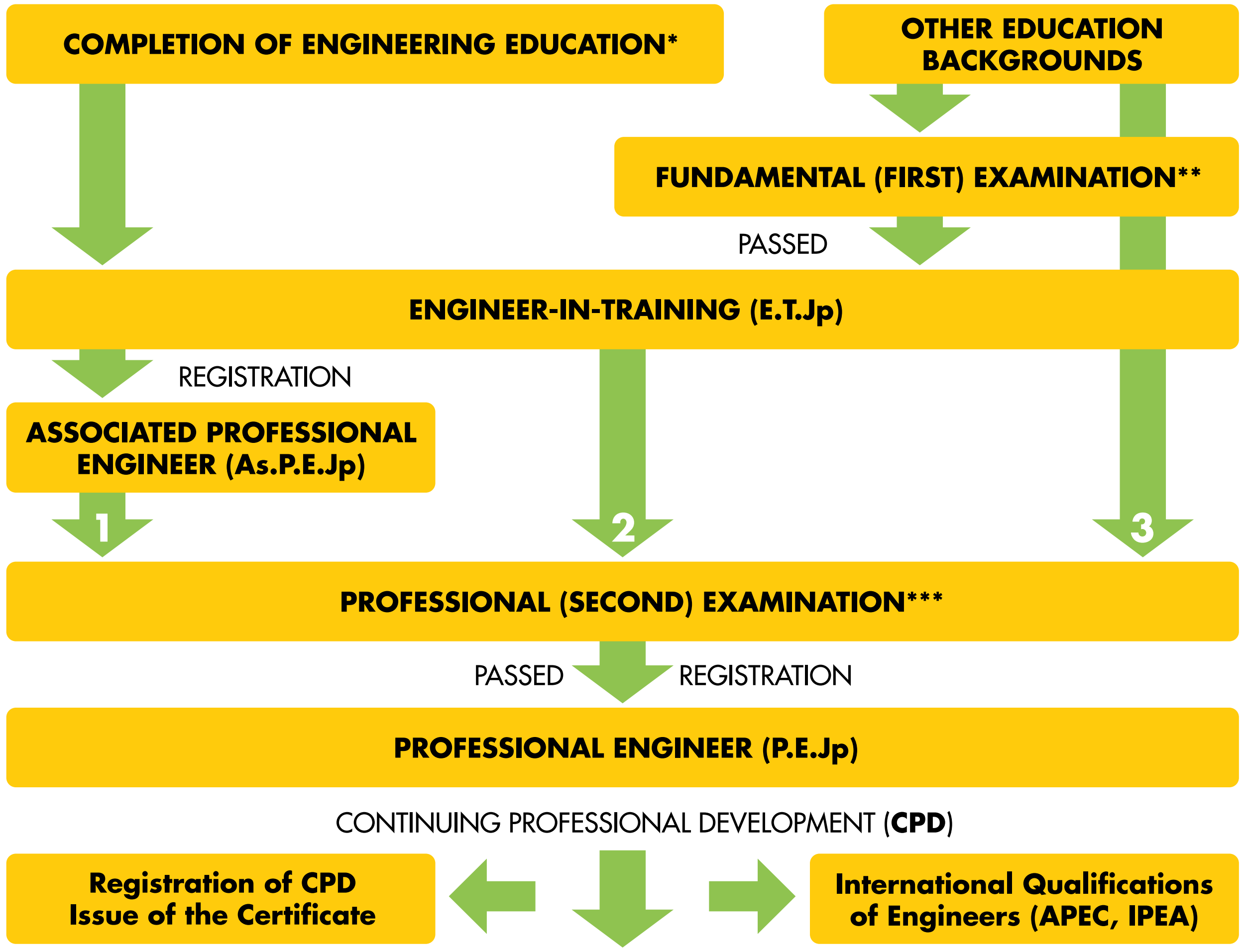
Engineering is a recognised national qualification, derived from the Professional Engineer Act.

