The time has come to create an Australian engineering profession that delivers to the highest technical standards and is equipped for a digital future. It is through consistency of standards, quality and a data mandate that the profession will be in a position to efficiently deliver the planned infrastructure project pipeline of $100 billion over the next decade.

This would ensure that every Australian engineer working across the disciplines of civil, mechanical, electrical, structural, environmental and fire safety have demonstrated their competency, achieved the appropriate professional experience and qualifications and hold the appropriate level of insurance to operate.

AECOM also requests a clear and consistent data mandate for all major government construction projects with an estimated capital cost of $100 million or more to be part of the first phase, gradually reducing the value over time to capture all projects as the industry’s digital capability becomes embedded.

As a country that is constrained by the availability of talent and skilled labour in key areas, digital engineering can help to increase productivity and reduce waste, allowing the industry to deliver more with less.
With projects and employees in every state and territory, AECOM provides over $650 million (FY17) worth of design and consulting services per annum to the economy and over $300 million specifically in support of government projects.

It is through an engineer’s role as custodians of essential services, such as water, waste, transit infrastructure and the safety and comfort of where we live, work and play, that they play such a critical role in society.

It is our view that engineers are the first providers, without whom we would not have safe roads, buildings, public transit, reliable energy or clean water. However, unlike professions like law and medicine, there is currently no national provision to regulate engineering as a profession.

Currently in Australia, this huge responsibility is being undermined by an inconsistent and confusing approach to governance and professional accreditation of engineers.

AECOM recognises and supports the efforts by Engineers Australia in developing and administering the National Engineering Register (NER) to develop state-based standards and registration schemes.

However, now the time has come for a co-ordinated national approach that brings together the federal government and the Australian states and territories through the Council of Australian Governments (COAG), to ensure accountability and consistency across Australia.

To provide confidence to everyone involved in procuring engineering services that they can expect engineers to operate at the appropriate level and adhere to a standard, national approach to quality, AECOM suggests three significant issues require attention during the next term of parliament.
## ISSUES

### NO SINGLE NATIONAL REGISTRATION SCHEME FOR PROFESSIONAL ENGINEERS

- **RISK**: Anyone can operate as an engineer in every Australian state and territory apart from Queensland.

- **PROPOSED SOLUTION**: National mandatory registration similar to the existing Queensland scheme and the one currently under consideration by the Victorian state government, which requires civil, structural, fire safety, electrical or mechanical engineers to be registered.

### NO CONSISTENT NATIONAL LEGISLATIVE REQUIREMENT FOR ENGINEERS TO BE USED ON PUBLIC OR PRIVATE CONSTRUCTION PROJECTS

- **RISK**: Concerns over the quality of technical designs if no professional engineer is involved in all phases of a project.

- **PROPOSED SOLUTION**: Mandate that only Chartered Engineers are capable of certifying the designs for all projects.

### NO ENGINEERING DATA MANDATE

- **RISK**: Failing to capture the data throughout the design and construction phase in a standard way leads to higher operational costs, limits innovation and is a handbrake on potential productivity gains.

- **PROPOSED SOLUTION**: Data capture mandate for all government projects to create a live digital model for all assets supported by ISO19650 standard.
In many other countries, including New Zealand, Canada, Singapore and Japan, all engineers are required to be registered and meet certain competency and educational standards to maintain a licence to operate. In addition to a comprehensive registration scheme, these countries have a stronger enforcement of the regulation surrounding the practice of engineering.

AECOM RECOMMENDS THE NEXT FEDERAL GOVERNMENT WORK WITH STATES AND TERRITORIES TO:

1. MANDATE A NATIONAL PROFESSIONAL REGISTRATION SCHEME FOR ALL ENGINEERS PRACTISING IN AUSTRALIA.

2. NATIONAL LEGISLATIVE REQUIREMENT FOR REGISTERED ENGINEERS TO BE USED ON ALL GOVERNMENT PROJECTS AND LARGE PRIVATE PROJECTS.

3. ONE DATA STANDARD TO GOVERN THE AUSTRALIAN ENGINEERING AND CONSTRUCTION INDUSTRY.
REGISTRATION MUST BE NATIONAL

The term ‘engineer’, and the training, experience and proven professional competence it entails does not have national statutory protection in Australia. Currently, Queensland is the only state or territory with a comprehensive registration scheme for engineers.

