

Chapter 4

The impact of the engineering skills shortage

4.1 In this chapter the committee examines the impact of the engineering skills shortage on infrastructure delivery, economic development, workplace productivity, public sector capability and employment.

4.2 As well as the significant economic costs and project delays outlined in this chapter, diminished engineering capacity can have serious consequences for public safety.¹ Reports from the National Engineering Registration board, cited by Australian National Engineering Taskforce (ANET), indicate that a number of public disasters—some of which have caused loss of life—were the result of 'engineering issues',² including the Thredbo landslide, Lane Cove Tunnel collapse and Canberra Hospital implosion. This advice is sobering and is a reminder how important public sector engineering capability is to our communities.

4.3 It is clear to the committee that the consequences of the skills shortage are being felt every day by employers, employees, governments and the community.

Impact on economic development and infrastructure delivery

4.4 Entrenched engineering skills shortages, depending on their severity, are likely to reduce investment and productivity growth in Australia, and result in poor quality or delayed construction projects. The resulting economic effects are felt in sectors as diverse as resources, roads, manufacturing, construction and the development of infrastructure.³

4.5 Engineers Australia listed the general impacts of the engineering skills shortage as including:

- Increases in wages of engineers and others with engineering skills
- Reduced retention rates, as employers with a skills shortage offer higher and higher wages
- The introduction of skills that are not 'embedded in the local culture' or 'within that particular industry'
- Cost overruns and increases in the cost of labour (up to 20 per cent of total project cost)
- Loss of engineering activity to the economy

1 Australian National Engineering Taskforce, *Submission 73*, p. 22.

2 Australian National Engineering Taskforce, *Submission 73*, p. 22.

3 Skills Australia, *Submission 80*, p. 16.

- The loss of projects to overseas, as costs force cancellations, and
- Reduction in the quality of project outcomes.⁴

4.6 Representing professional engineering firms, Consult Australia anticipated that unless skills shortages are addressed, there will be sustained negative impacts for both the private and public sector. Ms Megan Mott, Chief Executive Officer, observed that government is negatively impacted not just as a client, but also as a policy maker:

I say that because a lot of the significant challenges that governments, not only in Australia but across the world, face in population and demographic change, poverty, climate change mitigation and adaptation and stability of political environments will require significant engineering input into their long-term solutions. If there are not enough engineers in the market in Australia, particularly in our regional significance but also worldwide, that will have significant implications for delivery of solutions for those problems.⁵

4.7 The Business Council of Australia (BCA) released a report into Australia's capital investment on 7 June 2012.⁶ The report points to the \$921 billion pipeline of investment in resources, energy and economic infrastructure, warning that Australia risks not being able to efficiently deliver these projects because it is becoming a 'high-cost' and therefore 'high-risk' place to invest. Further, the BCA reported that Australia's low labour productivity has reduced its competitiveness, and in relation to skills shortages, the BCA concludes that Australia must train or attract 'high quality project planners and managers' in order to 'overcome major skills shortages'.⁷

4.8 A lack of qualified applicants can mean that engineers without all the necessary skills for the job are being hired.⁸ This can result in inadequate planning and 'trial and error' problem solving, which can then lead to mid-project changes which put pressure on timelines and costs. Alternatively, some projects will not proceed at all if adequate staff cannot be recruited.⁹ Engineers Australia reported that nearly

4 Mr Christopher Fitzhardinge, former WA Division President, Engineers Australia, *Proof Committee Hansard*, 27 March 2012, p. 2.

5 Ms Megan Mott, Chief Executive Officer, Consult Australia, *Proof Committee Hansard*, 28 March 2012, p. 15.

6 Business Council of Australia, *Pipeline or pipe dream? Securing Australia's investment future*, 7 June 2012. Available online: <http://www.bca.com.au/Content/101987.aspx> (accessed 12 June 2012).

7 Business Council of Australia, *Pipeline or pipe dream? Securing Australia's investment future*, 7 June 2012, p. 17.

8 This can have particular impacts on construction and infrastructure programs. For example, the shortage of consulting surveyors has a particularly pronounced impact due to the small number of specialists with such qualifications, and the high demand for surveying skills during conceptual and detail design in major infrastructure projects, and later during the construction phase: Consulting Surveyors National, *Submission 37*.