- Article 2 – "Professional engineer" means a person who has obtained a registration under Article 32 (1) and conducts business on matters of planning, research, design, analysis, testing, evaluation or guidance thereof, which require advanced and adaptive expertise in science and technology using the name of professional engineer.
- Article 32 – professional engineer registry – includes personal details, name of technical discipline passed.

Only those who have passed the professional engineer examinations and have completed registration can call themselves professional engineers. Examination of professional engineers started in 1958. This was difficult at first, because engineering is involved in specialised skills, meaning it was not easy for those not involved with technology to assess the skills. Before this, when there was no system to demonstrate engineering skill, businesses who needed to perform practical tasks were exposed to high levels of risk. This was necessary in order to utilise science and technology to expand the nation's business capabilities. Japan's national economy was held back as a result. The process of professionalising engineers helped create public confidence in hiring technical workers.

Examinations are part of the Japanese professional engineering registration system. Within the education process, there are 21 technical categories, with a further specialisation in each category. There are first and second stage examinations required to become an engineer. Second stage exams are unavoidable and difficult to pass, with strict eligibility requirements. There is also an oral examination tested by expert professional engineers. For reference, in the 2015 second stage exam, the number of examinees was 24,878; the average age was 43.3; and the passing rate was 14.7%. This is the most vital step of Japan's professional process, as passing this allows an individual to hold the engineer title.

THE PATHS TO P.E.Jp CERTIFICATION



Notes:

1. Minimum 4 years of practical experience under supervision of a Professional Engineer.
2. Minimum 4 years of practical experience under supervision of an experienced Engineer. ****
3. Minimum 7 years of practical experience.

*** Accredited Programs:**
Programs are accredited by the Japan Accreditation Board for Engineering Education (JABEE).
The MEXT announces those accredited programs through the official gazette.

**** The Fundamental (First) Examination:**
The multiple-choice examination is held every year in October.

***** The Professional (Second) Examination:**
The written examination for Professional Engineers is held every year in July. Applicants who have passed the written examination are qualified to take the oral examination, which is usually held in December of the same year as the written exam.

****** Experienced Engineer:**
An engineer who has engaged for 7 years or longer in practice including planning, research, design, analysis, testing and evaluation on matters requiring professional practical abilities of science and technology. Also, he/she must hold an official supervisory position in advising applicants.

Further references on Japan's Professional Engineering system:

- The Institute of Professional Engineers Japan, "Institution Profiles 2018", at *https://www.engineer.or.jp/c_cmt/kokusai/topics/003/attached/attach_3580_4.pdf*
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SINGAPORE

In Singapore, the Professional Engineers Board registers professional engineers in the branches of civil, electrical, mechanical and chemical engineering. Engineers are required to hold an approved degree or qualification listed in the Professional Engineers (Approved Qualifications) Notification/Amendment Notification 2016 and have acquired relevant experience. An applicant is required to sit and pass examinations prescribed by the Board on:

- Fundamentals of Engineering Examination
- Practice of Professional Engineering Examination

Alternatively, an oral examination is administered. Professional Engineers are required to attend a professional interview.

REGISTRATION OF PROFESSIONAL ENGINEERS

In year 2018, the Board conducted 54 professional interview sessions for 255 applicants while a total of 193 candidates were registered as professional engineers during the year. Table 1 shows the number of new professional engineers registered in the last 5 years.

TABLE 1 – NUMBER OF NEWLY REGISTERED PROFESSIONAL ENGINEERS BY YEAR

	NUMBER OF PROFESSIONAL ENGINEERS REGISTERED				
BRANCH OF ENGINEERING	2014	2015	2016	2017	2018
CIVIL	45	51	55	57	59
ELECTRICAL	24	20	28	21	35
MECHANICAL	17	15	13	21	21
CHEMICAL	—	—	—	63	78
TOTAL	86	86	96	162	193

As at 31 Dec 2018, there was a total of 4,107 professional engineers on the register of professional engineers and a total of 2,526 professional engineers on the annual register of practitioners. Table 2 shows the breakdown of the number of registered professional engineers and practitioners on the 4 main branches of engineering (namely, civil, chemical, electrical and mechanical).

