THE REGULATION OF ENGINEERS

Finding the right approach for a national economy.

National Engineering Registration Board

This report is prepared by the National Engineering Registration Board (NERB) in conjunction with Principled Public Relations and Public Affairs (PPRPA), and draws on significant work performed by Engineers Australia, and especially Leanne Hardwicke, Director National and International Policy and by Michael Bevan, Registrar of National Registers.

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1. Why this matters

Engineering services are vital to Australia's economic prosperity and its social well-being.

The benefits flowing to Australians from the success of the nation's mining and other wealth generating activities are underpinned by the significant contribution made to the establishment and operation of these industries by highly skilled engineering professionals. Similarly the design and delivery of critical infrastructure and major nation building projects depend on the application of engineering skills of the highest calibre.

Businesses and citizens look to engineers to provide the highest standards of quality and, above all, safety in the built environment. They also expect safety and reliability in the mechanical, electrical, medical, and electronic devices that enable them to work, play, travel, and remain healthy and secure. They are critical to manufacturing innovation and achieving a low carbon future through adaptation and the development of renewable energy. This is possible only in a society that has access to the services of engineering professionals in a diversity of disciplines who operate at the highest levels of competence and integrity.

Australia is fortunate to have a solid foundation of internationally respected engineering experience and expertise in its engineering firms, universities and professional associations. However, as Australia strives to become a seamless national economy with competition – internal and external – driving ongoing productivity growth, we believe the inconsistent legislation creates barriers and layers of red tape that hinder some of the most important service providers within the economy - engineers - need to be considered and addressed.

In much the same way that governments recognised the importance of providing a single market across all jurisdictions for the passage of vital services such as electricity in the late 1990s, we believe that the same consideration should be given to harmonising the regulation of Australian engineers in all States and Territories. This would serve as an important step in productivity reform in Australia.

This paper examines the way engineers are currently regulated in Australia and demonstrates the real and potential adverse impacts the existing regulatory framework has on public safety and on the productivity of engineers and how it is exacerbating the skill shortages with potentially negative implications for the national economy.

The paper seeks to identify whether a national registration system is optimal for the profession and if so, what the optimal model for engineering registration in Australia might be.

Ultimately, this is a decision for the Federal, State and Territory Governments drawing on their expert knowledge of their respective jurisdictions, and acting in the national interest. This paper seeks to inform those considerations.

2. The regulation of engineers in Australia and overseas

Currently there is no uniform regulatory regime covering engineers in Australia. Engineering services are regulated by a number of different Acts, regulations, by-laws and orders-in-council. Many of these relate to the building and construction industry.

- Queensland is the only State where engineers must be registered to provide professional engineering services.
- A number of other States have de facto registration systems, where engineers performing particular work must be registered on a national engineering register [1].

The National Engineering Registration Board (NERB) administers the voluntary registration of engineers and sets standards of competence.

This section provides background on the role of the NERB and the various regulatory regimes for engineers in Australia and overseas.

[1] *Mike Marley, 'Call for a national registration system for engineering practitioner', Civil Engineers Australia (July 2006), p. 32.*

2.1 Registration on voluntary national registers

The National Engineering Registration Board

The NERB is supported jointly by the Association of Consulting Engineers Australia (now Consult Australia), Engineers Australia, The Institute of Public Works Engineering, Australia (IPWEA) and the Association of Professional Engineers, Scientists and Managers, Australia (APESMA). The NERB has representation from all State and Territory governments, community organisations and professional associations. It supervises the operation of the following National Registers that are administered by Engineers Australia:

- National Professional Engineers Register (NPER)
- National Engineering Technologists Register (NETR)
- National Engineering Associates Register (NEAR).

The registers are administered to safeguard the community at no cost to government. The Australian Engineering Competency Standards, established by Engineers Australia on behalf of the profession in consultation with the NERB and other expert groups, are used as the basis for assessment of eligibility for inclusion on each of the registers.

National Professional Engineers Register (NPER)

NPER is the main vehicle for the registration of professional engineers in Australia. While registration on the NPER is voluntary for engineers, it is widely recognised by local authorities and most State and Territory governments. NPER has been included in regulations relating to the design, certification, and health and safety of buildings and building services. NPER also appears in other regulations relating to engineering practitioners, which include for example, coalmine health and safety and dam safety assessment.

- One of the shortcomings of reliance on a voluntary registration scheme is the inability to prevent unqualified or incompetent practitioners from offering or delivering engineering services. Declining registration or removing them from a mandatory register would address this shortcoming. As noted elsewhere in this paper this is best dealt with by a co-regulatory system of registration.

The requisite qualification for registration on NPER is a four-year engineering qualification accredited by Engineers Australia or equivalent. Applicants must also demonstrate that they are practising competently by satisfying the Australian Engineering Competency Standards Stage 2. Engineers with the required qualification and with sufficient practical experience (normally achieved under supervision from a more experienced engineer) apply for assessment at Stage 2 (experienced practitioners level) in the area of practice for which they are applying for registration. Evidence of competency must be based on work in the area of practice where registration on NPER is required.

Engineers can be registered on the National Professional Engineers Register without being members of Engineers Australia. However, members of Engineers Australia who have achieved current Chartered Professional Engineer (CPEng) status have demonstrated their competence at Stage 2 and may be required only to demonstrate competency within the area of practice for which they seek registration.

2.2 Australian State and Territory regulatory systems

Queensland – statutory requirements

As stated above, Queensland is the only Australian jurisdiction where engineers must be registered to provide professional engineering services unsupervised.

The *Professional Engineers Act 2002 (Qld)* prohibits persons who are not registered from offering or providing professional engineering services in Queensland. The only exception is for individuals who practise under the supervision of registered professional engineers.