9 Engineers Australia, *Submission 67*, pp 6–7.

30 per cent of respondents to a 2010 survey 'indicated that the skills shortages led to major problems including project delays and cost increases'.¹⁰

4.9 The committee received evidence suggesting that a number of infrastructure projects across Australia experience delays and cost blow outs. The Senate Foreign Affairs, Defence and Trade Committee recently reported that 'for many years the Australian Defence Organisation's program for procurement of major capital assets has been dogged by delays and cost overruns'.¹¹ Professor Trevelyan explained that, although they are better publicised, it is not just public sector projects that fall victim:

BHP have a public record of major project failures. They have the HBI plant in the North-West—\$3.6 billion. It was sold for scrap metal. There is the Ravensthorpe nickel project—\$3.3 billion. It was sold to a Canadian company for around \$250 million, I believe. I would have to check those actual figures. They are on the public record, but there are many, many other project failures which are occurring every day which are not on the public record. As I have said in my submission, the Australian Department of Defence cops a lot of criticism for its failures, which are public, but you will find just as many if not more failures in the private sector if you open the lid and look hard enough. The difficulty is that the private sector has an interest in covering up these failures, time and time again, and that is reflected in all of the information that has come my way.¹²

Scoping

4.10 Poor scoping at the initial project stages can add to cost blowouts and delays. For example, in 2011 the Association of Professional Engineers, Scientists and Managers Australia (APESMA) warned that the repair bills for the Queensland floods could blowout by up to 20 per cent as a result of poor scoping, due to a shortage of engineers.¹³ The committee heard that poor scoping can lead to adversarial relationships and poor project outcomes. This in turn can lead to legal disputes arising from project failures. For example, Consult Australia advised the committee that \$6 billion a year is 'wasted on disputation in projects across Australia'.¹⁴ The committee notes that much of this expense is borne by taxpayers, as many, if not all, large projects are commissioned by governments.

4.11 Proper scoping requires specialist engineering expertise, as the task involves:

- identification of the fundamental objectives of the project;

10 Engineers Australia, *Salary and Benefits Survey 2010*, Canberra, February 2011, p. 5.

11 Senate Foreign Affairs, Defence and Trade References Committee, *Procurement procedures for Defence capital projects – Preliminary Report*, 15 December 2011, p. 1.

12 Professor James Trevelyan, *Proof Committee Hansard*, 27 March 2012, p. 12.

13 Cited in Consult Australia, *Submission 66*, p. 14.

14 Ms Megan Motto, Chief Executive, Consult Australia, *Proof Committee Hansard*, 28 March 2012, p. 22.

- development of the principal's project requirements to achieve the fundamental objectives, taking into consideration stakeholder and end user requirements and risk;
- deciding upon the most appropriate contractual model and risk profile to deliver the project; and
- inclusion of those requirements into appropriate contractual scope documents for the project.¹⁵

4.12 In a 2008 survey conducted by Blake Dawson, 83 per cent of respondents reported that skills shortages negatively impacted their ability to develop scope documents to an adequate standard.¹⁶ More than half of respondents felt that their project was 'inadequately scoped' before it went to tender on the market.¹⁷ Mr Phillip Dingeldei, Chairman, Consulting Surveyors National, observed that when adequate scoping has not been conducted by government, the costs to business of responding to a tender are very high.¹⁸

4.13 The Hickory Group, one of Australia's largest apartment builders with origins in Melbourne, observed that diminished engineering capacity in government meant that many government departments were poorly equipped to participate fully in scoping exercises. This meant that there were more contractual disputes during the life of the project, and the end product cost more and was subject to more changes. Hickory suggests that the preferred approach is for government to be involved in the 'scoping of a project with a number of selected preferred contractors, an exploration of capabilities, and a finalising of the scoping of the project during this process', after which a preferred contractor is identified.¹⁹

Delay or postponement of projects

4.14 Delay or postponement of infrastructure projects has a huge impact on the community. Engineers Australia reported that a large number of projects are delayed because of difficulties recruiting expert skilled engineers.²⁰ For example, the Australian Institute of Traffic and Planning Management advised the committee that the loss of productivity as a result of peak hour congestion traffic is \$1.2 billion a year

15 Blake Dawson, *Scope for Improvement*, 2008, cited in Australian National Engineering Taskforce, *Submission 73*, p. 20.