TABLE 2 – NUMBER OF REGISTERED PROFESSIONAL ENGINEERS AS AT 31 DEC 2018

	TOTAL NO OF REGISTERED PROFESSIONAL ENGINEERS		TOTAL NO OF PRACTITIONERS (PROFESSIONAL ENGINEERS WITH PRACTICING CERTIFICATES)	
BRANCH OF ENGINEERING	NUMBER	PERCENT	NUMBER	PERCENT
CIVIL & STRUCTURAL	2,010	48.9	1,338	53.0
ELECTRICAL	930	22.6	594	23.5
MECHANICAL	927	22.6	513	20.3
CHEMICAL	159	3.9	75	3.0
OTHERS[1]	81	2.0	6	0.2
TOTAL	4,107	100	2,526	100

[1] Others include Aeronautical, Electronic, Industrial, Information Technology, Manufacturing, Marine, Naval Architecture and Production.

Further references on Singapore's Professional Engineering system:

- Professional Engineers Board, Singapore, at *https://www.peb.gov.sg/*
- ASEAN Federation of Engineering Organisations (AFEO), "Professional Engineers and PEB" at *http://afeo.org/wp-content/uploads/2018/09/PE-and-PEB-CAFEO-35-IES.pdf*.
- Annual Report 2018, PEB, at *https://www.peb.gov.sg/Downloads/PEBAnnualreport2018.pdf*

USA – CALIFORNIA

In 1928, the failure of the St Francis Dam in Los Angeles saw massive damage to residences and public infrastructure, causing the deaths of hundreds of people. The collapse of this dam is considered one of the worst civil engineering failures in America, and the incident triggered reform of design regulations and purging of any unregulated engineering work that would be deemed a hazard to public safety.

This disaster was a catalyst for California to enact legislation regarding proper registration of engineers. The 'Civil Engineers Act' of 1929 was not without opposition, especially among the mining, mechanical and electrical engineers. As such, the 1929 statute only applied to civil engineering. It was not until the 1947 amendment when registration requirements extended to professional engineers in the chemical, electrical, mechanical and petroleum streams. The 1947 amendment also created the State Board of Registration for Civil and Professional Engineers.

The procedure for registration in California is standard, with requirements set out in section 6751 of the *Professional Engineers Act*. First, there is an application to be an engineer-in-training (EIT), which requires passing the fundamentals of engineering exam (FE), as well as three years of education, three years of experience or a combination of the two totalling three years. To hold a licence to be a professional engineer, the threshold for experience is raised to six years, with the addition of passing a more specialised professional engineering exam (PE exam).

To accommodate the transition period for those who were already practicing and engaging in work while unregistered, grandfathering was necessary when new disciplines were added. Section 6767 and 6767.5 (now obsolete) were introduced to allow the provision of professional licenses to engineers who were previously unregistered. The only requirement was that the applicant had relevant experience in the industry they were applying for. No examination was necessary to become a professional engineer under that exemption. This did not mean that any person engaged in engineering work was then as a result able to become registered. As decided in *Toczauer v State Board of Registration*, section 6767.5 provided the right to attempt to qualify for registration on the basis of experience in the industry alone. Any projects the applicant worked on had to be judged as relevant to the branch of engineering they were applying for. This was decided with reference to the definition of the different branches of engineering, given in California's *Professional Engineers Act*.

