Fire Safety Engineering

The Final Report

Report 8 of this Series

THE WARREN CENTRE

ACKNOWLEDGEMENTS

The Warren Centre extends our gratitude to those individuals, government agencies, professional organisations, and corporations who shared their views and insights for this report.

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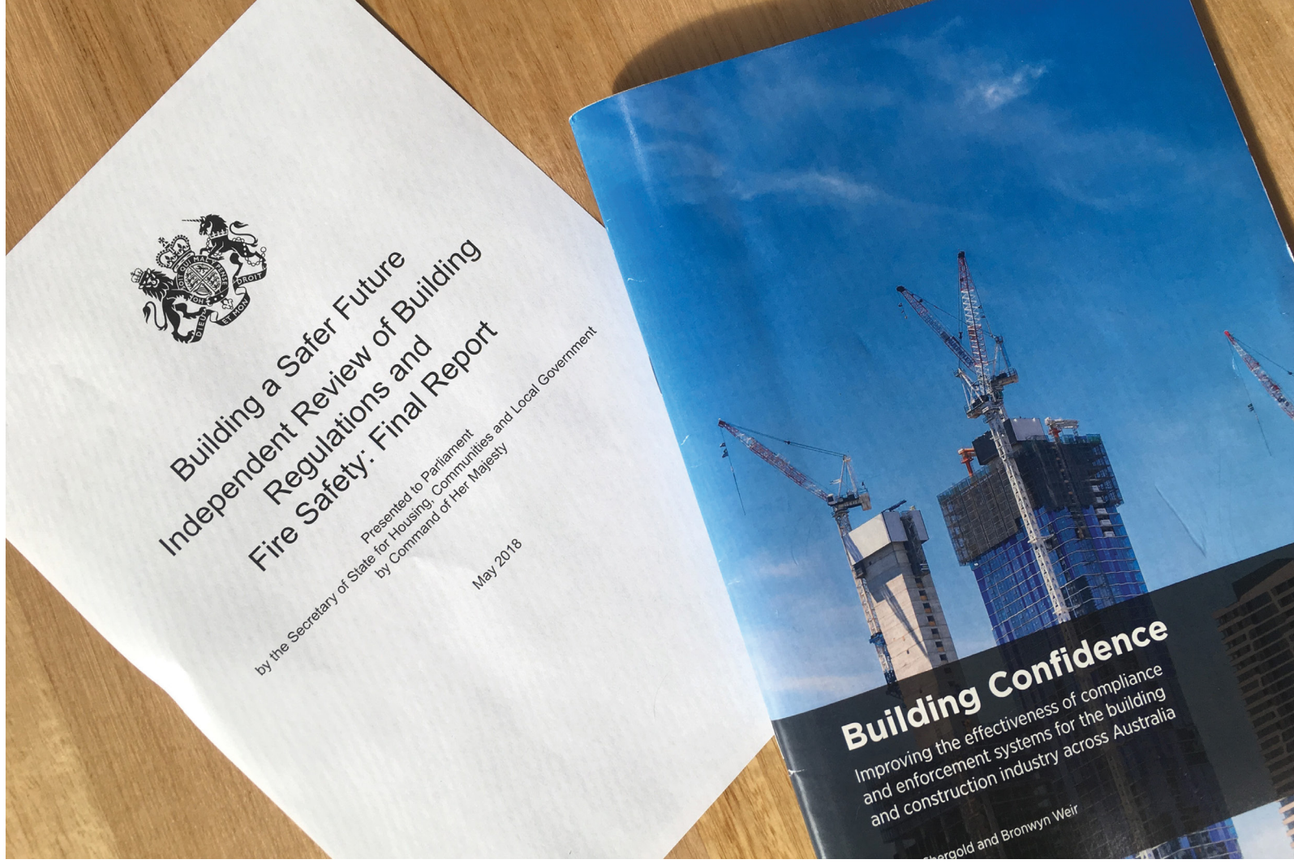


The Warren Centre's Professionalisation of Fire Safety Engineering Report Series addresses calls for reform in Australia and the UK.

THE WARREN CENTRE

ABOUT THE WARREN CENTRE

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

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

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

For more information about the Warren Centre visit www.thewarrencentre.org.au

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

Dr Bronwyn Evans, CEO of Engineers Australia, described EA's efforts to advance the National Engineers Register at the Warren Centre's February 2020 conference at the University of Sydney Business School.

Contents

1. Executive Summary

THE ULTIMATE PURPOSE OF THIS "PROFESSIONALISATION OF FIRE SAFETY ENGINEERING" RESEARCH PROJECT HAS BEEN TO ENSURE A SIGNIFICANT IMPROVEMENT IS MADE TO FUTURE BUILDING QUALITY AND SAFETY ACROSS AUSTRALIA.

The Shergold/Weir "Building Confidence" report emphasises the need for fundamental reform to restore trust in the construction industry. A critical aspect to this confidence is the provision of buildings that are safe, with fire safety being a fundamental issue to be considered. The reports which have been published as part of this Warren Centre project focus on how to best deliver fire safety and define a path that links the current sub-optimal situation to a future position of building safety and quality assurance. At the core of the recommendations of these reports is the adequate definition and accreditation of the Fire Safety Engineer and clear recognition as the professional responsible for delivering the design of the Fire Safety Strategy that is the basis for the fire safety of a building.

Professional fire safety engineers have fundamental knowledge, skills and other attributes to lead the fire safety design process for a building and demonstrate that the fire safety strategy and the selected fire safety measures meet the NCC building code and other design objectives. Furthermore, they are the only professionals that can engage with other designers (architects, structural engineers, etc.) to deliver a comprehensive and optimised building design that is safe from fire.

Professional fire safety engineers have fundamental knowledge, skills and other attributes to lead the fire safety design process.

In order to create a full and proper profession of fire safety engineering and meet all the recommendations of the Shergold/Weir "Building Confidence" report, this Final Report of the Warren Centre research project recommends:

- FSEs need to be given the professional responsibility and accountability for the overall design and implementation of the fire safety strategy of a building.
- This should be the case whether the building design is an implementation of the prescriptive Deemed To Satisfy (DT provisions, is based on an engineering analysis to demonstrate that the Performance Requirements in the NCC are explicitly met, or is any mix thereof.
- The basis of this approach is that the conceptual thinking behind the design and implementation of a fire safety strategy needs to be reoriented away from:
  - being driven by the DTS Provisions
  - the idea of Performance Solutions being simply alternatives to the DTS Provisions, and
  - the notion of equivalence.
- In being responsible and accountable, FSEs should be engaged from concept design to practical completion and handover. As such, FSEs should be responsible for:
  - The building fire safety design process and specification of the fire safety strategy (pre-construction); and
  - Verification that the fire safety design meets the NCC Performance Requirements at the building approval/permit stage, and that the fire safety design as constructed and commissioned as part of project Practical Completion, issuance of the Occupancy Certificate and owner/manager handover is as intended (post-construction).
- The overall process of regulatory control of building approvals should recognise that there are other design participants who are active and who contribute to the overall fire safety of a building, including practitioners who undertake detailed design, installation and maintenance of sprinkler systems, fire alarms, fire hydrants and other fire safety measures. However, FSEs should have complete oversight over all aspects of fire safety and how all the fire safety measures interact with one another as part of the fire safety strategy.
- The overall process of regulatory control of building approvals should recognise that the role of FSEs is not to issue approvals but, where necessary, to issue declarations of compliance with the NCC requirements. The acceptance of this advice and the issuing of building approvals and occupancy certificates is the remit of a certifier acting in the public interest.
- There should be regulated and mandatory requirements for independent peer reviews of fire safety engineering reports for some projects and on-site inspections and commissioning for some projects by nobody other than competent, registered FSEs. Decisions should not be left to certifiers or builders to decide whether peer reviews and inspections are required or not.
- The idea of the co-regulatory model is supported, with competencies set and assessed by the professional body but with licensing/registration by state and territory governments.
- The state and territory licensing/registration schemes should require FSEs to meet the assessment body professional accreditation requirements, have the necessary professional indemnity insurance, and be subject to practice reviews and penalties for inadequate practice of these schemes.
- State and territory licensing should protect the name "Fire Safety Engineer" and ensure fire safety engineering services are only undertaken by licensed FSEs.