The Board of Professional Engineers of Queensland administers the legislation. Professional engineers must be registered by the Board. Since amendments came into effect in July 2008, the Act has enabled the Board to operate cooperatively with the profession. The Board recommends to the Queensland Government the appointment of assessment entities to assess the qualifications and competencies of all applicants for registration. Engineers Australia, AusIMM and IFE are approved assessment entities. Engineers Australia assesses qualifications and competencies for this purpose by applying the same standards used for NPER (See 2.1 above).

- This arrangement is referred to as **co-regulation.**

New South Wales - Accreditation of Certifiers

Engineers wishing to issue construction, occupation, subdivision, compliance and complying development certificates under the *Environmental Planning and Assessment Act 1979 (NSW)* must be accredited by the Building Professionals Board under the *Building Professionals Act 2005 (NSW)*. Engineers who are registered on the NPER (see 2. 1 above) are taken to have satisfied all the specialty skills, specialty knowledge, specialty underpinning knowledge, specialty qualifications and experience requirements for the relevant accreditation statement and no further assessment of the applicant is required in relation to those requirements.

- This accreditation is limited and subordinates engineering accreditation under the largely building construction focussed Act, and does not deal with the wide range of engineering services which are on offer in the State apart from building construction.

Tasmania - Accreditation of building practitioners

The Tasmanian *Building Act 2000* provides for a system for the mandatory accreditation and insurance of building practitioners who are designers responsible for the design of buildings or the services in buildings. This covers architects, building designers, engineers and building services designers. It provides for the Director of Building Control to assess applicants for accreditation, ensure that the requirement for current insurance is met, and award accreditation certificates. The Accreditation Scheme is administered by a government body called Building Practitioner Accreditation (BPA). Engineers can be directly accredited when they are registered on the National Professional Engineers Register (NPER), and may also be accredited when they hold Chartered (CPEng) membership of Engineers Australia.

- Like New South Wales, regulation is limited to building construction.

Victorian Registration

The Victorian *Building Act 1993* requires most people who carry out or undertake work in the building industry to be registered as building practitioners with the Building Practitioners Board (BPB). Registered building practitioners are generally required to carry the appropriate insurance to provide consumers with adequate protection. The BPB registers individuals rather than companies or businesses. Engineers (civil/mechanical/electrical/fire safety) and draftspersons (building design – architectural, interior, services) require registration. To become registered with the BPB, engineers are required to have a university degree in engineering or another qualification that the BPB regards as equivalent, or a current certificate of registration from the National Professional Engineers Register. The engineer must understand laws relating to the building industry and be familiar with current engineering practices in their specific field. They must also have at least three years of practical experience to the satisfaction of the Board.

- Like New South Wales, this again is a limited model of registration within the operations of a purely building-focussed system.

South Australia

The South Australian Government does not directly regulate the engineering profession. The *Development Act 1993 (SA)* provides that registered certifiers and other building practitioners may rely on the advice of independent technical experts. For engineering, an independent technical expert is defined as a person having engineering qualifications that the relevant authority is satisfied with. A person can be loosely qualified to act as a technical expert on the basis of advice received from a relevant professional association or a relevant registration or accreditation authority.

Northern Territory

The *Building Act 2006 (NT)* requires the registration of building practitioners and certifying structural, hydraulic and mechanical engineers. Individuals or firms can apply for registration to the NT Building Practitioners Board. NPER registration and three years practical experience is required.

Western Australia

The proposed new WA Building Act will require building industry practitioners to be registered, including professional engineers, who may be registered under separate legislation, that certify compliance with relevant building standards and codes.

Australian Capital Territory

Under the *Construction Practitioners Act 1998 (ACT)* building certifiers must be registered with the Building, Electrical, and Plumbing Control section of the Department of Urban Services. Registration on NPER is sufficient for practitioners to achieve registration as a Principal Building Surveyor and as Plumbing Plan Certifiers.

Commonwealth

The Commonwealth Government has no requirements for registration of engineers working on Commonwealth materiel, land and buildings, though recent policy by the Defence Materiel Organisation has encouraged engineering staff to achieve Chartered (CPEng) Membership with Engineers Australia.

Summary

The Federation has an inconsistent and largely laissez-faire, self-regulatory set of regimes for engineering registration with little recourse for the consumer beyond normal common law protections afforded to all.

2.3 International models of registration[2]

At first glance, a variety of approaches have been adopted around the world for the regulation of engineers (Appendix A). Of the greatest significance is the pattern of assessment adopted almost universally for the registration or licensing of professional engineers. Each completes a university qualification, usually taking four or five years, gains a certain amount of experience working under the supervision of a more experienced engineer, usually more than three to four years, and then has to pass an assessment of competency in order to achieve registration.

University qualifications in engineering in many economies are accredited by independent professional associations; the most well-known of these is the Washington Accord, of which Engineers Australia is an inaugural signatory (Appendix A). Within the Accord, signatories monitor each other's accreditation systems on a six-yearly cycle to ensure that the standards of graduates remain consistent.

Parallel frameworks for accreditation of university qualifications in engineering exist in Europe and Asia which have the potential to produce graduate learning outcomes not greatly dissimilar from those monitored by the Washington Accord, though there are variations. Many professional associations also use some form of assessment mechanism to deal with engineers whose academic formation has been achieved through different pathways. In Australia, this is known as Stage 1 assessment. Elsewhere, Stage 1 is achieved through test by examination or an assessed technical assignment.

Following the period of supervised experience, normally with gradually increasing levels of responsibility for engineering work, graduate engineers submit to further assessment of their competence. In economies where a licence or registration is required for an engineer to practise independently, this second stage assessment usually takes the form of an examination or an assessment of competence through professional interview (PI), as is the case in Australia.

In economies where engineers are not required to register or hold a licence, legal instruments such as European Directives ensure that product standards are signed off by competent engineers.

