INFRASTRUCTURE PLANNING AND PROCUREMENT

Submission to House of Representative Standing Committee on Infrastructure and Communications

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EXECUTIVE SUMMARY

Engineers Australia is the peak body for the engineering profession in Australia. With about 100,000 members across Australia, we represent all disciplines and branches of engineering. Engineers Australia is constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community.

It is clear from the Australian Treasury's Intergenerational Reports that productivity growth is the key to maintaining Australian standard of living and fiscal sustainability as the population ages. In turn, access to and availability of economic infrastructure services are key drivers of productivity growth. Engineers Australia's periodic assessments of Australia's economic infrastructure has demonstrated that the infrastructure is barely adequate to meet present and future services and that major changes are necessary. Recommendations made by Engineers Australia in the latest Infrastructure Report Card deal with many of the matters covered by the Committee's Terms of Reference. Similar commentary and proposals have been articulated in a recent McKinsey report on infrastructure.

Central to change is infrastructure planning and governance arrangements. These matters have been addressed in some detail in the recent Draft Report by the Productivity Commission on Public Infrastructure. Members of Engineers Australia have consistently advocated improved infrastructure planning, particularly in respect to integration of planning with land use and urban planning and planning for population growth. The Productivity Commission recommendations go to the core of problems in this area and are strongly supported by Engineers Australia.

The Commission also proposes a set of integrated recommendations that are intended to reduce infrastructure project bid costs and to put aside prevailing risk aversion to open the way for the adoption of new technologies. Engineers Australia also strongly supports these recommendations, but adds an important caveat. Effective implementation of the Commission's recommendations depends on some restoration of the loss of public sector engineering and technical expertise. Engineering structures in all levels of government have been radically down-sized over the past two decades in favour of outsourced resources to the point where the public sector's ability to manage engineering contracts and capacity to adequately assess the engineering competencies of contractors and sub-contractors has been severely compromised. The consequences manifest themselves in higher costs and in a growing list of failures chronicalled by auditors-general.

For many years, Engineers Australia has argued that the information base for infrastructure decision making is inadequate. While replicating the capital accounts of business entities may not be feasible, this cannot be said about basic information relating to the stock of infrastructure, its age profile and how it compares to the economic lives of assets, location of assets, attention to maintenance and the current condition of assets. This information should be available in transparent form and be the baseline for future decisions. The Productivity Commission has recommended the establishment of an infrastructure cost benchmarking framework to assist planning and procurement processes. Engineers Australia strongly supports this recommendation.

The responsibility for infrastructure planning lies with government, irrespective of which sector ultimately constructs and/or owns infrastructure assets. The corollary is that infrastructure planning and procurement agencies require the competence, skills and experience to make the most effective infrastructure decisions. However good, economists, accountants and lawyers do not make good engineering decisions. Our earlier point about the de-engineering of the public sector is critical. Effectively dealing with this problem does not entail reversing history and restoring past structures. Rather it means that agencies with engineering and technical responsibilities implement procedures to identify the most appropriate mix of in-house and external engineering resources required to discharge

their responsibilities. Engineers Australia has proposed a framework to enable such assessments to proceed.

The provision of infrastructure services is not just about the construction of infrastructure assets; it also about the operation and maintenance of these assets over their economic life cycles. In all stages of this process, particularly cost optimisation, the role of fully competent engineers is critical. Like other professions, engineers complete a period of professional formation following the completion of essential educational qualifications. During this period, engineers specialise in specific areas of engineering practice. Engineers Australia regards a fully competent engineer as one who has necessary educational qualifications, who has completed the necessary period of professional formation and who has demonstrated attainment of 16 defined areas of competency consistent with international benchmarks. Within Engineers Australia fully competent engineers are recognised with Chartered Status. However, a mechanism to verify that comparable standards prevail among non-members is essential. Engineers Australia favours a national registration system for engineers to achieve this. Detailed arguments are provided in the submission.