16 Cited in the Australian National Engineering Taskforce, *Submission 73*, p. 20.

17 Cited in the Australian National Engineering Taskforce, *Submission 73*, p. 20.

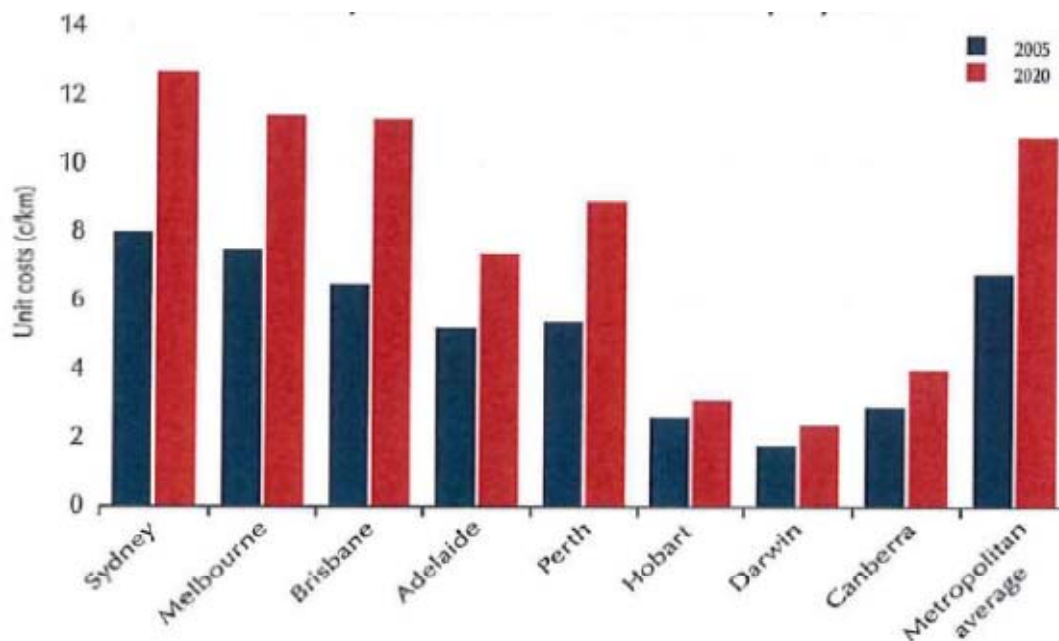
18 Mr Phillip Dingeldei, Chairman, Consulting Surveyors National, *Proof Committee Hansard*, 7 May 2012, p. 45. In the example provided during the hearing, the company was advised simply that a pipeline needed to be built from A to B. No further detail was provided.

19 Hickory Group, *Submission 75*, p. 3.

20 Mr Brent Jackson, Director of National and International Policy, Engineers Australia, *Proof Committee Hansard*, 27 March 2012, p. 2.

in Perth alone. This is expected to grow to \$2 billion by 2020.²¹ The projected impact of delayed road projects is severe, and this is illustrated by the table on the following page which sets out the estimated urban traffic and congestion cost trends for Australian cities.

Average unit costs of congestion for Australian metropolitan areas – current and projected



Source: Department of Infrastructure and Transport²²

4.15 The effects of the skills shortage are felt more acutely because of the 'lumpy' workload of a lot of government work, and this can also cause delays. During the Canberra hearing Ms Donna Findlay from Roads Australia explained the problem, and called for the states and the commonwealth to work together:

[We] think the states and the federal government need to come together and have clear transport plans so that you can see where the investment lies. The contracts of a lot of big projects are being let at the same time. We will talk about an A-team of engineers and B-team of engineers. Your A-team go off and they are all working on this project and then another big project comes up and the B-team are working on that project. Another project comes up, so you start to have all these great engineers on one project but not on the other projects. We would like to see all the states and the federal government come together and have a clear pipeline of road projects for the future.²³

21 Mr Craig Woolridge, Australian Institute of Traffic Planning and Management, *Proof Committee Hansard*, 27 March 2012, p. 32.

22 Department of Infrastructure and Transport, Additional Information Received, 19 April 2012. The graph was obtained from BTRE, Working Paper 71, p. 16.

23 Ms Donna Findlay, Policy Director, Roads Australia, *Proof Committee Hansard*, 7 May 2012, p. 2.

4.16 Roads Australia pointed out that communication between the states is often inadequate, resulting in major projects being programmed at the same time, so that companies cannot field their best people, who are otherwise occupied, to do the job.²⁴ To address this problem, Roads Australia has taken a proactive approach, setting up the Roads Australia Pipeline on its website for government agencies to input plans for the next 12 to 18 months.²⁵

4.17 The national infrastructure pipeline is anticipated to address part of this concern, as well as the federal government's National Infrastructure Construction Schedule which commenced in May 2012 and is discussed in Chapter 4.²⁶ However it is too early for the committee to assess the effectiveness of this policy.²⁷

Impact on employment

4.18 Skills shortages have an impact on employment in a number of ways. The most significant impact is on training and workforce development. Companies have focused on meeting the requirements of the boom. The Australian National Engineering Taskforce reported that companies have responded to capacity constraints by increasing reliance on contractors and external consultants rather than building capacity among the existing workforce.²⁸ This affects general workforce training and standards across the engineering profession.