Summary

While registration models within Australia are complex and inconsistent, it is apparent that many of Australia's trading partners and a number of like economies have in place a registration scheme, or at least protection of the term engineer or professional engineer or chartered engineer. This reflects the importance placed on the skills of an engineer and the place they hold in the economies of those countries. It also ensures that engineers who practise independently have the educational and experiential competencies to do so competently, and may have their practice restricted if they do not.

[2] Government of Western Australia and Engineers Australia, Discussion Paper: The Regulation of Engineers in Western Australia, Perth, June 2009, pp 42-45.

3. The strengths and weaknesses of registration systems

As outlined above, the engineering profession is currently regulated in a variety of different ways in Australia and internationally. This section examines the strengths and weaknesses of these different approaches in the context of a number of important principles. These include: safeguards to protect consumers and community safety, enhancing productivity and efficiency, and the need to address skills shortages.

For the purpose of this discussion, registration systems are broadly grouped into two categories: voluntary and statutory registration regimes.

3.1. Safeguards for consumers and the community

Consumer protection

In the absence of a statutory registration system for engineers, consumers are left to make their own investigations and judgements about the suitability of a particular engineer and their ability to complete the work required[3]. Determining who is a qualified engineer can be costly, particularly for consumers who do not use engineering services regularly. Although practitioners may pass on the costs they incur with statutory registration it should be expected that the costs of meeting registration requirements will be less than costs to consumers associated with making their own judgement. The costs of registration are discussed in more detail below.

The greatest risks to consumers result from engineering practitioners attempting to undertake work without adequate skills or competencies. The consequences can be costly in financial terms and catastrophic in human terms[4]. Risks to the purchasers of engineering services can include design and construction costs, litigation expenses, lost production and rectification costs. Furthermore, any deficiency in the engineering work completed may not become apparent for 10 or 20 years after the work has been performed[5].

A statutory registration system can aid the market by providing information to consumers on the education and experience levels of engineers. This enables consumers to make decisions that are more informed and can reduce the risks associated with choosing services based on price alone.

An unregulated environment can cause operational inefficiencies for industry. There have been instances where appropriately qualified and experienced engineers have not been engaged and, as a result, poor design has led to failure and environmental degradation. A requirement for the work to be completed by an appropriately qualified and competent engineering professional could prevent this type of failure[6]. It could also prevent more profound failures. For example, following tragic

[3] Government of Western Australia and Engineers Australia, p.10.
[4] Government of Western Australia and Engineers Australia, p.10.
[5] Government of Western Australia and Engineers Australia, p.10.

accidents within the Australian Defence Force such as the HMAS Westralia fire and the Sea King helicopter crash, improvements have been made by the ADF to the system by which the competence of engineering practitioners is assessed and authorisation is granted for the performance of designated activities[7].

Statutory processes for mandatory registration enable codes of practice to be published and uniformly enforced. They also provide robust mechanisms for the resolution of disputes and a system whereby registration can be revoked, suspended or conditions attached in the event of misconduct or incompetence. Statutory registration regimes can also provide for appropriate compensation processes.

- The current trend with Australian Standards is to move towards risk-based or performance-based codes. This increases the need for appropriately qualified and competent engineers to develop, interpret and comply with these standards, as well as the need for clear systems to protect consumers against unqualified or incompetent practitioners.

Public safety, health and welfare

Threats to public safety, health and welfare from the provision of engineering services by unqualified or incompetent persons have four elements, namely:

- Health – through such things as contaminated drinking water, 'sick' buildings, medical devices and other environmental incidents.
- Safety – through collapse of construction or mining works or through failure of hazardous services such as gas, electricity, petroleum or chemical process plants, or mechanical works.
- Property damage – where the effect is primarily measured in economic terms, and
- Of increasingly pressing and visible concern, environmental damage.

The consequences of engineering failure can be devastating. Incidents such as the Thredbo landslide, Longford Plant explosion, Lane Cove Tunnel collapse and the Canberra Hospital implosion all resulted from engineering issues. Overseas engineering failures such as the Gulf oil spill in the United States and coal mining disaster in New Zealand can create enormous economic and personal Cost.

A recent study on the causes of engineering failure by the Swiss Institute of Technology reported 800 cases of structural failure. These structural failures cost the lives of 504 people, injured 592 people and incurred millions of dollars' worth of damage to property. The study found that when an engineer was at fault, the failure could almost always be attributed to a lack of competency.[8]

- Statutory registration arrangements enable appropriate standards of competence to be set and assessed, and incompetent engineers to be removed from the system, thus protecting the public from harm. This is not possible under voluntary registration regimes. The ability to ensure engineering competence through assessment in Australia is currently limited by the ad-hoc State system, described above.

[6] *Government of Western Australia and Engineers Australia, p.12.*
[7] *Mike Marley, 'New Register for associates to be established, Engineers Australia (October 2008), p.39.*
[8] *Government of Western Australia and Engineers Australia, p.12.*

Performance standards for engineers

A national registration system will accelerate the introduction of a national performance standard for all engineers. A national performance standard, which focuses on how the engineer carries out and accomplishes an engineering task professionally, introduces an aspect of professionalism to engineering that is fundamental to other professions.

Recent research [9] indicates that the engineering profession's early moves to corporatization, the deskilling of the public sector of engineers and other such systemic issues have resulted in regular and preventable failures to deliver engineering services with commercially efficient and predictable outcomes. After a review of other professions operating in Australia and the engineering profession internationally, the research found that the adoption of a national performance standard for engineers is pivotal to:

- safeguarding consumers and the community because it requires a fully integrated "best for risk management" approach to be adopted by engineers;
- increasing productivity and efficiency because it promotes a more balanced, cost-effective working relationship between client and supplier, with the focus being on a "best for project" philosophy; and
- addressing skills shortage issues and increasing competition because it provides a systematic approach to the delivery of an engineering task, better enabling many small and medium engineering practices to engage more effectively in larger projects.