Infrastructure development in Australia has followed an intermittent course and at times there have been prolonged gaps between projects. This has severe consequences, including increased costs and availability of engineering skills when they are needed. Engineers are like everyone else facing unemployment, they look for work that is available to sustain their lives. Intermittency means this is not always in engineering. Research by Engineers Australia has shown that about 62% of Australians with engineering qualifications work in engineering. Intermittency is an important contributor because many engineers who resort to work in other fields do not return to engineering. The costs of their training and the costs of replacing their expertise increase the costs of subsequent infrastructure development.

THE INFRASTRUCTURE CHALLENGE

Engineers Australia's interest in economic infrastructure relates to the critical link between economic infrastructure and Australian productivity growth. There are two elements to this link: first, whether there are sufficient economic infrastructure assets to meet Australia's needs, and second, whether existing economic infrastructure assets are being utilised optimally, and the related issue of optimising available public and private sector investment in new assets.

In a recent speech, the Deputy Govenor of the Reserve Bank of Australia noted that the circumstances that compensated for the gap between growth in real domestic income per hour worked and growth in labour productivity (favourable terms of trade and an increase in the population aged 15 to 64 years) were unlikely to be repeated in the medium term future[1]. Instead, Australia will need to focus more closely on policies that increase productivity, particularly through improved infrastructure. This is not a new argument, it has been repeated several times in the Treasury's Intergenerational Reports[2] as the most important factor that will enable Australia to manage the costs of an aging population while maintaining our standard of living.

As an engineering organisation, Engineers Australia has devised its Infrastructure Report Cards (IRCs)to examine the adequacy of existing infrastructure assets to meet present and future needs. These

[1] Philip Lowe, Deputy Governor, Productivity and Infrastructure, 26 November 2013, www.rba.gov.au
[2] See 2002-03 Budget Paper No 5, www.treasury.gov.au for the first Intergenerational Report and Australian Treasury, Australia to 2050; Future Challenge, 2010, www.treasury.gov.au for the most recent.

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complex documents synthesise large volumes of qualitative and quantitative information about the nation's infrastructure into readily understood assessments[3]. The IRCs assess strategic planning, budget and financial and other documents released by State and Territory Governments and integrates these assessments with considered judgments from engineers expert in infrastructure matters. Assessments are rated as follows:

A (Very Good); Infrastructure is fit for its current and anticipated future purposes.

B (Good); Minor changes are required to enable infrastructure to be fit for its current and anticipated future purposes.

C (Adequate); Major changes are required to enable infrastructure to be fit for its current and anticipated future purposes.

D (Poor); Critical changes are required to enable infrastructure to be fit for its current and anticipated future purposes.

F (Inadequate); Inadequate for current and anticipated future purposes.

The first IRC was released in 1999 and assessed Australia's economic infrastructure as "D". Subsequent assessments in 2001, 2005 and 2010 showed some initial improvement, an assessment of "C" in 2001 followed by "C+" in 2005, which then stalled with a repeat assessment of "C+" in 2010[4]. An assessment of "C+"means that infrastructure is barely adequate and major changes are necessary for infrastructure to be fit for present and future purposes. This status is hardly consistent with innovation and productivity growth.

The 2010 IRC made the following recommendations to improve Australia's economic infrastructure included:

All governments must:

- Deliver more efficient infrastructure outcomes and develop innovative funding models to provide the required infrastructure.
- Harmonise infrastructure planning and regulation through improved cooperation and collaboration between all levels of government, business and the community.
- Address the imbalance between urban and rural and remote communities regarding access to high quality, reliable infrastructure.
- Develop plans and implement projects in all sectors in advance of need, and either build in capacity for growth or preserve land in all infrastructure sectors, particularly for ports, airports and transport corridors.
- Encourage private sector funding for infrastructure and where infrastructure delivery models include the private sector, have the appropriate allocation of risk to deliver the best project outcome.

State and territory governments must:

- Develop long-term infrastructure visions and plans that accommodate projected economic growth and population increases.
- Establish independent planning infrastructure advisory groups to provide advice on infrastructure priorities and provide infrastructure planning and funding advice.

[3] See www.engineersaustralia.org.au/infrastructure-report-card
[4] See: www.engineersaustralia.org.au/infrastructure-report-card.