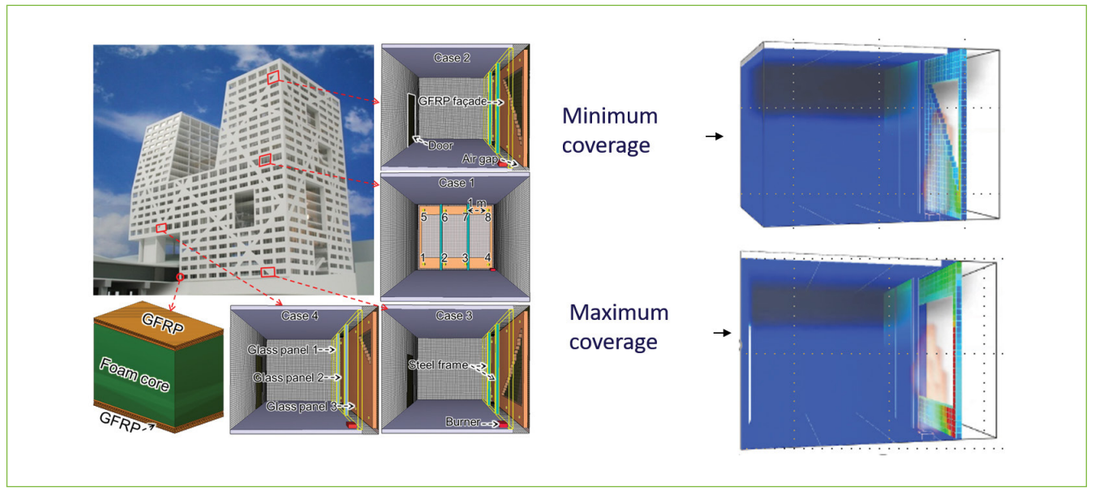
There should be regulated and mandatory requirements for independent peer reviews of fire safety engineering reports for some projects.

These recommendations for professional practice of fire safety engineers can only be implemented if underpinned by another series of recommendations related to competency, education and professional body accreditation, including:

- A clear and adequate definition of competency should be adopted that is a consensus agreement by the profession and governments.
- A robust pedagogy for university education of fire safety engineers should be adopted which will deliver future professionals that meet all required competencies for first stage accreditation.
- New (or upgraded) university courses on fire safety engineering should be developed and accredited which can deliver the Stage 1 competencies required for professional accreditation of individuals and meet the professional resource demand in Australia in terms of number of graduates and their geographical distribution.
- Clear processes for the assessment and accreditation of university courses, as well as assessment of Stage 1 competencies and Stage 2 competencies should be implemented by professional bodies to meet state and territory licensing/registration requirements.
- A framework for development of career pathways should be adopted.
- The profession of fire safety engineering should be promoted as an attractive career.

All these recommendations have been evaluated in terms of timeframes and the benefits as a basis for a reform program which can improve fire safety across the Australian building and construction industry to rebuild the trust and confidence espoused by the Shergold/Weir Report.

Fire modelling at RMIT University.



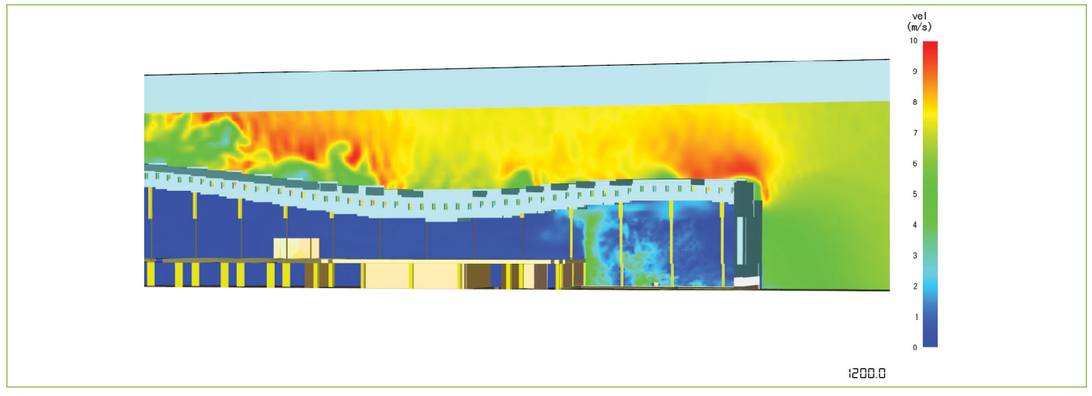
2. Introduction

THIS RESEARCH SEEKS TO RESPOND TO THE PROFESSIONAL CHALLENGES TO FIRE SAFETY ENGINEERING WHICH HAVE FOLLOWED FROM THE LACROSSE, NEO 200 AND GRENFELL BUILDING FIRES, AND THE HIGHLY RELATED SHERGOLD/WEIR "BUILDING CONFIDENCE" REPORT AND ITS RECOMMENDATIONS. THE RESEARCH AND THE REPORTS OF THIS PROJECT HAVE HIGHLIGHTED THE NEED FOR SIGNIFICANT REFORM OF BUILDING REGULATIONS AND FIRE SAFETY ENGINEERING PRACTICE.

The Warren Centre research has examined and made very specific findings and recommendations in relation to regulatory controls, competency, education, registration and accreditation, technical methods, audit and enforcement. The findings and recommendations pertain to fire safety design of buildings, the implementation of the fire safety design and compliance with the National Construction Code (NCC).

However, unless the recommendations are taken up by governments, regulators, professional bodies, fire authorities, educators, insurers and others to yield real reform, then the research will be in vain.

Nevertheless, it is recognised that reforms require resources and time to implement. Change will therefore occur at different rates across the various parts of the building and construction industry and through the professional bodies working towards lifting the competency and professionalism of practitioners. This Final Report and transition plan have therefore been developed to examine some of the potential timelines for reform by various organisations alongside the advocacy needed to mobilise action within organisations to implement recommendations to realise the true benefits of reform and how public safety will be improved. In particular, the need for greater fire safety engineering resources and skills are keys to the success of this reform agenda. The move to a full and proper profession for fire safety engineers and a well-developed career structure will cement the successes and deliver permanent impact.



Computational Fluid Dynamic modelling by Warrington Fire.