Further references on California's Professional Engineering system:

- Royal W. Sorensen, "Professional Engineering Registration in California", Engineering and Science Monthly, May 1948, pp. 10-11 at *http://calteches.library.caltech.edu/637/2/Registration.pdf*
- Board for Professional Engineers, Land Surveyors, and Geologists, *Professional Engineers Act*, at *https://www.bpelsg.ca.gov/laws/pe_act.pdf*.
- California Society of Professional Engineers, "Inception of the California PE Act", at *https://www.nspe-ca.org/licensure/inception-of-the-ca-pe-act*.
- Senate Bills 1963, Bill 1202, Volume 9, Section 23.
- Statutes of California, 1969, Volume 2, Chapter 811, Section 3.
- *Toczauer v State Board of Registration for Professional Engineeers*, Court of Appeal, 2nd District, Division 3, California.

In California, to obtain a licence to practice as a professional engineer, the threshold for experience is six years, and applicants must pass a specialised professional engineering exam.

10. Appendix B

Government versus Professional Body Registration

THERE ARE ADVANTAGES AND DISADVANTAGES TO THE PROPOSITION THAT STATES AND TERRITORY GOVERNMENTS MIGHT BOTH ASSESS COMPETENCY (COUNTER TO THE RECOMMENDATIONS ABOVE WITHIN THIS REPORT) AND ALSO REGISTER/LICENSE FIRE SAFETY ENGINEERS. SIMILARLY, THERE ARE PROS AND CONS TO THE PROPOSITION THAT ALL THESE ACTIVITIES ARE LEFT WITHIN THE HANDS OF ONE (OR MULTIPLE) PROFESSIONAL BODIES.

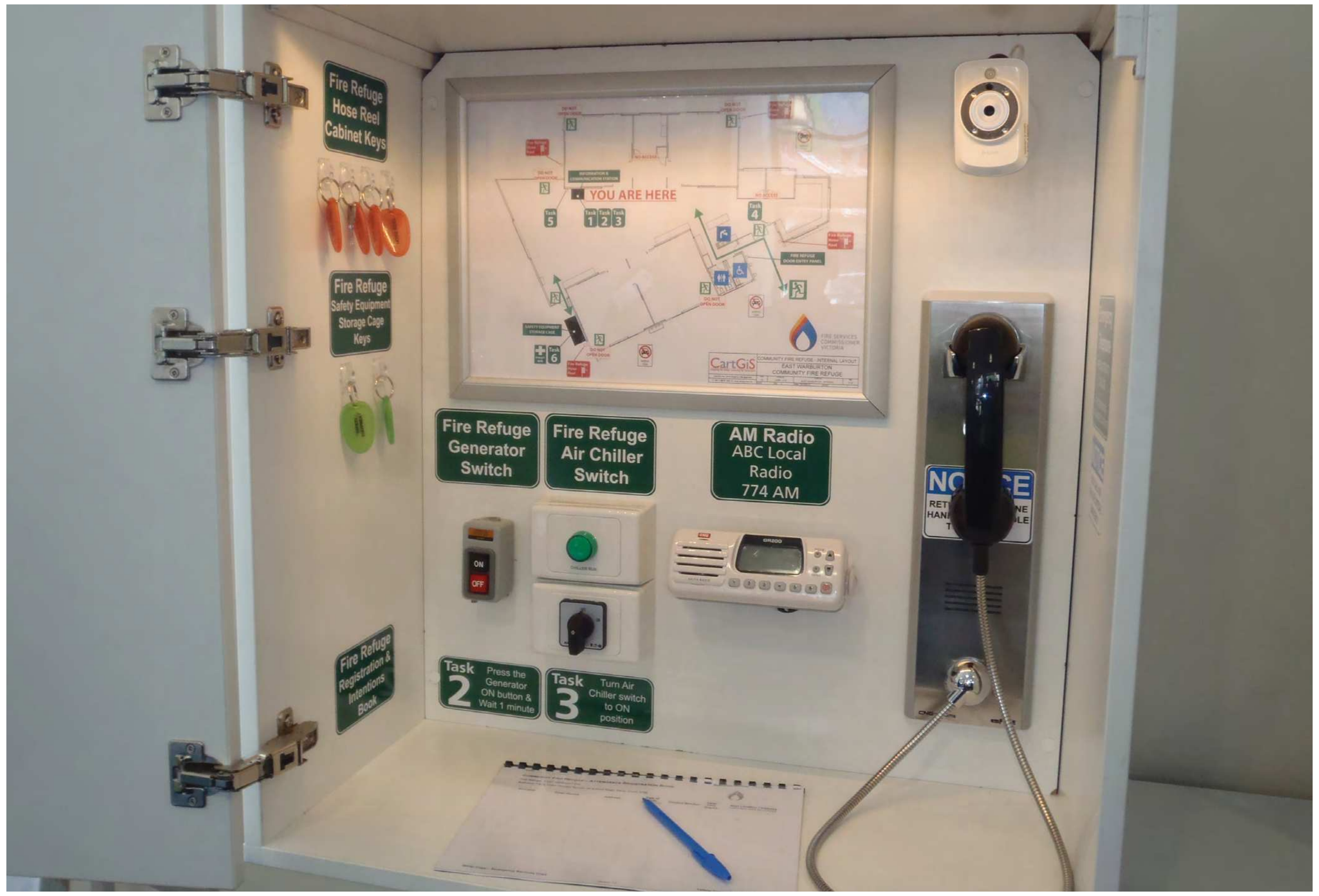
It is recognised that in Australia there is a shared responsibility for professional accreditation on the one hand, and authority to practice and professional registration on the other hand. This is called the co-regulatory model. While this shared model will continue in Australia, in a research sense, it is worth considering the different attributes of each model to see if there are lessons learned or particular attributes of either model which might be incorporated into the Australian overall control of fire safety engineering.