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Infrastructure owners and managers must:

- Improve the maintenance of existing assets, through adequate funding and asset management plans.

- Integrate climate change mitigation and adaptation into infrastructure plans.

In 2013, Engineers Australia published an interim review of progress in infrastructure development since 2010.[5] This report is a comprehensive update assessment of trends in engineering construction on Australia's key infrastructure including roads, ports, railways, bridges, water, electricity and telecommunications assets. The report showed that since 2010, significant investment in Australia's infrastructure has occurred, but, a substantial proportion was in support of the resources sector. The large scale of activity obscured the extraordinary variability in infrastructure activity between asset classes and between States and Territories. The variability was particularly evident in Western Australia and Queensland where spending on resource-related infrastructure, such as ports and railways, dominated much lower activity levels in non-resource areas. While investment in infrastructure may be at record levels, the analysis in this report showed that sufficient activity has not occurred in critical assets such as transport and utilities infrastructure. The resources sector is important, but so too is the rest of the economy and this is where more effort is required.

Productivity improvements are also necessary within the infrastructure system itself. This is a global problem and not just one in Australia and was summarised in a recent McKinsey Report as follows:

> *"The potential to improve productivity is so large because of failings in addressing inefficiencies and stagnant productivity in a systemmic way. On the whole, countries continue to invest in poorly conceived projects, take a long time to approve them, miss opportunities in how to deliver them, and then don't make the most of existing assets before opting to build expensive new capacity"[6], and*
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> *"All too often, a surprisingly stable status quo persists in which inaccurate planning and forecasting lead to poor project selection. A bias among public officials to build new capacity, rather than make the most of existing infrastructure, is common, leading to more expensive and less sustainable infrastructure solutions. A lack of incentives, accountability, and capabilities as well as risk aversion has prevented infrastructure owners from taking advantage of improvements in construction methods such as the use of design-to-cost and design-to-value principles, advanced construction techniques and lean processes. Infrastructure authorities frequently lack the capabilities necessary to negotiate on equal terms with infrastructure contractors, rendering them unable to provide effective oversight and thereby drive performance."[7]*

In global context, the McKinsey prescription for realising improvements is remarkably similar to views expressed by Engineers Australia and includes:

- Close coordination between infrastructure authorities responsible for different types of infrastructure with common socioeconomic goals and how each class of infrastructure contributes to achieving them.

- Clear separation between political and technical responsibilities is necessary.The roles of the public and private sectors must be clearly spelt out to clarify market structure, regulation, pricing

[5] Engineers Australia, Analysing Australia's Infrastructure Trends, 2013, www.engineersaustralia.org.au
[6] McKinsey Global Institute, Infrastructure Productivity: How to save $1 trillion a year, 2013, www.mckinsey.com.mgi
[7] McKinsey, op cit

and subsidies, ownership and financing, in other words, there is more to private sector participation than PPPs.

- Trust based engagement of stakeholders is critical.
- Reliable data for day to day oversight and long term planning are essential.
- Strong public sector capabilities in planning, delivery of infrastructure assets and services are essential.

Engineers Australia has consistently raised these issues in its assessments of Australia's infrastructure. While some improvements, such as the formation of Infrastructure Australia, have been made, other infrastructure decisions, such as the rush to construct desalination plants throughout Australia, reflect the essence of the criticism reviewed above. Above all else, what has been overlooked is the need for a long term, systemmatic approach in which infrastructure is accorded the importance it deserves. In the light of these deficiencies, the contribution of infrastructure availability to productivity growth seems problemmatic.

THE PRODUCTIVITY COMMISSION DRAFT REPORT

The Government has referred a range of issues relating to public infrastructure for examination by the Productivity Commission which has now released its Draft Report. Recommendations 7.1 and 7.3 and Draft Finding 7.2 are particularly pertinent and relate to the institutional governance arrangements necessary to overcome deficiencies referred to in both sets of recommendations discussed above. The recommendations also cover processes necessary for optimal project selection, approaches to financing projects, performance reporting and the competence and responsibilities of employees involved in infrastructure selection and procurement. Engineers Australia strongly commends these recommendations for consideration by the Committee.