Queensland has a certification and registration system operated by the Board of Professional Engineers of Queensland (BPEQ) to ensure that only registered professionals can use the term ‘engineers’, but that is obviously only effective in that state. It is thought that Victoria will soon follow Queensland’s lead, with the introduction of a state-wide mandatory registration system for engineers providing professional services in Victoria.

In some states, the building industry has specific registration schemes in place. However, they only apply to those engineers operating in that sector and it’s inconsistent across the states and territories.

It is our view that this inconsistent approach to certification and registration is leading to the following impacts:

**THE EROSION OF TRUST** State-by-state standards for engineering and construction lead to inconsistent quality and allow for rogue operators to erode the public’s trust in the engineering profession.

**REACTIONARY DESIGN BY DISASTER** Without a robust framework surrounding engineering, only another catastrophic failure can expose the inherent weaknesses of substandard engineering.

**HOLDING BACK DIGITAL INVESTMENT** Inconsistency undermines the business case for investment in digital engineering tools, which creates a barrier to productivity enhancements.

**REDUCED COMPETITION** It creates fragmented and less-attractive markets for those considering entering the Australian market.

**WORKFORCE IMPLICATIONS** Labour mobility is hampered as markets experience peaks and troughs of demand.

**CURRENT APPROACH TO REGISTRATION**

Below is a short summary of the current myriad of registration systems for engineers:

- **ACT**: The Australian Capital Territory currently does not require engineers, including those in the building industry, to be registered, accredited or licensed.
- **NSW**: In NSW, only some engineering disciplines, for example fire safety, require an accreditation, but not all practitioners are necessarily registered engineers.
- **NT**: In the Northern Territory, only some (but not all) engineers, such as fire engineers, are required to be registered or licensed.
- **QLD**: Queensland’s legislation requires engineers, including those in the building industry, to be registered, and unregistered engineers are only allowed to carry out professional engineering services under supervision.
- **SA**: In South Australia, engineers, including those in the building industry, do not need to be registered, accredited or licensed.
- **TAS**: In Tasmania, fire safety, mechanical and electrical, structural and civil engineers are required to be licensed. There is no requirement for registration of other engineering disciplines.
- **VIC**: For Victoria, engineers in the building industry are required to be registered and most are required to carry professional indemnity insurance. There is no requirement for registration of other engineering disciplines.
- **WA**: In Western Australia, engineers, including those in the building industry, do not need to be registered, accredited or licensed.
It is clear that in some states, some engineers need to be registered whereas in others the engineers or even technicians are free to practice in the capacity of an engineer.

Engineers currently operating across multiple states are required to maintain various licences and registrations, and not every engineer is qualified to operate in every state. With a consistent national framework, not only can we reduce the burden on engineers to maintain different accreditations, but we can also improve the mobility of engineers and greatly assist in sharing of engineering resources across states to help meet the unpredictable peaks and troughs of the national project pipeline.

AECOM IS PROPOSING A NATIONAL REGISTRATION SCHEME COVERING MAJOR ENGINEERING DISCIPLINES

Chartered status should be mandatory for those wishing to operate as engineers. We recognise that the Engineers Australia framework for Stage 1 (Graduate) and Stage 2 (Chartered) competency allows for a clear pathway to Chartered or CPEng status and provides a consistent national approach for defining the key characteristics of an engineer, including academic qualifications, work experience, commitment to ethical behaviour, continuing professional development and maintaining professional indemnity insurances.

Establishing a professional registration scheme. Professional registration without active monitoring of its members will only result in an erosion of quality and trust. A robust framework needs active administration to ensure compliance with the benchmark, including by way of professional development and dealing swiftly with breaches.

Each state in Australia has different requirements around how engineers can be involved in projects, from business case development to construction and operations. Changes can be made mid-way during a construction process without an engineer’s involvement, and a business case can be developed that may be financially sound, but impractical to construct.

Often a gap emerges between the engineering design process and the construction process that can lead to catastrophic failure, as a seemingly small change of material or design made for aesthetic or cost saving reasons results in a poor project outcome.

We recommend:
To ensure the community is protected, engineers should be included at key decision-making points in the planning, procurement and construction phases of a project.
Following the Christchurch earthquake in 2011, it was found that Gerald Shirtcliff, who had falsified his engineering credentials, had overseen the design of the CTV building. The building’s complete collapse resulted in over 100 deaths, accounting for the vast majority of fatalities on the day of the quake. New Zealand subsequently mandated independent reviews by structural engineers prior to granting a building permit. This will help to reassure the public and improve the overall quality of building design across the country.