The other two facets of professionalism are ethical standards (moral framework) and competency standards (sufficiency of qualification and experience), both of which are well established in the engineering profession.

- Performance standards for engineering could be integrated within competency standards and an appropriate code of practice under a statutory registration system in order to improve the reliability of engineering services.

3.2 The impact of regulatory schemes on productivity and efficiency

As described above, engineers operating throughout Australia are currently covered by over a dozen Acts and regulations that contain various competency standards and processes for (mostly voluntary) registration. In addition, the regulatory and quasi-regulatory regimes maintained by local and State governments impose various performance-based standards. Engineers must work in accordance with these, or provide for certification by professional engineers or other persons with engineering qualifications. This creates complexity as well as added compliance costs.

A fundamental principle accepted since the 1990s has been that, to be successful, the Australian economy must function as a national economy, rather than one segmented by State boundaries which inhibit the flow of services, whether they be in electricity, gas, freight or the provision professional services or of labour. This trend to remove barriers to trade and competition between States and Territories follows an international trend towards easier passage of goods and services across international boundaries, as reflected by a variety of Free Trade agreements which have been enacted throughout the last 20 years.

In November 2008, the Council of Australian Governments (COAG) signed the National Partnership Agreement to Deliver a Seamless National Economy. The Agreement recognises that jurisdictional differences can make compliance with regulation

[9] *The Warren Centre at the University of Sydney, the PPIR Protocol – www.ppir.com.au*

costly and cumbersome. A program has been established to progressively harmonise regulations in order to make compliance more efficient for firms operating throughout the Australian economy. The 'seamless' national economy is being pursued across a number of trades and professions by COAG. For example, proposals for national arrangements to regulate the legal profession are well advanced[10]. These arrangements will not involve Commonwealth legislation. Instead it is proposed that model legislation will be enacted in all jurisdictions and a national regulator for the legal profession will be established.

- A similar scheme of uniform statutory registration for engineers would drive efficiencies for the entire system and improve productivity for engineers by reducing their compliance costs.
- Under a national scheme the non-productive time spent in preparing applications and the fees currently paid by engineers to various registration and other bodies around the country could be consolidated to cover one mandated registration process. This would also significantly reduce the current administrative burden for engineers of registering with various bodies in different jurisdictions and complying with a raft of different regulatory requirements.
- A nationally consistent statutory registration process would also provide the community and industry with a clear and simple process to assess engineers' qualifications, experience and competence.

3.3 Addressing skills shortages and mobility of trade

The skills shortage in relation to engineers in Australia is well documented. A survey of businesses employing engineers conducted in January 2008 by Engineers Australia indicated:

- 73 per cent of businesses reported skills shortages
- 80 per cent of businesses could not recruit the required skill set
- 82 per cent of businesses reported there were moderate to severe consequences of skills shortages, including monetary problems and project delays.[11]

Forecasts by leading industry professionals predict that over the next 10 years more than $500 billion will be spent on infrastructure projects in Australia. Such projects, in areas like road, rail, electricity, water and telecommunications, are expected to require significant engineering resources.[12] And Despite the Global Financial Crisis, demand for engineering services has remained high, particularly in the resource-rich States of Queensland and Western Australia. Australia is facing a shortage of some 20,000 engineers. This situation is exacerbated by the ageing nature of the profession. Almost 25% of the current membership of Engineers Australia is aged over 50.[13]

- Mobility of trade is a key issue for professionals, such as engineers.
- According to the Productivity Commission the current requirements for architects to register and pay a separate registration fee in each State and Territory they wish to practise in acts as a barrier to architects working across jurisdictions. The Productivity Commission recommended the development of a national register, based on mutual recognition principles, so that architects that satisfy the requirements in any one jurisdiction would automatically be permitted to practise in all jurisdictions within Australia.[14]

[10] McClelland, R (Attorney-General), 2010, National Legal Profession Reform Bill, Parliament House, Canberra, 21 April.
[11] http://www.eng.usyd.edu.au/gse/mpe/shortage.shtml
[12] http://www.eng.usyd.edu.au/gse/mpe/shortage.shtml
[13] Data provided by Engineers Australia
[14] Productivity Commission, Annual Review of Regulatory Burdens on Business: Business and Consumer Services, Australian Government, Canberra, August 2010, p.135.

Similarly, ensuring engineers have mobility of trade through a nationally consistent statutory registration process could help to reduce skills shortages where they are most needed. A national system for registration that ensures there is portability of the profession across jurisdictions would allow professional labour to flow freely across borders and respond to demand without having to comply with the different requirements in each jurisdiction. It would also ensure that, as different parts of the Australian economy grow, engineers would be able to travel to meet demand without added compliance costs.

- The engineering profession cooperating with statutory registration boards will achieve consistency and mobility through co-regulation.

Trades and other professions draw their livelihoods from the foundations that are laid by competent engineering and the profession continues to be in great demand in Australia's resilient economy. A lack of available labour in key areas is becoming an increasingly pressing issue. A lack of supply of engineers would produce a 'bottleneck' for employment opportunities.

- The greater status or community standing derived from a statutory system of competence-based registration will give the engineering profession a stronger identity, serve to attract aspiring students into the profession and help address the current skills shortage.

Facilitating International Mobility

A national statutory registration process would also assist engineers to have international mobility and could help to integrate engineers from overseas. Australia currently participates in six multilateral international agreements governing mutual recognition of engineering qualifications and professional competence. These include:

- Three agreements covering mutual recognition in respect of tertiary level qualifications in engineering, i.e. the Washington Accord, Sydney Accord and Dublin Accord
- Three agreements covering competence for independent practice by engineering practitioners, i.e. APEC Engineer Framework of Substantial Equivalence, Engineers Mobility Forum Agreement and Engineering Technologists Mobility Forum Agreement.