3. Task Brief

The broad scope for this Final Report is to develop a pragmatic transitional plan on how to get from the current state of fire safety engineering and design in Australia to the required state to meet the Shergold/Weir recommendations, professional ambitions and satisfactory public safety. This must address education, accreditation, registration, regulation, and practice controls to ensure a full and proper profession for FSEs, and it must align processes that are disparate and fragmented across the various states and territories in the Commonwealth.

Fire hydrant adjacent to lift (cannot be taken up or down floors from this point, must be near a stair) in an 8 storey building. Nearest stair 25 m away.

4. Summary of the Previous Reports and Recommendations in this Series

The broad scope for this Final Report is to develop a pragmatic transitional plan on how to get from the current state of fire safety engineering and design in Australia to the required state to meet the Shergold/Weir recommendations, professional ambitions and satisfactory public safety.

This Final Report is built upon all of the other reports prepared as part of this Warren Centre series entitled, “Professionalisation of Fire Safety Engineering”. A summary of the key findings from each of these reports is provided below. However, for the background and complete research evidence, findings and recommendations, the full reports should be consulted. The reports are available for download from the Warren Centre website. https://www.sydney.edu.au/engineering/industry-and-community/the-warren-centre/fire-safety-engineering.html

- **Regulation Report (Report 1)** – This report highlighted the fact that regulatory controls of the practice of fire safety engineering differ in every state and territory of Australia. At the present time, two states license FSEs, two states register FSEs and the other states and territories have no controls. The “engineer” title and limiting of the provision of engineering services to only professional engineers only occurs in Queensland, but new legislation recently been passed in Victoria and NSW will require future registration of professional engineers. Only in NSW are registered FSEs required to undertake inspections prior to occupation certificates being issued to ensure the fire safety strategy has been correctly implemented. The recommendation is a need for reform and national consistency of regulatory controls across Australia, including professional registration of fire safety engineers by all states and territories.

- **Education Report (Report 2)** – The research on FSE education provision and accreditation by professional bodies, such as EA and IFE, across Australia showed some very substantial limitations. Of the three traditional university courses teaching FSE, only one course, at the University of Queensland, is currently accredited by Engineers Australia (EA). The appropriate education of FSE requires a well-defined and modernised curriculum based on a pedagogy that will generate fire safety engineers with the competencies and attributes required for future practice. Currently, such pedagogy or a modern curriculum has not been fully developed for Australia or internationally. Current curricula focus on the knowledge base that underpins the profession and ignore many other professional attributes. Current curricula have undergone very little development over the past 25 years. The accreditation of degrees as satisfying the requirements for first stage of the accreditation process, or the review of competencies through an alternative route to registration by the IFE or EA can hardly be consistent or robust given these shortcomings. The key recommendation from this report was a call for development of new and improved best practice competencies which could then be matched by updated university education courses for FSE.

Fire testing at RMIT University.

- **Methods Report (Report 3)** – This research examined the differences between the processes of FSE design, verification against Performance Requirements, and the independent assessment for NCC compliance of a building conducted by certifiers, with the support of independent peer reviewers where necessary. A review of the proposed NCC Fire Safety Verification Method (FSVM) highlighted that in the FSVM these separate processes of design and verification have been conflated, and the FSVM methodology for verification may well drive a building design rather than follow it, with potential adverse safety outcomes. The FSVM also seeks to adopt the role of guidance for design and analysis, more like the International Fire Engineering Guidelines (IFEG). It is recommended that clarification and revision of the IFEG, FSVM and Practice Guides be undertaken to better reflect the separate but key processes in FSE.

- **Roles Report (Report 4)** – This report has developed new roles for design FSEs, those undertaking peer reviews, and those FSEs working in the fire authorities. The proposed roles reflect the recommendations of the Shergold/Weir "Building Confidence" report and the Hackitt report. The report calls for design FSEs to be involved from concept design through to handover, involvement in construction inspections and commissioning. The report also obviates the need for projects to develop a holistic fire safety strategy, a complete package of fire safety measures, and a suitable manual for use by building managers and occupants. It also calls for verification by FSEs of NCC compliance of the fire safety strategy at both building permit and project completion stages of a building project.

4. Summary of the Previous Reports and Recommendations in this Series

This Final Report is built upon all of the other reports prepared as part of this Warren Centre series entitled, "Professionalisation of Fire Safety Engineering.

- **Competencies Report (Report 5)** – The development of competencies for FSEs has been informed by the Roles Report and the future roles of FSEs as proposed in this Warren Centre research. The competencies have examined the knowledge, skills and personal professional attributes needed by a FSE in the future. They have been based on the competency framework of the International Engineering Alliance (IEA), the Washington Accord requirements and the general framework utilised by Engineers Australia. The proposals address competencies to be gained through Stage 1 (academic training) and Stage 2 (supervised professional experience) milestones, and the report lists indicators of attainment to assist in competency assessments for accreditation by professional bodies such as EA and IFE.

- **Professional Development Report (Report 6)** - This report examines the research findings and recommendations on professional development of fire safety engineers from all the earlier research and reports. It assembles a comprehensive set of recommendations with supporting evidence in relation to competencies, education, and career pathways, as well as professional development more broadly. The recommendations on education for fire safety engineers specifically address the competencies and attributes required for professional practice to create a level of professionalism which will be attractive to and encourage greater numbers of engineers to consider a career in fire safety engineering.

Fire & Rescue NSW.