STATES AND TERRITORIES

The perceived advantages of a government body undertaking both professional accreditation as well as control over permission to practice are considered to be:

- From the candidates' perspective, the local state/territory becomes a one-stop shop to assess competencies and professional experience, as well as register/license fire safety engineers.
- Professional indemnity insurance requirements for registration/licensing can be legally enforced by the same body which provided permission to practice and ultimately controls practice standards.
- As states can legislate, this provides a direct means to control the engineering title such as "fire safety engineer" being licensed, e.g., make "fire safety engineer" or "fire engineer" a restricted or protected term.
- States could include state-specific competencies around their legislation, specific construction concerns, and any roles of the fire safety engineer which the state may have legislated. For instance, NSW requires fire safety engineers to inspect buildings, but VIC does not. Thus, a NSW state specific competency check could include more site related requirements for interstate applicants to ensure that fire safety engineers licensed in other states and territories can operate appropriately in NSW (although this Warren Centre project is recommending all fire safety engineers around Australia be involved in construction inspections and commissioning).

> In Singapore, the government undertakes both the competency checks and licensing.



Fire refuge and communications system.

The disadvantages to a single government system are that:

- Potentially each state/territory applies its own criteria in assessing competencies and supervised professional experience, and its own requirements in registration/licensing, which could potentially be based on the level of education available within the state/territory. This could create a "lowest denominator". Due to the existence of mutual recognition among states and territories candidates might elect to apply for accreditation and registration via state or territory with the easiest, minimum requirements.
- Where mutual recognition is not available there is further an issue of 'red tape' to be accredited across multiple states and territories. For instance, each state or territory could require its own competency check consisting of interviews and written tests.
- The competency and professional experience assessment may not be up to date with the latest fire safety engineering research and practice, and many states and territories do not have the expertise or experience of developing competencies or undertaking competency assessments. This would all create new government costs, however, it is more easily handled within the profession.
- There would be no incentive for development of fire safety engineering education and solution of the underlying competency problems. Also, there are potential issues with currently practicing fire safety engineers. A state/territory-based approach would likely provide some form of pathways or "grandfathering" for existing engineers to become accredited. This may mean setting a low bar but would be viewed by the states as politically necessary for commercial investment / building industry operations in the short term.