Engineers Australia also strongly supports Draft Recommendations 11.1 to 11.9 as critical to reducing infrastructure bid costs and through this encouraging higher participation by infrastructure construction and management entities. High bid costs have been an unfortunate feature of tendering processes for too long and, as McKinsey notes inherent in existing processes are risk aversion and a bias towards existing and "safe" technologies. Higher than necessary costs and failing to utilise the best technologies undermine productivity gains. To overcome these issues, however, steps to overcome the losses of public sector technical and engineering competences are essential. Engineers Australia details its views on this issue in the following section.

The experiences accumulated in compiling the IRCs has convinced Engineers Australia that better infrastructure data collections are indispensible at two levels. Better State and Territory information for all important infrastructure asset classes are needed to ensure that high level infrastructure decisions are made along rigorous business lines. Essential information such as the stock of infrastructure assets, its age profile, location of the assets, attention to maintenance, technical efficiency etc, are not available on a consolidated basis. Questions about adequacy therefore take on a "band-aid" character and rushed decisions lead to poor outcomes, for example, to build desalination plants to deal with water shortages that could be met in other ways.

Draft recommendation 8.2 of the Draft Productivity Commission Report deals the need for project level benchmaking data. This is a long overdue direction that Engineers Australia strongly supports. Benchmarking infrastructure costs contributes to planning and project evaluation in public sector agencies and in infrastructure construction businesses. Benchmarking would be particularly valuable for

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smaller organisations, whether public or private sector, who may not have the resource base to undertake the necessary level of research, and through this, improve the competitiveness of procurement by involving more players in the process.

PUBLIC SECTOR PROCUREMENT

Engineers Australia believes that de-engineering of the Australian public sector through structural change in favour of outsourcing has severely impacted its technical and engineering procurement capacities. The details of these changes are described in a major Engineers Australia publication[8] which can be accessed at www.engineersaustralia.org.au/about-us/research-and-reports . The report identified two key risks associated with undue reliance on outsourced engineering expertise relevant to the Committee's inquiry:

- The inability to manage engineering contracts because contracting staff lacked the necessary technical expertise.
- The inability of contract staff to adequately assess the engineering competencies of contractors and sub-contractors.

The seriousness of these risks is evident from a range of consequences highlighted in the report including:

- Inadequate project scoping leading to significant project cost blow-outs estimated to increase public sector project costs by 20%[9].
- Declining standards in project design documentation in the construction and building industry resulting in 60 to 90% of all project variations and increasing project costs of 10 to 15%.

A range of reports by private sector management consultants and by Auditors-General have chronicalled a long list of projects that have experienced substantial cost over-runs due to the factors cited above. These reports, of course, focus on specific projects and do not include the costs to the community which does not have timely access to the facilities promised by the projects[10].

The Engineers Australia report examines in some detail the contribution that engineering expertise brings to the procurement table and demonstrates how the exercise of engineering knowledge, skills and judgment contribute to the alignment of procurement with multi-level Government objectives, providing illustrative examples.

The issue addressed in the report is the need to, and importance of applying an optimal level of engineering expertise to procurement decisions that involve significant engineering and technical content. However good, economists, accountants and lawyers do not make good engineering decisions. While discussion of this issue begins with recognition of the consequences of de-engineering the public sector, Engineers Australia does not believe a solution to the problems descibed requires full reversal of the process and the restoration of all former structures. Rather a combination of internal engineering competence and external resources could meet requirements. The precise mix depends on the circumstances of individual agencies and the projects under consideration. With this in mind, the report provides frameworks for agencies to use to determine the present status of their engineering

[8] Engineers Australia, Government as an Informed Buyer; How the public sector can most effectively procure engineering-intensive products and services, by Athol Yates for Engineers Australia, 2012, www.engineersaustralia.org.au
[9] See Government as an Informed Buyer, op cit, p14
[10] See Chapter 1 of Government as an Informed Buyer, op cit

procurement capabilities and the most appropriate mix of in-house engineers and external engineering resources to suit their requirements.