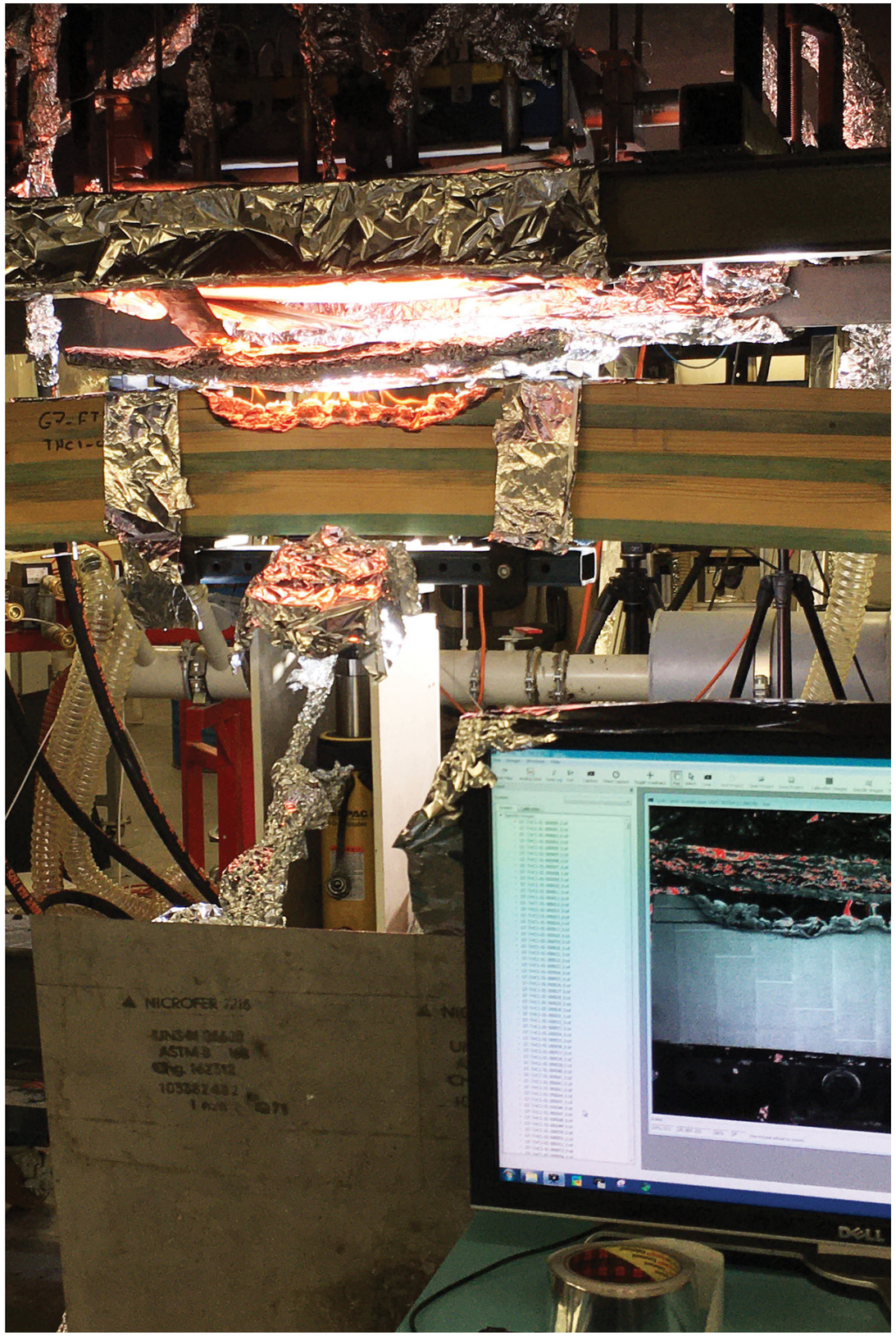
4. Summary of the Previous Reports and Recommendations in this Series

- **Accreditation and Regulatory Reform Report (Report 7)** - This report argues the case for national registration of fire safety engineers in a consistent manner by all states and territory governments based on enhanced levels of competency assessment by professional bodies like EA and IFE. This should ensure all fire safety design and fire safety engineering is undertaken only by registered fire safety engineers who are accredited by the professional bodies meeting the criteria of “Assessment Bodies” set by the states and territories.

  The report sets out the respective functions of states and territories on the one hand and professional bodies on the other hand, where reform is needed, and how the governments and professional bodies play to their strengths in the co-regulatory model for best fire safety outcomes.

  The report highlights the fact that governments should regulate the role of fire safety engineers so that they take full responsibility and are accountable for the fire safety strategy and package of fire safety measures for buildings from concept design to handover.

The key recommendation from this report was a call for development of new and improved best practice competencies which could then be matched by updated university education courses for FSE.



Fire testing of FRP/timber laminate at University of Queensland.

5. The Imperatives for Reform – Successes and Failures

THROUGH THIS WORK, A DETAILED LOOK AT OTHER REFORM PROGRAMS IN AUSTRALIA AND INTERNATIONALLY WAS CONDUCTED AND USED TO EXAMINE THE SUCCESSES AND FAILURES AND THE REASONS FOR THESE OUTCOMES. THIS WAS NEEDED TO DEMONSTRATE WHY REFORM OF REGULATION, PROFESSIONAL REGISTRATION, AND EDUCATION IS NECESSARY AND WHICH FACTORS ARE LIKELY TO YIELD THE MOST BENEFIT FOR AUSTRALIA.

As part of this review it was identified that the reforms that led to the Performance Based Building Code of Australia (BCA 1996) resulted in design being driven in many instances by practitioners without a level of competency in fire safety engineering consistent with what should be expected of a professional engineering discipline. This was due to the lack of a proper competency and accreditation framework for FSE. The general conclusion is that the introduction of the performance-based building code and private certification, in the absence of a proper competency and accreditation framework for FSE, has been a flawed regulatory reform. This framework requires substantial additional reform in respect of FSEs and certifiers as highlighted by Shergold/Weir.

The report on the UK building regulations by Dame Judith Hackitt following the Grenfell Building fire concluded that there was a

After the 2017 tragedy, the Grenfell Tower Inquiry is still underway in London and not expected to conclude before December 2021.

The report on the UK building regulations by Dame Judith Hackitt following the Grenfell Building fire concluded that there was a poor culture within the building industry and regulatory system.

poor culture within the building industry and regulatory system. Therefore oversight and extensive reform were needed if improvements in fire safety were to be achieved. Further work by Spinardi and Law established that this can only be achieved if improved competency is attained for fire safety engineers and AHJs (Authorities Having Jurisdiction) / fire services. Furthermore, they recommend a new system which incorporates a competency framework where only fire safety engineers have responsibility for and sign off **on all** fire safety designs.

The licensing process of Professional Engineers in the USA and in other jurisdictions (Canada, Germany, Japan and Singapore) has demonstrated significant benefit to the public. Engineering licensure formalises codes of professional conduct in statutes and rules. These codes of professional conduct are enforceable legal requirements, and there are prescribed disciplinary processes and actions that apply when a professional engineer acts outside of the code of professional conduct.

Details of some of these reforms, the outcomes and all cited references are documented in the Education, Professional Development, and Accreditation and Regulation Reform Reports. They provide very strong evidence for the reforms and improvements needed in Australia now in relation to competency, education, professional accreditation, and regulatory controls for fire safety engineering to help restore trust and confidence in the building and construction industry.

Sue Eddy, CEO of the Victorian Building Authority, spoke on VBA's reform efforts at the Warren Centre's February 2020 FSE Conference.

6. Proposed Reform Actions and Recommendations

BASED ON THE PROFESSIONAL DEVELOPMENT REPORT, THE ACCREDITATION AND REGULATION REFORM REPORT, AND THE DETAILED EVIDENCE WITHIN THIS AND THE OTHER WARREN CENTRE PROJECT REPORTS, THE KEY ACTIONS AND RECOMMENDATIONS ARISING FROM THIS RESEARCH ARE SET OUT BELOW.

PROFESSIONAL DEVELOPMENT - EDUCATION AND TRAINING

The key findings and recommendations on education, training, resource / skills constraints, and future professional careers in fire safety engineering are:

1. An Australian Education Committee should be convened to develop a National Education Plan in conjunction with leading universities and industry to substantially increase the number of FSE graduates. Adoption of a cooperative model between universities is the most effective means of meeting the short and medium term education requirements and should be developed.
2. Research is needed to establish an education pedagogy to create the link between fire safety engineering education courses and the competencies for fire safety engineers needed to ensure they have the knowledge, skills and attributes required to fulfill the role of the profession with a high degree of efficacy.
3. Sustainable university education courses in fire safety engineering need to be developed or updated based on the established pedagogy to meet the competency requirements. These education courses should be the result of an agreement between university and practice through a Stage 1 accreditation process. Course structures and detailed curricula need to be developed to meet the principles and structure detailed on education and skills development.
4. Governments should develop funding schemes for universities engaging in the development of these new education courses to meet resource needs.
5. University degree programs delivering fire safety engineering need to meet the requirements of EA for course accreditation. No course should be allowed to deliver FSE without having at least a provisional accreditation.
6. University degree programs should be designed and structured to ensure graduates completing these courses, and then having the requisite supervised experience to achieve all the required competencies (Stage 2), can be accredited (registered) by EA and IFE.
7. Nationally accessible education and training opportunities need to be developed to allow the flexibility for entry at different levels and via different pathways. This may involve EA and universities combining efforts to fill knowledge/skills gaps through short-term, medium term and long-term education offerings, including micro-credentialing.