It is tragic that a disaster of this nature is required to take action on the quality of design and we are urging action now so that Australia does not have to experience a similar tragedy. Mr Shirtcliff was also found to have signed off on the designs of many projects while working in Australia, all of which were subsequently audited, costing millions of dollars.

Beyond the obvious safety concerns and risk to life, the lack of a standard national approach breeds industry inefficiencies that lead to higher costs, more disputes and legal costs, all of which increase the final cost of any project. This has an impact on affordability for cities like Sydney and Melbourne, where population growth is outpacing OECD average.

The argument that a mandated, independent design-review process would slow down project delivery should no longer be an excuse. If the review were carried out to agreed criteria nationally, it may actually accelerate new project approvals.

We envision a future where national standards allow for the creation of digital tools that would automate much of the design-review process so it is no longer seen as a standalone process, but rather as an ongoing part of any project.

The process of independent verification can, and must, be adopted for all major civil and building projects.

We recommend:

• Mandate that the key engineering disciplines in all projects other than single-occupancy residential homes be independently verified at key milestones, including on completion of concept design, detailed design and tender documentation. The level of independent verification required can be established based on the complexity and value of the project.

• Establishing an industry panel for key engineering disciplines to be engaged on a random basis for independent verification for specific, higher-risk design; for example, buildings where combustible claddings will be used.
NATIONAL PRACTICE STANDARDS

Beyond the need to create a national registration scheme for professional engineers, AECOM has major concerns about the lack of national practice standards for buildings and infrastructure projects. The recent, high-profile example of the Opal Tower in Western Sydney throws into sharp relief the lack of national standards for the design of residential towers.

Whether an engineer is designing a fire system in a residential project in Sydney or in Melbourne, they should be working to the same national practice standards and codes, not each state’s local version, as is currently the case. We believe that the lack of national standards leads to poor project outcomes, impacts on workforce mobility and reduces the ability to drive efficiencies and innovation.

Following the release of the report, Building Confidence — Improving the effectiveness of compliance and enforcement systems for the building and construction industry in Australia, by Professor Peter Sheirgold and Ms Bronwyn Weir, various state governments have committed to improving the quality and safety of buildings and construction. This has helped to prime the states and territories and makes it the ideal time for the federal government to build on the momentum of the Sheirgold-Weir report, and in doing so, to shape the future of the construction industry.

CLADDING CONUNDRUM

Since the 2014 Lacrosse tower fire in Melbourne, states around the country have been struggling to come up with a remedy to the inappropriate, substandard or unsafe use of cladding on residential and other public buildings, such as hospitals. It is a national issue with a genuine threat to the safety of residents and it is being handled differently in every state.

Rather than having to negotiate a state-by-state approach on materials and rectification measures, one approach at the federal level would put an immediate stop to the misuse of certain materials. This would be more effective than the current situation where legal battles take place in various states between builders, landlords and home owners, which can impact property values and make it difficult for people to sell their homes.

Another worrying example of the inconsistent approach to standards can be found in the way that each state manages fire safety. For example, since October 2017 in New South Wales the onus has been placed on the building owner to consider a fire safety practitioner’s competency to “assess a building’s essential fire-safety measures”.
WHY DATA DRIVES INNOVATION

The engineering and construction industry around the world is undergoing a seismic shift in how it delivers projects, which is being driven by data and has the potential to make a huge and lasting impact on economic productivity. Failing to consistently capture the data during the design phase of a building makes construction and post-construction rectification works more expensive.

In the next 10 years the federal government is investing $100 billion in infrastructure assets; many of these will be publically owned and operated for decades to come. This puts the government in a unique position to accelerate the adoption of data standards required to realise the benefits of effective engineering data management. Effectively leveraging the data that engineers create through the design and the construction phase is essential to reducing the total cost of ownership for new infrastructure assets.

- Like the variance in technical standards found across Australia, engineers and many of our clients are not uniformly capturing the true value of data. This is a huge financial impost for the asset owners when it comes to operations and maintenance.

- If captured and managed effectively the engineering data will also be the raw material to drive innovation and productivity improvements across all phases of the asset lifecycle.

- In a similar way to registration and certification, Australia urgently requires a consistent national approach to engineering data management. This will drive consistent data storage and usage to improve project quality and reduce costs of ownership for all government infrastructure projects.

HANDBRAKE ON INNOVATION AND PRODUCTIVITY

LACK OF INNOVATION:
The construction industry is one of the least innovative in most countries around the world.