Retention

4.19 The mining boom in Queensland and Western Australia has driven up demand for workers with engineering and related skills which, because of the skills shortage, have been recruited to a significant extent from the manufacturing, power and traffic sectors. This demand exacerbates skills shortages in other engineering sectors, and creates frustration when recently trained apprentices depart for the mines.

4.20 The committee heard that a large number of engineers were migrating from the eastern states to Queensland and Western Australia. The Chamber of Minerals and Energy Western Australia observed that 11 per cent of population growth in Western Australia was from interstate migration, and this 'historically is a very, very high number'.²⁹

24 Mr Dan Reeve, Capacity Chapter Member, Roads Australia, *Proof Committee Hansard*, 7 May 2012, p. 2.

25 Mr Dan Reeve, Capacity Chapter Member, Roads Australia, *Proof Committee Hansard*, 7 May 2012, p. 2.

26 www.nics.gov.au (accessed 4 June 2012)

27 Department of Infrastructure and Transport, *Submission 62*, p. 21

28 Australian National Engineering Taskforce, *Engineers Survey*, March 2010, p.14.

29 Mr Bruce Campbell-Fraser, Chamber of Minerals and Energy WA, *Proof Committee Hansard*, 27 March 2012, p. 25.

4.21 Roads Australia advised the committee that once workers attain a higher level of certification 'they are off to the mining industry'.³⁰ Other submitters reported a similar trend.³¹ The Australian Industry Group observed that the mining boom has created a situation where the manufacturing sector trains apprentices who, once fully trained, are subsequently attracted to the resources sector. The impact on the manufacturing sector is significant, and creates a disincentive to train more apprentices:

This places enormous strain on the manufacturing sector to retain a highly skilled workforce at the very time the sector is under considerable competitive pressure from overseas and is in a period of structural adjustment. The resultant reluctance by manufacturing enterprises to engage apprentices who subsequently depart to the resources sector contributes to the existing skills shortage of engineering trades.³²

4.22 This observation was echoed by Manufacturing Skills Australia, who reported that manufacturing workers are 'poached' by the construction sector.³³

4.23 The impact of the skills shortage is also exacerbated for local governments which tend to have fewer resources but must compete with the mining and private civil construction sectors for engineers.³⁴ Local governments have a large and diverse set of responsibilities. Local Government Managers Australia noted that local government engineers 'administer and supervise the design, construction and maintenance of roads and bridges, pedestrian and cycle facilities, regional airports, buildings, storm water drainage, recreational facilities, parks and waste disposal'.³⁵

4.24 The Institute of Public Works Engineering Australia (IPWEA) represents engineers who provide engineering services to local communities through local governments. During the Canberra hearing the committee asked about the impact of the skills drain, and the National President, Mr Di Iulio explained that some local councils had excellent engineering capability but other councils were struggling:

With the number of highly skilled people now being pulled out of our industry into the mining industry and so forth, having people who are qualified and who can actually make those appropriate decisions at the right time are running a bit thin.³⁶

30 Mr Dan Reeve, Capacity Chapter Member, Roads Australia, *Proof Committee Hansard*, 7 May 2012, p. 2.

31 See for example, Consulting Surveyors National, *Submission 37*, p. 2.

32 Australian Industry Group, *Submission 58*, p. 1.

33 Manufacturing Skills Australia, *Submission 25*, p. 5.

34 Local Government Managers Australia, *Submission 57*, p. 4.

35 Local Government Managers Australia, *Submission 57*, p. 2.

36 Mr Paul Di Iulio, National President, Institute of Public Works Engineering Australia, *Proof Committee Hansard*, 7 May 2012, p. 59. See also *Submission 64*.

4.25 However, it is worth bearing in mind that even mining companies, those to whom skilled workers most commonly are attracted, sometimes struggle to keep staff. The Association of Mining and Exploration Companies (AMEC) reported that most of their members are small companies who struggle to retain quality staff, as many move to larger companies once they have developed their skills. Mr Justin Fromm explained:

[AMEC's] membership is the explorers, the emerging miners, the smaller end of town: small numbers of staff, engineers are few and far between. The anecdotal stories that we hear when we talk to our members are that the bigger companies drag through those engineers. They will stay with the smaller companies for a little while to get their careers started and then they will be drawn off to the larger companies. From our point of view, the difficulty is that the little companies are struggling with their engineering skills. The big companies can take care of themselves with respect to their graduate programs—and I do not have a full understanding of those programs—but our issue is for the little companies trying to access those same engineering skills for their projects.³⁷

4.26 As discussed in Chapter 2, many companies are not interested in recruiting graduates. JSM Appointments, a recruitment company based in Western Australia, reported that among those graduates who do secure employment, there is a high turnover as they seek better opportunities elsewhere in the industry, and higher level roles being offered by competing firms to lure them into the company.³⁸

4.27 Retention in the context of an aging workforce is discussed in Chapter 5.

Impact on public sector capability

4.28 The move away from in-house engineering in the public sector has had a noteworthy impact on the quality of engineering-related public sector outcomes.