8. Career development for fire safety engineers through multiple pathways needs to be encouraged through planned outreach programs led by universities teaching fire safety engineering along with SFS and IFE and other industry bodies.

This should all be aimed to encourage more people to enter the profession, encourage career development, and lift the competency standards to make a true and proper profession.

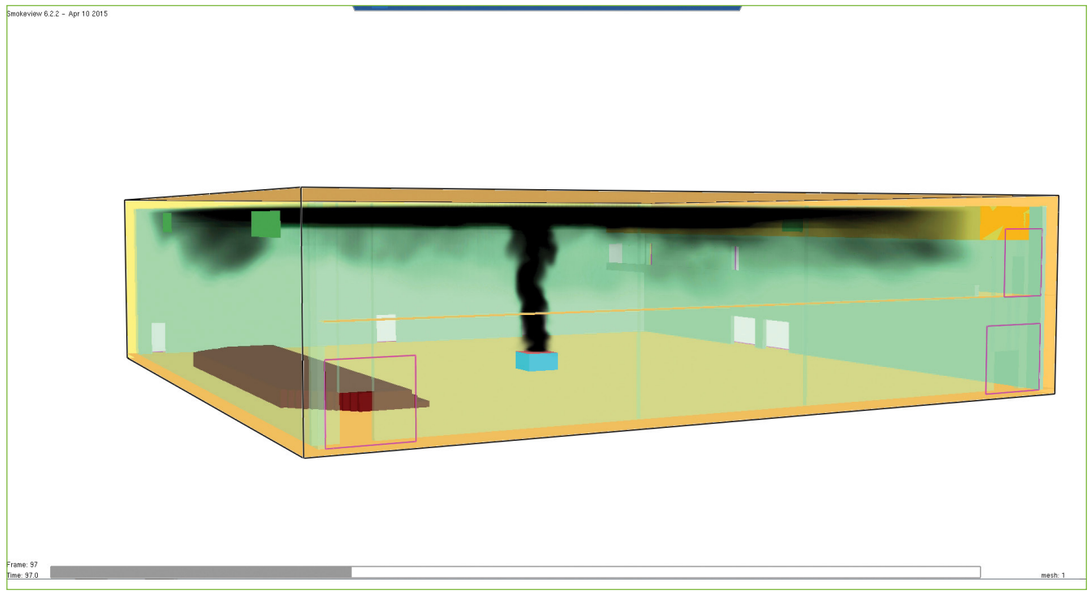
PROFESSIONAL BODIES AND ACCREDITATION

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

9. Create new professional accreditation schemes with the new competencies and attributes as established through this project.
10. Establish new accreditation assessment processes, linked to new competencies, attributes and updated CPD requirements, including NCC training, with strong input from recognised FSE professionals in process formation and in individual assessments.
11. Develop a professional audit program to regularly evaluate performance and practice of accredited fire safety engineers.
12. Provide a service to assess, investigate and report any occurrences of unsatisfactory professional practice referred by state and territory governments.
13. Provide guidance for applicants for individuals currently practicing FSE and seeking professional body registration and how they will be assessed for Stage 1 and Stage 2 competencies, including those following alternative career and professional development pathways (e.g. those without a Washington Accord first degree in fire safety engineering, overseas graduates, etc.).
14. 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, avoiding any grandfathering of existing registration unless the requirements can be shown to be substantially equivalent.

An Australian Education Committee should be convened to develop a National Education Plan in conjunction with leading universities and industry to substantially increase the number of FSE graduates.

15. Develop new design guidance, practice notes, guidance on peer review, CPD sessions, and training courses to drive change in FSE competencies and practice.
16. Provide a pathway, assessment procedures, and criteria towards Stage 1 accreditation of university programs, including those for existing education programs, with input from recognised and experienced FSE professionals.
17. 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.
18. 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.
19. Engage with the insurance industry and communicate 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.
20. Develop a national strategy towards guaranteeing the support of university educational programs through an Australia Education Committee vested in EA.



Fire smoke modelling undertaken by South Australia Metropolitan Fire Services.

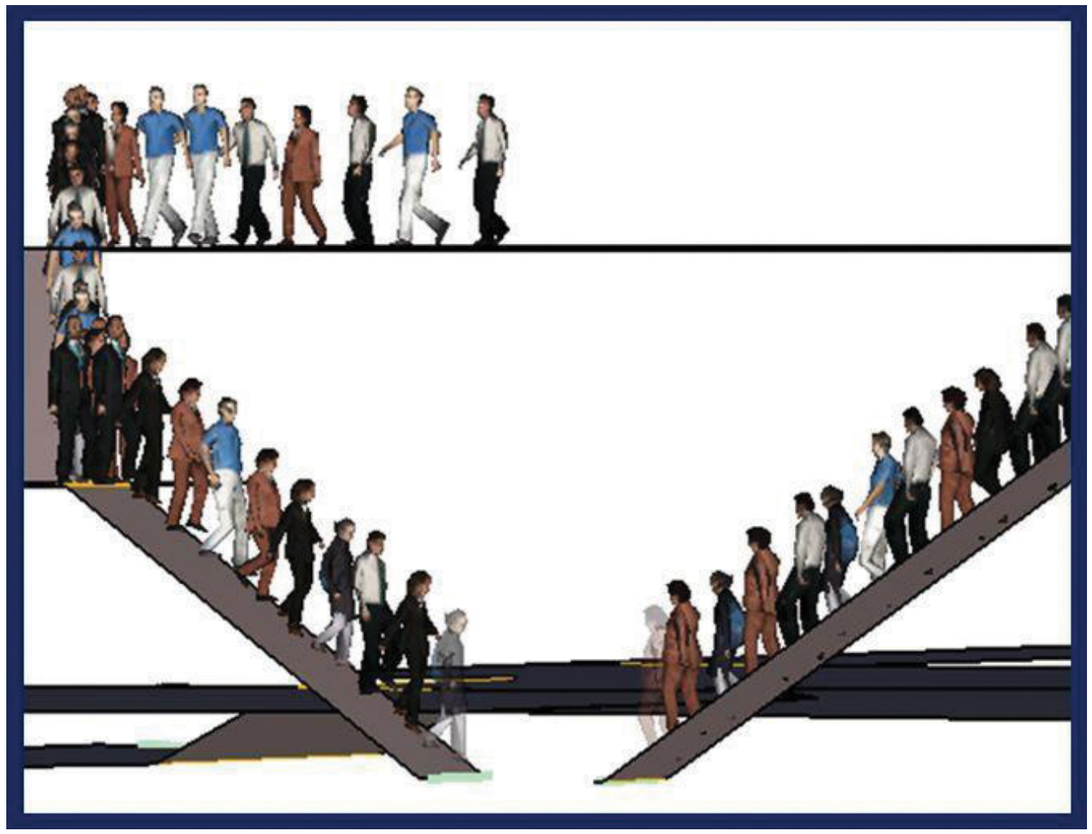
The success of the overall framework depends on a concerted advancement in all aspects.