- It is unlikely that each state/territory would be willing to drastically cut down on the number of fire safety engineers available to provide fire safety engineering services by introducing a set of competency requirements at a level that is appropriate.
- There would be no need for the accredited/registered/licensed fire safety engineers to abide by any code of ethics.
- States often do not themselves have the expertise to judge competence of engineers. This means either the competency issue would not be fixed, or they would need hired experts to assist in those judgements and create a bureaucracy to manage the whole process. While some states have existing government bodies drawn from the profession (e.g. experts on Victorian Building Authorities Buildings Appeals Board) which can be excellent, this would further divide the level of competence of engineers across Australia. A 'test' to pass for competences would be the local state engineer or whomever they engage to do the reviews, rather adopting a nationally unified benchmark such as Chartership.

As an example, in Singapore, the government does both competency checks and licensing, but in the US individual states, it is a different arrangement, where the states license engineers who have passed a standard national exam written and administered by a national not-for-profit organisation (NCEES, The National Council of Examiners for Engineering and Surveying), but professional bodies, such as The Society of Fire Protection Engineers (SFPE), help develop that exam. (See for example https://www.sfpe.org/page/2011_Q3_4). The US federal system is quite fractured, with no American equivalent to COAG or the BMF, and unfortunately the US states have slightly different experience levels between one another, and other details of licensure required to get a Professional Engineer license. As the university qualifications and EIT/PE exam requirements are uniform, there is a general practice of comity among the states to recognise an incoming applicant from a different state, there are over 50 different state and territory models operating in the US.

> It is recognised that in Australia there is a shared responsibility for professional accreditation on the one hand, and authority to practice and professional registration on the other hand.

> There is the potential for a completely professional body driven system.

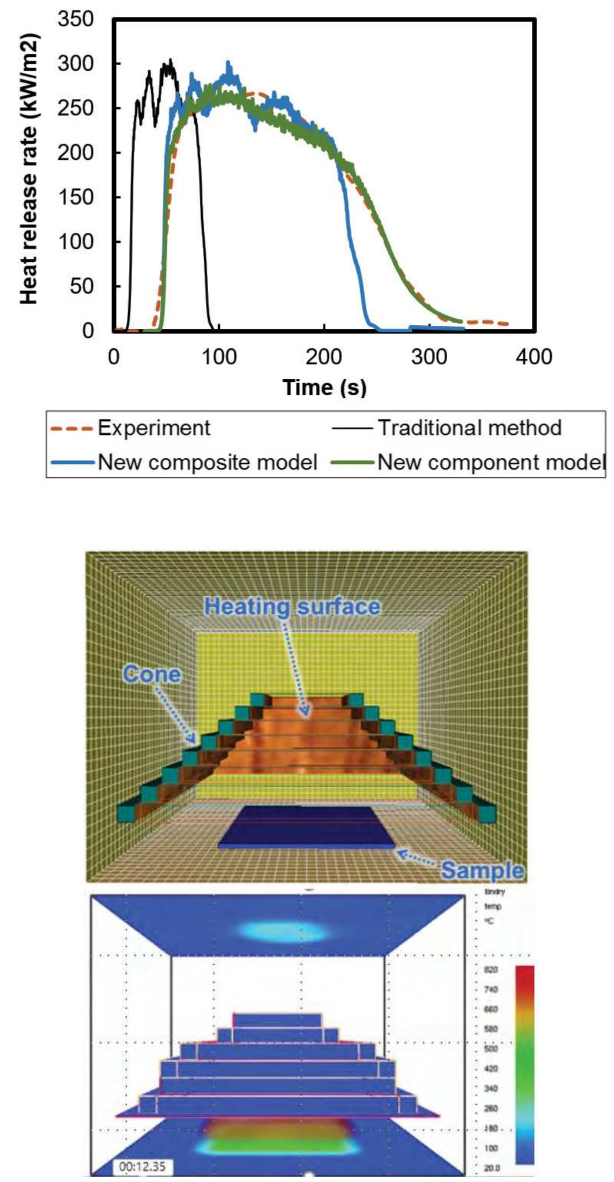
PROFESSIONAL ENGINEERING BODIES

At the other end of the spectrum compared with the wholly government run system discussed above, there is the potential for a completely professional body driven system. In this system the professional body not only assesses competencies but also licenses/registers engineers. There are also pros and cons where the professional bodies, such as EA and IFE, are to assess and register/license fire safety engineers, provided they follow the same set of competencies and assessment processes.