LACK OF PRODUCTIVITY:
Engineers use computers, but by and large they are yet to harness their true potential to lift productivity. The advent of computer-aided design was not a significant change of process, but rather, of medium (i.e. digital rather than paper).

LACK OF COLLABORATION:
Design and construction contracts tend to be adversarial, and the idea of working together effectively (without a data mandate) is prohibitive.
AECOM urges the federal government to create a national, standard data mandate for all state, territory and Commonwealth government projects, working with the Council of Australian Governments.

This whole-of-government framework, aligned to international standards, would outline how to implement building information modelling on all major government infrastructure projects. In doing so, the government would provide much-needed certainty to the engineering, design and construction industries to invest in the right software tools, training and development for existing and future employees.

The rich information generated for each government project would improve the design, construction, management and operation of each asset. This data dividend would benefit all Australians by reducing the overall cost of all infrastructure projects and improving the productivity of a notoriously inefficient construction sector.

**COLLABORATION AND INVESTMENT**

The time is right for the federal government, through CSIRO’s Data61 to collaborate nationally with the engineering sector to drive standards and policies that will ensure the true value of engineering information is captured on all government projects and that the data is provided as a platform for innovation and productivity improvements.

**ADOPT ISO19650 STANDARD**

This standard would be adopted on all infrastructure projects across Australia to provide clarity to all participants in the engineering and construction industry about how to capture, store and catalogue all relevant asset data.

**ENGINEERING DATA CERTIFICATION**

The new national practice standards across the profession would require engineers to demonstrate that all designs and deliverables comply with agreed data standards, both in terms of storage and data management.
When Victoria’s Engineer, Dr Collette Burke, launched the Victorian Digital Asset Strategy (VDAS) in February 2019, she said, “World-class assets demand the application and use of engineering and project best practices — such as digital engineering including Building Information Modelling (BIM).”

Unfortunately, these standards are not applicable in the remaining states and territories, where a siloed and non-integrated approach to infrastructure design and construction persists.

AECOM applauds the commitments by the Victorian and Queensland governments, which have both committed to using digital tools to coordinate the planning, delivery, operation and maintenance of government infrastructure.

Despite a clear digital shift across many other sectors, the vast majority of graduate engineers are leaving university with little understanding of the value of engineering information management and how to maintain the integrity of that information throughout each phase of a project.

Elsewhere, the private sector is tackling this issue by creating in-house standards, procedures and processes to capture and manage engineering information in the most effective and efficient way.

There are some examples where this is being addressed on a project or department level, but it is inconsistent across the country. One example currently underway is the Cross River Rail Project DNA (Digital Network Approach) initiative, which will provide a digital foundation for the entire project from the start. They are already using a 4D Building Information Model (BIM) to enable community and stakeholder engagement, so that people can understand the likely impact, accelerating the feedback loop and creating a more transparent process for all stakeholders.

In New South Wales, TfNSW has put in place digital engineering standards that all projects have to adhere to, recognising the value of the information models created to deliver better engineering, construction and operation outcomes.
The government’s purchasing power comes with a responsibility to seek value for money and to drive positive change that improves project outcomes and overall productivity. This further enables the community to obtain a greater return on the investments made by government on its behalf.

By committing to the changes outlined in this paper, and working with the industry through Engineers Australia and the state governments to implement and oversee them, we are confident Australia will see a reduction in errors and costly legal disputes, improvements in the attractiveness of engineering as a profession and increased productivity.

Urgent action is required to create a safer, more-productive and competitive engineering and construction sector in Australia.

We are confident that this issue would have bipartisan support and that it is feasible that these proposed reforms could be implemented within the next three years.

Buildings and infrastructure being designed and delivered today will be part of our communities for the next hundred years or more. It is the engineering professionals’ responsibility to make sure that those assets are safe and fit for purpose. However, we need the support of the federal and state governments to eradicate poor practices by providing a clear mandate for enforcement and, in doing so, improve the quality of life of all Australians.
ABOUT AECOM

AECOM is built to deliver a better world. We design, build, finance and operate critical infrastructure assets for governments, businesses and organizations. As a fully integrated firm, we connect knowledge and experience across our global network of experts to help clients solve their most complex challenges. From high-performance buildings and infrastructure, to resilient communities and environments, to stable and secure nations, our work is transformative, differentiated and vital. A Fortune 500 firm, AECOM had revenue of approximately $20.2 billion during fiscal year 2018.

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