GOVERNMENTS

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

21. The NCC building code and other guidance should be amended by ABCB to require fire safety engineering to be performed only by registered FSEs.
22. All states and territories should introduce Professional Engineers Registration Schemes, including for fire safety engineers, based upon EA and IFE assessment schemes which properly evaluate competencies, attributes and current CPD, ethics and on-going accreditation surveillance.
23. Regulatory changes should be introduced 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.
24. Nationally consistent regulatory guidance should be adopted 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.
25. Clear nationally consistent regulations should be adopted for the role of fire authorities in the building certification and approval processes.
26. Mutual recognition between states and territories should be addressed so that professional registration requirements have national consistency.
27. All Professional Engineers Registration Schemes in the states and territories covering fire safety engineers should include requirements for PI insurance and sanctions, with requisite penalties for unsatisfactory performance, fraud or illegal practices.
28. Provisions should be introduced for referral of cases of unsatisfactory professional practice to the relevant professional body for investigation, assessment and reporting.
29. Governments should develop agreements with professional bodies to establish the roles of "assessment bodies" and a monitoring framework for accreditation as well as a shared and consistent framework of sanctions applied to malpractice.
30. Mandatory independent peer reviews should be adopted for 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.



Fire evacuation modelling by Warrington Fire.

GENERAL

It is essential to emphasise that the list of recommendations does not represent a set of optional actions from which government, professional bodies and educational institutions can pick and choose. The success of the overall framework depends on a concerted advancement in all aspects. Neglect of any of these recommendations can render the integrity of the process flawed.

7. Timelines for Actions and Recommendations

Arup's Adelaide Oval Redevelopment project implemented Performance Based Engineering.

No.	ACTION	WHO RESPONSIBLE?	TIMEFRAME FOR IMPLEMENTATION
1	Establish Australian Education Committee (AEC) for fire safety engineering – Develop cooperative education model	EA, SFS, WC, UQ	1 year
2	Develop pedagogy for FSE education courses	UQ, other universities	1 year
3	Develop/update education courses – new curricula	UQ, other universities	1-2 years
4	Funding support for FSE education	VBA, QBCC, NSW + EA, SFS, EA, UQ and industry	1 year
5	Education course accreditation by EA	UQ and universities	2 years
6	Ensure course graduates meet EA engineering registration requirements	UQ and universities	1 year
7	Education and training programs – bridging, short courses, CPD seminars	EA, SFS, EEA, UQ and universities	6 months to 2 years
8	Career development programs	EA, SFS, UQ and universities	1 year
9	EA/IFE to update competency requirements with new accreditation schemes	EA, IFE	1 year
10	EA and IFE to establish new competency assessment processes	EA, IFE	1-2 years

No.	ACTION	WHO RESPONSIBLE?	TIMEFRAME FOR IMPLEMENTATION
11	Establish new professional audit procedures	EA, IFE	1 year
12	Procedures for investigation of unsatisfactory professional performance	EA, IFE	1 year
13	EA and IFE – new guidance for applicants for accreditation	EA, IFE	1-2 years
14	Transition plan for re-registration	EA, IFE	1-2 years
15	New design guidance, practice notes for CPD	SFS, IFE	1 year
16	New assessment procedures for accreditation of university courses	EA, Unis	1 year
17	Nationally consistent Code of Practice and Code of Conduct	SFS, IFE	1 year
18	Long term career development strategy for FSEs	SFS, IFE, EA, Unis	1-2 years
19	Engage with insurers, brokers – approach to PI risk management	EA/SFS	1 year
20	New strategy for support of FSE education/ AEC	EA, IFE, Unis, governments, industry	6 months
21	Amend NCC, guidance to recognise practice by registered FSEs only	ABCB	1 year
22	New Professional Engineering Registration Schemes for fire safety engineers based on professional body competency assessments, including mutual recognition	All states and territories	1-3 years, depending on the jurisdiction
23	Regulations to require fire safety engineering work only by registered FSEs	All states and territories	1-3 years, depending on the jurisdiction
24	Regulations to include specific roles for FSEs from concept to handover	All states and territories	1-3 years, depending on the jurisdiction
25	Nationally consistent role for fire authorities	All states and territories	1-3 years, depending on the jurisdiction
26	Mutual recognition between governments based on nationally consistent registration requirements	All states and territories	1-3 years, depending on the jurisdiction
27	All registration schemes to include consistent Professional Indemnity insurance, sanctions	All states and territories	1-3 years, depending on the jurisdiction
28	Nationally consistent procedures for referral to professional bodies for unsatisfactory performance	All states and territories	1-3 years, depending on the jurisdiction
29	Nationally consistent basis for evaluation of professional “assessment bodies”	All states and territories	1-3 years, depending on the jurisdiction
30	Mandatory independent peer reviews	All states and territories	1-3 years, depending on the jurisdiction

In addition to the potential timeframes for implementation of these actions or recommendations, some of them will have to be sequential, depending on previous actions or actions of others. An optimised sequence for quick implementation to deliver the benefits being delivered to the Australian building and construction industry and for public safety must be facilitated and arranged among the universities, professional bodies, state and territory governments, and other industry parties.

It is also recognised that timeframes for some actions by states and territories to introduce registration of engineers, including fire safety engineers will vary, with licensing already in place in Queensland and Tasmania, legislation passed but not fully implemented in regulations in Victoria and NSW, and other actions being considered in other jurisdictions based on a national professional engineering registration policy being developed by the ABCB Implementation Team.

To update professional body registration assessment schemes by EA and IFE, it is recognised that IFE would have to work through their international IFE Registration Group and possibly the UK Engineering Council which might involve a longer duration compared with local adoption of new competencies and changes in assessment procedures by EA.

The University of Queensland fire testing team with a roaring blaze in the background!

8. Benefits and Beneficiaries

GENERAL

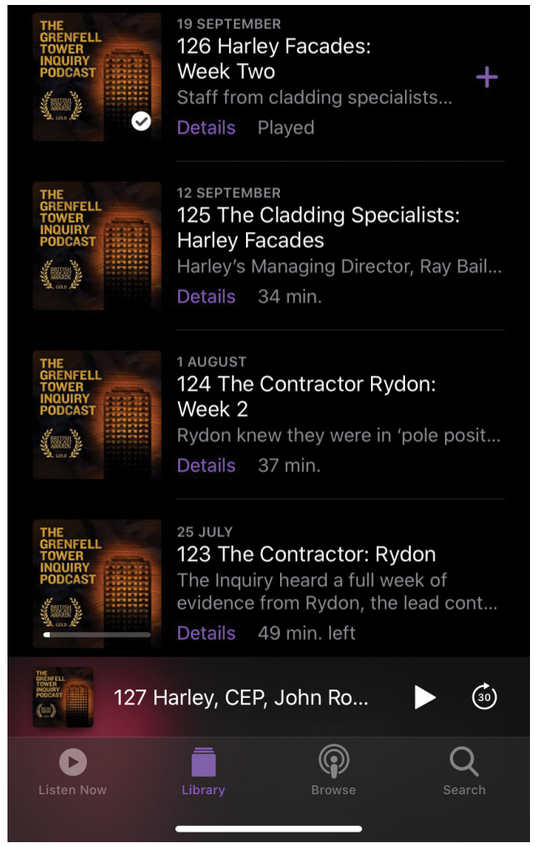
Fire safety engineering, when exercised to its full potential, is an enabling discipline. Stunning architectural visions have been delivered that would not have been possible without modern fire safety engineering. These include, for example, the “Birds Nest” Main Stadium and the Aquatic Centre built for the 2008 Beijing Olympics. Closer to home here in Australia, the Eureka Tower, Barangaroo, 1 Bligh Street, Adelaide Cricket Ground New Stand, and the Macquarie Bank building in Sydney are examples.