Engineers Australia is also party to several bilateral agreements that help members achieve recognition in countries such as Canada, Texas (USA), UK, Ireland, Malaysia and Japan and vice versa. New Zealand Engineers who are registered under the *Chartered Professional Engineers Act (2002)* NZ would also be recognised in Australia through arrangements with the proposed statutory registers under the *Trans-Tasman Mutual Recognition Act* (Cmwth).

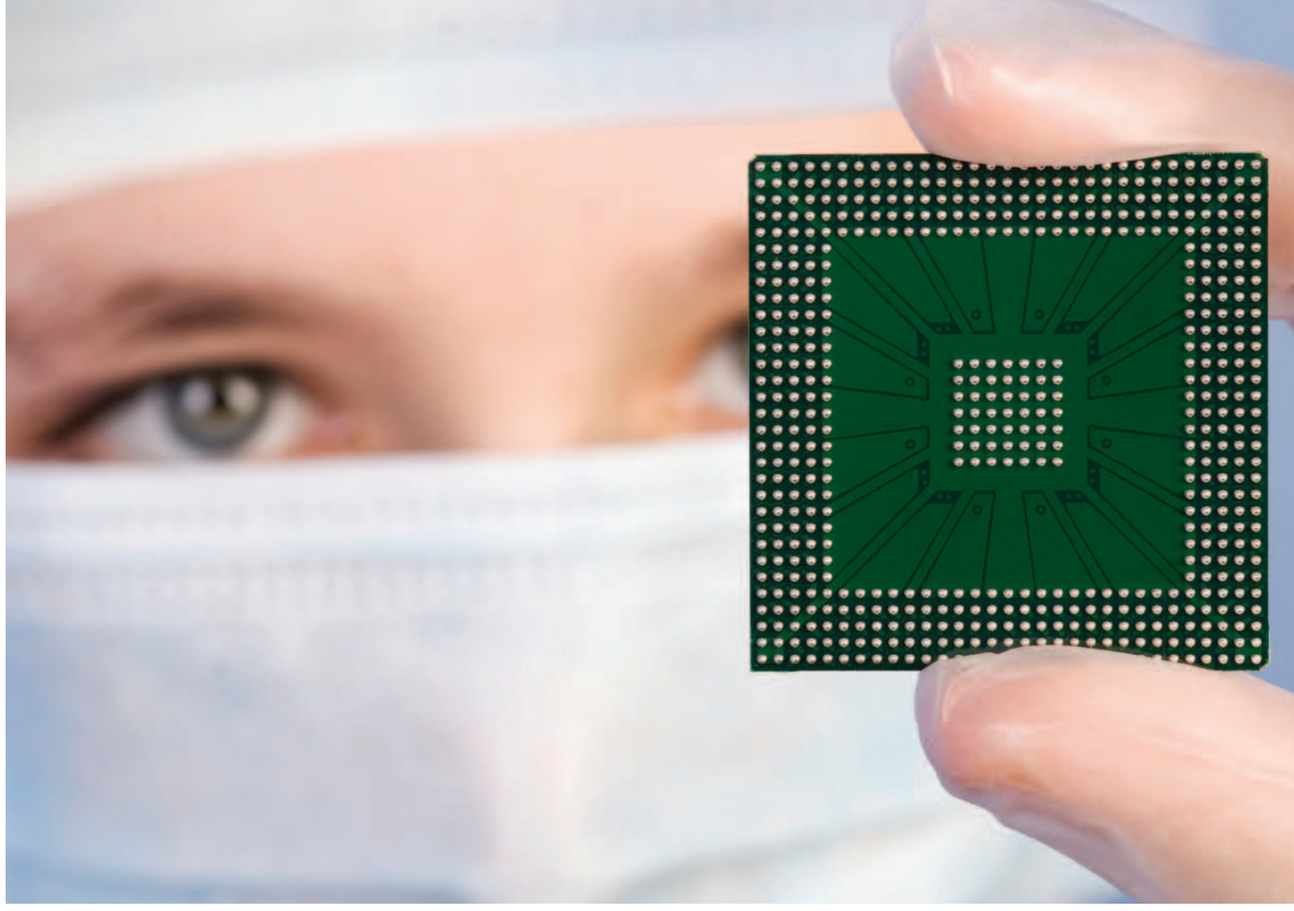
- Development of a statutory national registration system would allow the profession to more easily access international markets where registration is essential. It would also provide a framework within which engineers coming to Australia from overseas could be assessed and recognised more easily where they are appropriately qualified and competent. This would be a further way to address the skills shortage in Australia while ensuring high standards of competence. It would also facilitate an improvement in our export income from engineering services.

It should be noted that recognised standards of practice are essential for trading in accordance with the World Trade Organisation trade and services obligations, and under bilateral free trade agreements. Many of Australia's trading partners, such as Japan, Malaysia, Korea, the United States, China and Singapore, have statutory registration for engineers, and place faith in a

legislated, comprehensive registration system. In many countries, engineering is seen as a critical profession whose practitioners should be recognised and registered by government. A statutory registration system built on the profession's own accreditation of qualifications and competency-based assessment of experience could provide Australia a competitive edge in this context.

Summary

A national registration system will accelerate the introduction of a national performance standard for all engineers. It will improve safeguards to protect consumers and community safety by enabling codes of practice to be published and uniformly enforced, and establishing mechanisms for the resolution of disputes and appropriate compensation processes. Uniform statutory registration for engineers would drive efficiencies for the entire system and improve productivity for engineers consistent with the COAG reform agenda, and help to reduce skills shortages where they are most needed.



4. Registration of engineers – an optimal model

The previous discussion highlighted the many benefits of a statutory registration system for engineers and the need for national consistency in this area to improve professional mobility and productivity in the Australian economy.

This section examines the elements and merits of different models for the registration of engineers, as well as the most appropriate way to achieve a nationally consistent scheme. This section also recommends an optimal registration model.