ENGINEERING COMPETENCE AND THE REGISTRATION OF ENGINEERS

Engineers Australia is primarily concerned with the standards and competence of the engineering team in Australia. The engineering team comprises Professional Engineers (at least the equivalent of a four year full time Bachelor degree in engineering), Engineering Technologists (at least the equivalent of a three year full time Bachelor degree in engineering) and Engineering Associates (at least the equivalent of a two year full time Associate degree or Advanced diploma in engineering) and all levels of the team work in an integrated way on engineering projects. What must be remembered is that infrastructure is not just about its construction, as important as that is, but includes the operation and maintenance of infrastructure assets over their economic life cycles.

Although it is common to describe the engineering team in terms of necessary entry level educational qualifications, attainment of these qualifications is just the first step to becoming a fully competent engineer. Fully competent engineers must successfully complete a period of professional formation, typically three to four years in duration. The requirement to satisfy professional criteria in engineering is similar to requirements in other professions like law, accounting and medicine. An important aspect of professional formation in engineering is that specialisation primarily occurs during engineering practice.

Within the ranks of its members, Engineers Australia recognises fully competent engineers by granting them chartered status. A Chartered Engineer has completed the necessary period of professional formation and has demonstrated the competence to practice independently and to sign off engineering designs and decisions by satisfying Engineers Australia's 16 "stage 2" competencies. These competencies are consistent with international benchmarks and ensure that the standards of Chartered Engineers are world best practice. Chartered status carries with it an obligation to practice according to Engineers Australia's code of ethics and an obligation to engage in continuous professional development (CPD) to stay abrest of engineering developments, changes in technology and new engineering practices. Chartered Engineers are audited against CPD requirements every five years.

Membership of Engineers Australia is voluntary and these arrangements clearly do not apply to non-members. As a result another mechanism is essential to verify the credentials of this group. Engineers Australia's preferred option is a nationally consistent system of registration for engineers, administered by States and Territories, with registration criteria equivalent to Engineers Australia's stage 2 competencies. Engineers Australia believes that such a system is necessary to:

- Establish a nationally consistent register of engineers who have demonstrated full competence against internationally benchmarked standards, who practice in line with, and are committed to a code code of ethics and who actively maintain currency with engineering technologies and practices.
- Reduce red tape; a consistent national registration scheme would replace fourteen inconsistent, partial registration schemes applying across States and Territories.
- End restrictions in these existing schemes on mobility of engineers and the bureaucratic and financial barriers to engineers wishing to practice in more than one jurisdiction.
- Fully assess the competence of migrant engineers who between 2006 and 2011 accounted for 71% of the increase in the supply of engineers.
- Enable effective action to be taken against engineers who practice negligently or unethically as is the case in medicine and law.

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- Provide the framework for assessing the numbers of fully competent engineers in Australia, enabling more effective engineering work force planning and policy making. Recent engineering skill shortages related to the availability of fully competent engineers. Increasing the number of people with engineering qualifications is a step towards a solution but not a complete solution.

A benefit-cost study has shown that such a scheme, despite difficulties fully ennumerating benefits, has a net present value to the economy in excess of $7 billion using a discount rate of 7%, producing a benefit-cost ration of 3.14[11].

These arguments in favour of a nationally consistent registration system for engineers are consistent with the arguments posed in the previous section concerning the connection between engineering competence and procurement of engineering intensive services and assets. Engineers Australia believes that efforts to contain the costs of infrastructure projects will fail unless and until this matter is properly addressed. Nationally consistent registration of engineers is integral to such a solution.

At present, the only Australian jurisdiction to require formal registration of engineers is Queensland. To register as a Professional Engineer in that State, individuals are required to satisfy the same provisions for base line education and professional training as advocated by Engineers Australia for Chartered Engineer status. In Queensland, unless an engineer is registered and has met the necessary educational and professional standards, they are not legally able to determine final engineering decisions or to approve final engineering designs. Engineers who are not registered must work under the supervision of an engineer who is registered. The Australian Capital Territory and several other States are currently considering registration systems for engineers similar to the Queensland system.