Yet, when not exercised to its full potential, the absence of fire safety engineering can be catastrophic. Nowhere recently has this been more starkly demonstrated than by the Grenfell Tower disaster in London. It is only attributable to the luck of timing that the Lacrosse fire in Melbourne’s Docklands did not result in similar tragedy, and the VCAT ruling in the Lacrosse fire litigation that awarded significant damages against the fire safety engineer serves to highlight the importance of turning fire safety engineering into a full and proper profession.

The implementation of this project’s recommendations will contribute to safer buildings in Australia. At no time is this more important than now, when the reaction of governments in response to the current COVID-19 crisis will be to fast track development projects to encourage economic growth.

This project contributes to the development of an industry, reinforcing the importance of professionalism in engineering and the need for consistent levels of competence. Registration and licensing of engineers throughout Australia to ensure only professional engineers undertake engineering work. This is consistent with the intent of the Victorian *Professional Engineers Registration Act 2019* and the NSW *Design and Building Practitioners Act 2020*.

Reinforcing the role of the competent professional in the design process will remove barriers to innovation. These barriers arise because of the current focus of fire safety codes and standards which favour



The BBC is broadcasting a weekly podcast summary of the ongoing Grenfell Tower Inquiry.

generalised solutions based on experience. The implementation of new materials and products is typically without the limits of applicability of these general solutions, and there is a tendency to try to shoehorn new materials into these rules. This often ignores the risks and hazards that new materials may introduce. The skilled professional engineer is not restricted to these generalised solutions and can competently address the technical safety hazards that new products and materials pose in the built environment.

This project strongly advocates for improved education capacity, to respond to the need for a greater number of degree exit level graduates entering the profession. Moves to implement this are already underway, promoting cooperative teaching models which will make the education required to enter the profession available throughout Australia, while sustainably growing a higher education discipline in engineering faculties nationally. Australia will emerge as a global leader in fire safety education.

Currently Australia is faced with a huge bill to both the public and private sectors as a result of inadequate fire safety consideration given to facades. More competent professionals will reduce the cost of this remediation. More competent professionals with an ability to identify the issues posed by changes to the materials and techniques used in the built environment will limit the potential future risk as developments in construction and materials move further away from the limits of applicability and suitability of existing codes and standards. The project's results mean that the risk posed by fire to the building stock of tomorrow will be significantly limited.

The project has uniquely collected and represented the input and opinion of a significant cross section of the fire engineering community. This project coordinated advocacy efforts from a wide number of volunteers yielding real impact. Effective advocacy efforts were undertaken to reach government officials and change their opinions to adopt the thinking that greater professional skills were a better antidote than increasingly restrictive codes and regulations. A true profession, versus a trade, is built upon a foundation of expertise and service to society.

In summary, as a result of the implementation of the recommendations of this Warren Centre research and this Final Report, the benefits for the Australian building and construction industry, for the quality and fire safety of buildings and their occupants, and for public health and safety more generally will include:

- Improved culture and ethics in the building design and construction industries
- Better quality buildings in terms of design and construction
- An optimised design process (cost, outcomes synergies, etc.)
- Improved safety of buildings for occupants, fire authorities and the general community
- Reduced fire risks and restored confidence by the insurance industry, thereby reducing premiums for Professional Indemnity and asset protection
- Better protection of people's investments in property
- Enhanced social equity and a fair market for all professionals involved in design and construction
- National consistency of regulations
- Avoidance of future fire safety "surprises".

SPECIFIC BENEFICIARIES AND BENEFITS

More specifically, these recommendations provide the major beneficiaries with the following:

- **Commonwealth Government**
  - A set of detailed nationally consistent recommendations and actions in relation to fire safety engineering for the ABCB Implementation Team as their specific response to the Shergold/Weir Building Confidence report.
  - A means of strengthening the NCC and other ABCB guidance in relation to fire safety practice and outcomes by mandating fire safety design and verification by registered professional fire safety engineers.
- **State and Territory Governments**
  - A set of detailed recommendations and actions in relation to fire safety engineering as the specific response of state and territory governments to the Shergold/Weir Building Confidence report.
  - Detailed support for legislation/regulation with regard to professional registration of engineers, including fire safety engineers.
  - Strengthened competencies and assessment procedures by the professional bodies on which to rely for their registration schemes.
  - Detailed recommendations with regard to the role of fire safety engineers that can go into regulation of practice that will lead to safer, better quality and more cost-effective buildings.
  - A strong basis to communicate to investors, the building and construction industry and property owners/occupants that change is occurring to rebuild trust and confidence.
  - A safeguard against future building fire safety and building quality "shocks" or "surprises"; more competent practice by fire safety engineers and others.
- **Professional Bodies (EA and IFE)**
  - A set of modern world's best practice competencies for fire safety engineering which to adopt into the National Engineers Register (NER) or equivalent for fire safety engineers.
  - Guidance on the means to assess fire safety engineering applicants seeking NER or equivalent accreditation, including the need for CPD.
  - Guidance of new best practice for fire safety engineering to incorporate into professional body practice notes, training courses and other CPD offerings by Engineers Australia and the Society of Fire Safety.
  - A strong basis for developing career structures and pathways which can be used in STEM education and careers publicity for fire safety engineers.

8. Benefits and Beneficiaries

- **Universities**
  - The basis of professional competencies required and the pedagogy to develop new and updated university courses for fire safety engineering.
  - A national organisation that can develop a cooperative model for fire safety engineering education in Australia which can produce the greater numbers of new and competent graduates needed by designers, fire authorities and the building and construction industry.
  - A governance structure for national coordination of fire safety education which provides the vehicle needed to seek and get government agreement to fund further fire safety engineering education and training in Australia.

- **Building Owners, Managers and Occupants**
  - Improved building design and construction with greater build quality and safety.
  - Assets which are more cost-effective to manage and maintain. Better value retention.
  - Increased understanding of building fire safety measures and evacuation/safety management procedures through the provision of a suitable fire safety manual for each building.

- **Designers, Construction Teams and Certifiers**
  - A clear definition of roles and responsibilities.
  - Provision of more competent fire safety engineers, with increased creative fire safety design skills, for more innovative and cost-effective designs, but with clear responsibility and accountability for meeting NCC Performance Requirements.
  - More competent fire safety engineers to assist with construction inspections, commissioning of fire safety systems, and greater confidence at the certifier step that the fire safety strategy has been followed through into construction and practical completion.