4.1 Regulatory models – the options

Status quo

The current registration system is ad hoc and largely voluntary. There is no restriction on the use of the title of engineer. This means services may be provided by practitioners without appropriate competencies and with disregard to performance standards.

As engineers are responsible for major infrastructure projects of wide public import (dams, bridges, roads, power stations, manufacturing plants and mining projects as just some examples), the integrity of buildings, structures and various medical and consumer items, many people other than the initial purchaser of the engineering service are affected by poor work. Public safety may also be adversely impacted in an unregulated system.

Under a voluntary, or unregulated, model there is no way to eliminate unqualified or incompetent engineers from the system or those who are found guilty of misconduct. An unregulated system may also diminish the professional status of engineers and detract from the quality of applicants and graduates in training institutions. Over time this may also reduce the standard of professional engineering services delivered in the community. [15]

Co-regulation

Under a co-regulatory model for the registration of engineers, the qualifications, competencies and performance standards required for registration are assessed by professional associations accredited by a statutory authority or similar body 'the authority', which is recognised by legislation. Government is responsible for administering legislation, including the authorisation of professional associations and taking disciplinary action where misconduct or incompetence is identified through the auspices of the authority.

This arrangement helps to ensure high standards in competency and performance assessment.

Authorised professional associations would be expected to require registered engineers to undertake continuing professional development to maintain and develop their skills, as is the current practice of professional associations, ensuring continued contemporary competence.

Under co-regulation, the profession itself is responsible for the accreditation of university programs and the development and application of competency standards. Professional associations are well suited to staying abreast of market changes across the full spectrum of present and emerging engineering disciplines and are well placed to tailor assessment processes.

There are two approaches that may be taken to define who must be registered.

On the one hand, legislation would establish a statutory register, based on the profession's input. Such legislation would then need to be referenced through amendment of other legislative instruments that regulate engineering services that affect public safety, health and welfare, such as regulatory approvals for plant, mines or buildings. The associated start-up costs for this option obviously must provide for significant legal drafting effort.

On the other hand, registration legislation would apply to all persons who perform engineering services unsupervised, and include a high-level, generic definition of the engineering services only a registered engineer can provide. **This is our recommended model.**

It is important when considering which model to adopt to consider the primary goals of improved consumer protection and safeguarding community welfare, health and safety and environmental outcomes. It is clear that the inclusion of all persons who provide an engineering service unsupervised provides the community with a reliable outcome and also assists all stakeholders,

[15] Department of Public Works, Professional Engineers NCP Review, Final Report, Queensland Government, Brisbane, February 2000, p.14.

whether consumers or producers of engineering services, with a common and shared understanding of the requirements of registration.

The preferred inclusive system is expected to be less costly and resource intensive to implement and administer, both for governments amending legislation and for companies and individuals. Thus a secondary goal of reduced regulatory burden is achieved.

Mandated regulated system

This option is similar to co-regulation but has a greater focus on the structure and responsibilities of the board that regulates the profession. Under this model the government's regulatory role is provided through the board structure, for example the Legal Practitioners Board. The board may comprise representatives of the industry and other relevant professionals and could draw in industry expertise as necessary.

In this model the statutory board is given responsibility for establishing and applying criteria for the qualifications and competencies required for registration. Professional associations do not have a direct role in the registration process, but may help to establish standards of professional practice.

The mandated regulated system lends itself to the same alternatives to the definition of who needs to be registered, as offered under the co-regulatory model.

This approach to the regulation of the profession has less flexibility than under co-regulation and will be less responsive to professional trends.

- A mandatory regulated system was replaced in Queensland when amendments to the *Professional Engineers Act 2002* (QLD) came into force in July 2008, establishing co-regulation.

Hybrid model

This is a combination of various aspects of co-regulation and a mandated regulated system, described above.

Federal model

A federated model for the regulation of the engineering profession would involve a central Board with a moderate bureaucracy and require much smaller registration units in each State and Territory. A "centralist" model would require adoption by each State and Territory Government, much as the Building Code of Australia is adopted into building regulation in each jurisdiction. Obviously, complaints handling, investigation and disciplinary action would have to be done locally, each in accordance with the prevailing judicial system. However, the attraction of a federal system is that it could leverage from the current National Professional Engineers Register which is well recognised in all jurisdictions. A federal model could also be based on co-regulation or a mandated regulated system as above, with the similar alternatives to the definition of who needs to be registered. There are obvious economies of scale with a federated model that must be examined in a quantitative economic analysis.

4.2 Achieving a national scheme

There are clear benefits of a statutory scheme of registration for engineers administered through a co-regulatory model. As highlighted earlier in this paper, the greatest regulatory efficiencies can be achieved through a nationally uniform scheme, with a built-in provision that registration in one jurisdiction would legitimise practice in all Australian jurisdictions. Such a scheme would avoid the cost and complexity of different compliance requirements in different jurisdictions.

Commonwealth legislation providing for a federal model is highly unlikely for a number of reasons. The Commonwealth has limited powers under the Australian Constitution to legislate in this area. The only relevant constitutional power is the corporations power, which may not be an appropriate vehicle for national legislation of this nature. Changing the Australian Constitution is extremely difficult and can only occur by referendum. Without constitutional change, a federal model would require the States to refer their powers to regulate the profession under section 51 (xxxvii) of the Constitution, and is also unlikely to happen.

Another way to introduce nationally consistent laws is through mirror legislation: where one State introduces legislation and all the other States adopt it in full. In relation to trades, template legislation to be adopted by different jurisdictions is generally proposed by COAG. However, it can be difficult to achieve absolute agreement between jurisdictions. To address this issue COAG has developed a process whereby it sets guidelines in particular areas of regulatory reform and requires each State to report back on how it is achieving consistency with the guidelines. These processes present potential options to pursue nationally consistent statutory registration laws for engineers.