The advantages of a professional bodies system are:

- The assessment of competencies and requirements for supervised professional experience is consistent Australia-wide with no state variations.
- The professional bodies have the expertise and long experience of preparing sets of engineering competencies, developing assessment procedures and undertaking all the required competency assessments of candidates
- The aforementioned assessment is more likely to be up to date with the latest fire safety engineering research and practice because it has direct input from professional engineers.
- Accredited fire safety engineers need to abide by the code of ethics of the professional engineering bodies.
- Accredited fire safety engineers need to have continuing professional development set by the professional bodies, the requirement of which at present (e.g., 150 hours over 3-yearly period under EA) is more stringent than that under the current local state accreditation schemes (e.g., there are no CPD requirements currently in VIC under the Victorian Building Authority registration scheme, and up to eight hours of CPD per year under the NSW Building Professionals Board Accreditation Scheme (See for example: https://www.fairtrading.nsw.gov.au/__data/assets/pdf_file/0007/461455/Building-Professionals-Board-Certifier-Accreditation-Scheme.pdf).
- There would not be a "lowest denominator" for applicants to pick and choose the easiest path for accreditation among differing states' and territories' requirements. Though there may be more than one accreditation scheme available (EA and IFE), the intent of the previous Warren Centre reports is for each to be brought up to the same stringent competency requirements.
- There is no 'market' pressure to relax the assessment requirements.

- The use of a professional engineering body does not preclude a state/territory from having PI or specific legislation related requirements, only from having other fire engineering competencies.
- If legislation is appropriately drafted in conjunction with professional engineering body providing accreditation, then this pathway would not preclude government from protecting titles.
- As an example, UK has no formal licence required. However, the professional engineering bodies can provide Chartership which is used as accreditation for clients seeking experts in their field. Notably though this is only a beneficial item when clients are aware of the accreditation and its benefits and may request to employ Chartered engineers for their own benefit and confidence. The UK is undertaking its own review now following the Grenfell Tower disaster.
- Queensland operates primarily on this route. To become RPEQ, an engineer must be assessed by one of six Authorised Assessment Organisations. These are: Australasian Institute of Mining and Metallurgy (AusIMM); Engineers Australia (EA); Institute of Chemical Engineers (IChemE); Institute of Public Works Engineering Australasia – Queensland Division (IPWEAQ); Professionals Australia (PA); and the Royal Institution of Naval Architects (RINA). For Engineers Australia, the Chartered or the National Engineering Register credentials both qualify to RPEQ. Queensland presently registers in 26 different categories of engineering.
- It should be noted that while NER can be obtained for some disciplines without chartership, NER in the category of fire safety engineering is only accessible to chartered members or non-members following a Stage 2 competency check. (See https://www.engineersaustralia.org.au/sites/default/files/NER%20FAQS%20%202019-2020.pdf.)
- Although Engineers Australia is the peak body for engineering, there are five other bodies recognised in the RPEQ system, and EA is not a sole assessor.



Innovative Fire and Façade Engineering Group at RMIT University led by Dr Kate Nguyen.

10. Appendix B

The disadvantages of a professional bodies system are:

- There could be a lack of state/territory specific requirements, such as 'local' legislation and building regulations, in the assessment of competencies and supervised professional experience.
- Professional engineering bodies do not have the legal power to license engineers or apply legal audit and enforcement procedures with civil or criminal penalties.
- Professional bodies do not require professional indemnity insurance for accreditation.
- There is a potential disadvantage of a perception that an 'industry regulating itself' and is not sufficient to ensure proper competence.

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Fire engineering test at University of Queensland.