- **Professional Fire Safety Engineers**
  - A clear definition of roles and responsibilities.
  - A clear set of recommendations to improve education and training, improve competence, and enhance the recognition of fire safety engineers through professional registration.
  - A role for fire safety engineers totally aligned to the Shergold/Weir Building Confidence Report that emphasises the responsibility and accountability to deliver buildings with the required level of fire safety.
  - The basis for career pathways and the development of a true and proper profession for fire safety engineering.

- **Insurers, Brokers**
  - Professional recognition through education and competence, professional registration, and clear lines of responsibility and accountability that will reduce risks and claims through PI insurance for fire safety engineers.

Peter Johnson, Arup Fellow, presented findings from the preliminary Roles Report at the Warren Centre FSE conference in February 2020.

9. Advocacy and Implementation

Effective implementation requires the following organisations to execute the necessary changes to their legislation, regulations, education, training, guidance or processes. Alternatively, of necessity, they may be involved as part of the lobbying or advocacy group encouraging adoption of the suggested reforms:

- BMF/ABCB Implementation team
- State and Territory Governments
- AFAC + FRNSW, QFES, MFB, etc.
- Universities – UQ, WSU, VU, UoC (NZ) and others
- Engineers Australia (EA)
- EA/Society of Fire Safety (SFS)
- Institution of Fire Engineers (IFE)
- Society of Fire Protection Engineers (SFPE)
- Fire Protection Association, Australia (FPAA)
- Consult Australia (CA)
- Property Council of Australia (PCA)
- ICA/FM Global – insurers, brokers
- Underwriters Laboratories Inc (UL).

Based on this list, the organisations expected to change their requirements and actually implement the project recommendations, in many cases based on government/profession/industry partnerships, are as follows:

- ABCB - National Construction Code (NCC) and NCC education
- State and territory governments - Building regulations and registration schemes
- Universities - FSE education courses
- EA and IFE - Competencies and related accreditation requirements
- EA Society of Fire Safety - New codes of practice and guidance
- ICA, FM Global - Guidance from insurers, brokers.

Two possible options were considered by the project team for a coordinated advocacy program of reform in relation to fire safety engineering would be:

- A representative committee made up of a wide range of industry and professional bodies managed under the auspices of The Warren Centre to give the independent reputation and prestige of The Warren Centre and the University of Sydney, or
- A representative committee made up of a wide range of industry and professional bodies convened through Engineers Australia and with the Society of Fire Safety, which is logical given EA/SFS is the major representative body which champions the profession of fire safety engineering in Australia.

A true profession, versus a trade, is built upon a foundation of expertise and service to society.

9. Advocacy and Implementation

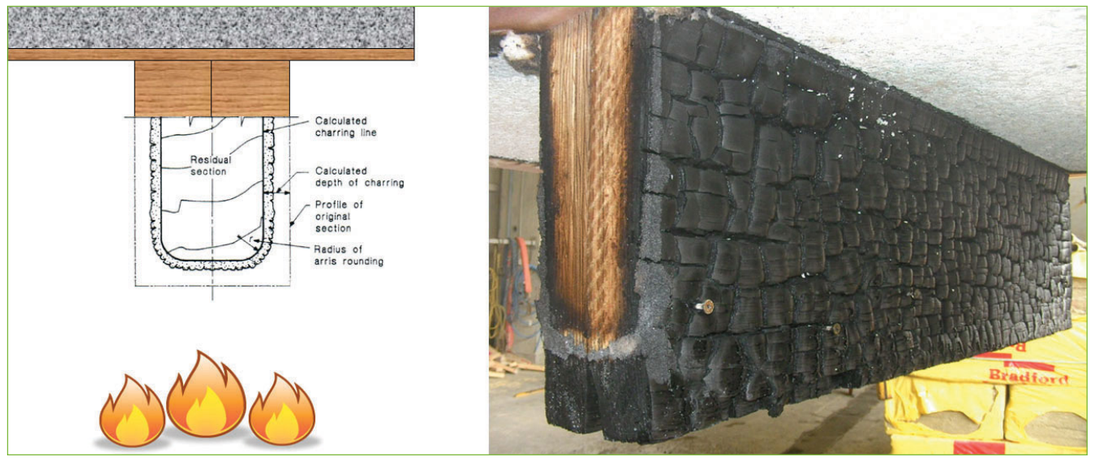
The consensus of professional and industry representatives is that this committee should be nationally constituted and come under the direction of Engineers Australia, which includes the Society of Fire Safety:

- A representative National Education Committee is also required to engage with local and federal governments to deliver targeted funding for the development of educational programs in Fire Safety Engineering. This should be funded with long term (10 years) seed money that should serve to jump start the creation of the profession. Programs should be expected to be self-sustained after that period.

This advocacy program would need to include:

- Direct engagement of elected officials, government policy officers and regulators at state, territory and Commonwealth government levels.
- Speaking engagements at conferences, industry events, and professional meetings across the major building and construction organisations.
- Papers and articles in the magazines and journals of a wide range of organisations of influence.
- Press releases, social media and other media messaging of the reform agenda and the benefits.

Charred timber examined after a fire test.



There is a wide body of fire safety technology.

10. Summary

FIRE SAFETY ENGINEERING IS IN GREAT NEED FOR REFORM. THE SHERGOLD/WEIR "BUILDING CONFIDENCE" REPORT AND THIS WARREN CENTRE ON "PROFESSIONALISATION OF FIRE SAFETY ENGINEERING" REPORT SERIES COINCIDES IN HIGHLIGHTING THE MANY WEAKNESS OF THE CURRENT FRAMEWORK. SIGNIFICANT EVIDENCE DEMONSTRATES THE NEGATIVE IMPACT FROM THE FLAWS OF THE CURRENT SYSTEM ON CONSTRUCTION IN AUSTRALIA. THE PUBLIC HAS THEREFORE LOST CONFIDENCE THAT THE CONSTRUCTION INDUSTRY CAN DELIVER A QUALITY AND SAFE PRODUCT.

This project responds to clear and well documented evidence of the key weaknesses of the current system. The resulting report series advances a new model and a path forward that includes a set of transitional measures that can guarantee a rapid and solid improvement. Evidence has been highlighted of the many benefits that this new framework can bring to all stakeholders.

At the core of the path forwards is a change of emphasis from regulating the process of delivering a fire safety strategy to regulating the practice of fire safety engineering and those who practice it. The underpinning regulatory framework, accreditation systems and competency framework required for reform have been described in detail.

The described path includes many steps involving government, industry, higher education institutions and professional bodies. This final report emphasises that these steps have to be considered as a whole. Unreflected omission of any of these individual elements can fully invalidate the entire framework. Evidence shows several cases where this has happened in the past.

Finally, a call for national consistency in the implementation of all aspects of this reform is emphasised by the report.

THANK YOU!

This project would not have been possible without the support of a large community of professional fire safety engineers, building professionals, professional fire fighters, public servants, and other supporting professionals. As sponsors, authors, reviewers, speakers and presenters in various forums and conferences, The Warren Centre and Sydney University formally acknowledge the following persons and organisations who contributed to this project and its success.

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Transitional Plan for Fire Safety Engineering - Report 8 of this Series

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THE WARREN CENTRE

THE UNIVERSITY OF SYDNEY

The Warren Centre hosted a kick off forum and two Fire Safety Engineering conferences during this project.