4.3 The recommended model

Based on analysis of the issues facing the engineering profession, a proposed optimal model for the statutory registration of engineers in Australia has been developed and is set out below.

A nationally consistent *Engineers Act* introduced in each State and Territory with mutual recognition governing the registration of professional engineers. The model legislation would:

- require registration of engineers offering engineering services (excludes graduates working under supervision)
- restrict the title 'registered engineer' to those engineers who are on the register
- require mandatory professional development for ongoing registration
- set up a framework for the operation of a board and a register of engineers
- set criteria for approving assessment entities.

State and Territory Registration Boards would be established that:

- are appointed by the responsible Minister
- set and determine 'fitness to practice' criteria for registration and maintain the register
- approve assessment entities and have regard for assessment outcomes determined by the assessment entity
- monitor compliance with the Act, accept and investigate complaints, and prosecute persons in breach of the Act.

Under the legislation, the State and Territory Registration Boards would approve assessment schemes and authorise assessment entities to:

- conduct the assessment of applicants against approved qualifications criteria and national competency and performance standards
- develop and disseminate appropriate standards of professional practice
- audit compliance with ongoing registration requirements
- report periodically to the Registration Board/Committee on its performance of assessment.

Complaints and disciplinary boards/tribunals could be established that:

- operate within each State or Territory judicial system
- comprise members with some expertise in engineering matters
- hear disciplinary actions against practitioners and imposes sanctions and penalties
- take action against unregistered practitioners.

The National Engineering Registration Board would have a continuing role and would continue to offer registration based on assessment against approved qualifications criteria, national engineering competency and performance standards and ongoing professional development requirements. It would also assist with national consistency of engineering regulation.
This model is designed to:

- improve risk management and consumer protection
- enhance the skills and status of engineers while also building community awareness of the engineering skills required to protect community safety, health and welfare
- enhance public safety and ensure that qualified and competent professionals observe statutory codes of practice
- deliver greater efficiency by cutting red tape via consistent legislation and allowing engineers to register just once to practise across Australia.
- address skills shortages and enhance professional mobility

Summary

The recommended model would see a nationally consistent Engineers Act introduced in each State and Territory with mutual recognition governing the registration of professional engineers; State and Territory Registration Boards with assessment, competency and performance standards development and compliance responsibilities; and complaints and disciplinary boards/tribunals for consumer protection.

5. The cost of establishing a statutory national registration model

While detailed costs have not yet been quantified, a single national registration scheme is expected to be less costly than the current system, with its myriad of different registration requirements. One scheme would drive efficiencies for the entire profession and improve productivity for engineers, while also driving efficiencies for employers. This section discusses the costs of a national statutory registration system in more detail.

It is sometimes argued that registration regimes increase the cost of services while reducing the choice of service providers. This is based on the assumption that a registration system increases the cost of services to the consumer because it limits the number of potential providers by entry restrictions, and increases costs for engineering companies by requiring them to pay registration fees. This view clearly fails to take into account the substantial costs to the national economy and the community incurred as a result of the delivery of substandard services when inadequately qualified or incompetent practitioners are able to provide such services. It also fails to recognise the existence of ad hoc registration systems that add costs to all engineering practices that operate across jurisdictional boundaries.

Although registration may limit the number of providers by excluding the unqualified and incompetent, it does not necessarily reduce competition. Anecdotal evidence suggests that there is robust competition between competent providers.

In the case of increased costs for engineering companies, registration fees are minimal and responsible firms already hold professional indemnity insurance as part of good business practice. The increased costs of engineering services must be weighed against the cost to the community of substandard services. The costs for engineering companies also include the unproductive time spent by skilled professionals in preparing applications for registration when employers wish to use their services interstate.

PriceWaterhouseCoopers conducted a National Competition Policy review of the *Professional Engineers Act 1998* (Qld), which requires registration of engineers.[18] This review assessed a number of regulatory options to identify the incremental costs and benefits of each model, as well as their consistency with key policy objectives. These objectives were:

- protecting the health and safety of the community by ensuring that only competent persons provide professional engineering services

[18] Department of Public Works, Professional Engineers NCP Review, Final Report, Queensland Government, Brisbane, February 2000.

- providing a means of distinguishing those persons who have achieved competency in the provision of professional engineering services
- ensuring accountability of professional engineers by providing for independent disciplinary processes

The study found that a deregulated model revealed an incremental net cost, compared with the scheme in Queensland that requires registration of engineers. In addition, the study indicated that a deregulated model did not meet the policy objectives, set out above.[19]

The study also found that a co-regulatory approach offered the greatest incremental net benefit, in addition to slightly better compliance with policy objectives. The overall net benefit was primarily expected to accrue from the involvement of professional associations (in the competency assessment process) who should be better in touch with industry developments than the Board of Professional Engineers of Queensland. The co-regulatory approach would thereby provide greater assurance of the competency of registered engineers and reduce risk of physical and financial harm to consumers.[20]

The study noted that the co-regulatory model is not considered more restrictive than the status quo in other States. This is because although other States do not have registration-specific legislation, they do regulate the practices of engineering through associated legislation.[21]

Summary

It is expected that a national statutory system of registration for engineers, adopting a co-regulatory model, will greatly reduce compliance costs, and deliver a net benefit to the industry and the broader community.

[19] Department of Public Works, Professional Engineers NCP Review, Final Report, Queensland Government, Brisbane, February 2000, p.19.
[20] Department of Public Works, Professional Engineers NCP Review, Final Report, Queensland Government, Brisbane, February 2000, p.19.
[21] Department of Public Works, Professional Engineers NCP Review, Final Report, Queensland Government, Brisbane, February 2000, p.19.

6. Conclusion

Engineers play a key role in our economy and provide crucial skills and services that impact on our day to day lives. Like other professionals, engineers have a high degree of responsibility and liability imposed on them by courts and regulators. Many other professions and trades with similar or lesser levels of community responsibility already have a statutory registration system.