In its Draft Report on Public Infrastructure, the Productivity Commission notes there are defects in the Queensland arrangement, particularly relating to enforcement. Engineers Australia is aware of this issue and sees inclusion of appropriate arrangements against unethical and negligent practice as essential as is the case in other professions[12].

In the absence of a nationally consistent registration system for engineers, several like minded engineering peak organisations have joined with Engineers Australia to establish a voluntary system of registration, the National Engineering Registration Board (NERB). The other organisations are Consult Australia, Professions Australia and the Institute of Public Works Engineering, Australia. NERB is administered by Engineers Australia on behalf of all partners.

THE CONSEQUENCES OF INFRASTRUCTURE INTERMITTENCY

Infrastructure projects are typically discreet undertakings and conclude when the asset under construction has been completed. Frequently, there are time gaps between projects, sometimes prolonged gaps. In many instances, they are too long for engineers to be without work. The general presumption is that engineers find new work on other infrastructure projects or some other type of engineering. However, this is not always the case and often engineers accept employment outside engineering because of financial and family pressures and personal locational preferences.

In mid-2013, Engineers Australia conducted a survey of its members to establish their views on a range of matters. Results showed that an absolute majority of members, including non-responses, believed that intermittency in infrastructure projects was detrimental to engineering employment and to engineering careers. Intermittency in employment is not compatible with modern lifestyles and

[11] See www.engineersaustralia.org.au/nerb/national-registration
[12] See the arguments put by Engineers Australia in response to the productivity Commission Draft Report at www.engineersaustralia.org.au

responsibilities and may lead some engineers to leave the profession. This boom-bust cycle is endemic and is the genesis of the next engineering skills shortage.

It is important to appreciate that Australia's engineering skill shortage was a shortage of qualified engineers to actually work in engineering. Research by Engineers Australia[13] identified 52 of 358 four digit ANZSCO occupations as engineering occupations. In 2006, the labour force individuals qualified to be part of the engineering team was 200,615. However, only 122,258 or 60.9% were employed in engineering occupations. In 2011, the comparable figures were 263,890, with 163,912 or 62.1% employed in engineering occupations[14]. In other words, over one third of qualified engineers were employed outside of engineering.

Engineers invest long periods of their lives in education and training, up to seven or eight years, and this is followed by an obligation to undertake continuous professional development to keep up with technological developments in their field. Few engineers would regard intermittent employment as a sufficient return on this investment. Faced with a period of unemployment due to project delays, engineers do what all rational people do, find work in other areas commensurate with transferable skills and abilities. The consequences are the loss of experienced engineers who eventually need to be replaced in infrastructure work forces, incurring additional costs. Observing these disruptions to engineering careers creates disincentives for young people to choose engineering careers.

Intermittency is a feature of several areas affected by Government decision making. The evidence relating to infrastructure is found in the large annual variability of new engineering construction on assets such as roads, railways, electricity generation and transmission, water and sewerage, gas facilities and telecommunications at State and Territory level. At national level, aggregation smooths out some of the variability but the consequences are still there. There is evidence that intermittency has adversely affected defence acquisitions and stop/start decision making in renewable energy has led to engineers who trained specifically for this field to move to more consistent fields of employment.

A key consequence of intermittency of engineering work is that there are temporary shortages of experienced technical personnel at the early stages of projects, precisely when these skills are most critical. Engineers Australia notes that it is often argued that skilled migrants on 457 temporary visas can resolve shortages. The educational qualifications and skills of temporary migrants, unlike those applying for permanent visas, are not subject to assessment. This has long been an area of contention for Engineers Australia because the acceptability of educational qualifications is entirely in the hands of sponsoring employers under pressure to implement work on infrastructure projects.

[13] Engineers Australia, The Engineering Profession in Australia; A Profile from the 2006 Population Census, September 2010, www.engineersaustralia.org.au
[14] Engineers Australia, The Engineering Profession: A Statistical Overview, Tenth Edition, September 2013, www.engineersaustralia.org.au

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