Australian Governments – through COAG – are developing national systems for trade and professional qualifications. A profession as important as engineering should undergo a similar process. Such a scheme would also reduce the current costs of doing business for both engineers and industry by simplifying compliance requirements and removing red tape.

There is a set of standards and skills that are expected from engineers. These are well established through Engineers Australia's accreditation of engineering programs delivered by Australian Universities and the Australian Engineering Competency Standards Stage 2 as applied to the National Professional Engineers Register. A national statutory registration system is an appropriate mechanism for identifying engineers with such skills, ensuring these standards and skills are well maintained and for dealing with engineers who fail to meet those standards and skills.

Many of Australia's trading partners have statutory registration of engineers and place faith in a statutory based comprehensive registration system. Registration in the country of origin usually facilitates registration in other countries and a national scheme will support this.

Most importantly, a statutory national scheme of registration would help to protect public safety, health and welfare. It would provide information for consumers and protect the community from unethical practitioners. Such a scheme would also make it less costly for all engineers to work throughout Australia and help to address the current skills shortage.

Registration and licensing of engineers internationally

The following table summarises the approach taken to registration or licensing engineers in many of Australia's chief trading partners:

Economy	Permit to Practise	Stage 1	Professional Formation	Stage 2	Ongoing Monitoring
Canada	Licence	Washington Accord	Engineer in Training	Examination	None
New Zealand	Protected title of CPEng	Washington Accord	Supervision	Competency demonstration	Periodic reassessment
USA	Licence	WA plus Examination	Supervision	Examination	None
United Kingdom	Protected title of CEng	Washington Accord	Supervision	Professional review with PI	CPD not audited
Korea	Consulting Engineer	Examination	Not specified	Examination	None
Japan	Consulting Engineer	Examination	Not specified	Examination	None
Malaysia	Registration by BEM	Washington Accord	Supervision	Professional review with PI	CPD not audited
Germany	Protected title Ingenieur	University	None	None	none

Canada

Engineering in Canada is regulated by self-governing professional licensing bodies at the provincial and territorial level. The 12 licensing bodies ensure high standards of engineering practice and education in Canada. They also take appropriate action to prevent the illegal practice of engineering by unlicensed individuals. Each licensing body's mandate is created by a specific Engineering Act. The Canadian Council of Professional Engineers (Engineers Canada) promotes consistency in educational and experiential standards for admission to the profession and licensure.

New Zealand

Engineers are registered under the Chartered Professional Engineers of New Zealand Act 2002. Under the Act engineers must demonstrate regularly (every five years, or more frequently) that they are still able to practise competently to retain registration. The Act also enables complaints about the performance of engineering services or in respect of unethical behaviour to be investigated by the registration authority.

United States of America

While there is no protection of the title of 'engineer' in the USA, or any national register, there is a system of licensing of engineers that is run by individual States. A licence is issued to engineers that can pass examinations in the fundamentals of engineering (written soon after graduation) and engineering principles and practice (written after some years of experience under supervision). Of the two million or so graduate engineers, only about 400,000 are licensed. A licence is required only for a restricted number of activities: for example, signing off certain design drawings.

United Kingdom

In the UK the Engineering Council is formally recognised by government through a memorandum of understanding. To be eligible for registration with the Council, an individual must first obtain membership with a Council nominated engineering institution who in turn will nominate the person for registration with the Council.

Registration with the Council requires completion of an approved engineering course, a requisite period of practical experience and a minimum age requirement. The Council licenses its member institutions to assess and accredit academic programs at universities and colleges and to assess the practical experience of Members for the award of Chartered Engineer (CEng) status.

Korea

Registration is required for practising engineers in Korea. Requirements for registration include successful completion of professional engineering tests at two stages in an engineer's career. The pass rate for the exam is 12 per cent. Prior to sitting the exam the candidate must meet requirements for practical experience dependent on his or her initial qualification.

Japan

In Japan, professional engineers are registered under two separate legal frameworks; one regulates engineers working with infrastructure and the other regulates engineers in all other sectors such as manufacturing, chemical processing, aerospace, naval architecture, electrical, electronics and computing. Registration or licensure is essential for the former. The latter is

dominated by large industry and registration is not mandatory. In Japan registration is also achieved through the successful completion of professional engineering tests at two stages.

Germany

Germany's 16 Länder regulate who is allowed to use the title Ingenieur. This title may be used by science and engineering graduates from German universities, universities of applied science, or an equivalent private engineering college. The unauthorised use of the title is an offence. Apart from certain specialist activities, mostly in construction, there is no requirement for postgraduate experience and no register of qualified engineers.

Greece

The Technical Chamber of Greece administers the register of all qualified engineers. Registration is a prerequisite for practice in the engineering profession in Greece. The basic engineering qualification in Greece is a five-year course and the title is protected by law.

Washington Accord

The following economies and nominee professional associations are signatories to the Washington Accord in addition to Engineers Australia:

Canada	The Canadian Accreditation Board of the Canadian Council of Professional Engineers www.engineerscanada.ca
Hong Kong SAR	The Hong Kong Institution of Engineers www.hkie.org.hk
Ireland	The Institution of Engineers of Ireland www.iei.ie
Malaysia	Board of Engineers Malaysia www.bem.org.my
New Zealand	The Institution of Professional Engineers, New Zealand www.ipenz.org.nz
South Africa	The Engineering Council of South Africa www.ecsa.co.za
South Korea	Accreditation Board for Engineering Education for Korea www.abeek.or.kr
Taiwan	Institute of Engineering Education Taiwan www.ieet.org.tw
Japan	Japan Accreditation Board for Engineering Education www.jabee.org
Singapore	The Institution of Engineers Singapore www.ies.org.sg
United Kingdom	The Engineering Council of the UK www.engc.org.uk
United States of America	The Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology www.abet.org

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