4.29 Consult Australia expressed strong concerns to the committee about the decline in public sector engineering capability. While Consult Australia did not believe that there will be, or should be, a return to large public works departments in government, it considers that government capability can be improved because:

There is...a significant lack of skill sets in high-level procurement—people who are able to develop scopes of work, develop conceptual arrangements for projects, assess tenders in government and then manage those tenders and manage those jobs with the appropriate allocation of risk as opposed to complete risk shifting. There is an innate conservatism because there is lack of confidence in the skill set to manage and understand risk on projects.³⁹

37 Mr Justin Fromm, Senior Policy Officer, *Proof Committee Hansard*, 27 March 2012, p. 18.

38 JSM Appointments, *Submission 34*, p. 4.

39 Ms Megan Motto, Chief Executive, Consult Australia, *Proof Committee Hansard*, 28 March 2012, p. 16

4.30 The Australian Institute of Traffic and Planning Management reports that as a result of skills shortages, particularly in Queensland and Western Australia, organisations are now employing staff with minimal traffic and transport skills, and a number of experienced staff will shortly retire. At the same time, demand for traffic and transport infrastructure is increasing.⁴⁰

4.31 Following the reduction of engineering teams in government agencies across Australia in the 1980s and 1990s, Engineers Australia inquired into the impact of the loss of engineering expertise in a report released in 2000 titled, 'Government as an informed buyer'.⁴¹ Engineers Australia warned that as a consequence of the reduction in expertise, governments may be unable to manage engineering contracts because contracting staff lacked the necessary technical expertise. Further, contracting staff may also be unable to adequately assess the engineering competencies of contractors and subcontractors.⁴²

4.32 The Australian National Engineering Taskforce 2010 Survey reported some concerning trends in public sector engineering capability. Quotes from anonymous respondents reveal the acute skills shortages in government agencies:

Over the last two years, our Engineering department has dropped from a peak of over 100 people to just 16. We have barely enough people to maintain existing product, without considering any new projects.⁴³

...

We have insufficient qualified people to make effective judgement calls regarding the expenditure of public money. We have a large number of partially qualified people doing the job of senior engineers.⁴⁴

...

There are a number of specialist vacancies that have been very difficult to fill, despite national and international searches - in some cases we have compromised by appointing relatively inexperienced engineers, with a view to an intensive skills development program. In the interim we have a greater reliance on consultants to fill the gap. Challenge will be to keep the employees once trained up, particularly given the market environment.⁴⁵

...

40 Australian Institute of Traffic Planning and Management, *Submission 39*, p. 2.

41 Athol Yates, *Government as an Informed Buyer*, Recognising technical expertise as a crucial factor in the success of engineering contracts, Institution of Engineers Australia, Canberra, 2000.

42 Engineers Australia, *Submission 67*, p. 12.

43 Australian National Engineering Taskforce, *Engineers Survey*, March 2010, p. 3. Available online: http://www.anet.org.au/wp-content/uploads/2010/03/survey_report_summary.pdf (accessed 4 June 2012).

44 Australian National Engineering Taskforce, *Engineers Survey*, March 2010, p. 4.

45 Australian National Engineering Taskforce, *Engineers Survey*, March 2010, p. 4.

As a government department, we moved from having a large in-house engineering workforce, to outsourcing most functions. We are now largely an administrative/management agency. However with that outsourcing we lost a lot of institutional knowledge and capability. We struggle to remain an informed client and are desperately trying to build technical expertise in key areas that cannot be met through the private sector. The current situation is inadequate to meet current demands, let alone provide a sustainable model to meet future demands. The organisation has not successfully tackled the issue of attraction and retention of engineers and allied technical personnel.⁴⁶

4.33 In 2003 Engineers Australia released a policy on government purchasing. In this document Engineers Australia set out recommendations and advice to government to promote the need for government to properly address technical and engineering risks when purchasing engineering, information technology and other technical products.⁴⁷

4.34 Engineers Australia warned the committee that government cannot rely simply on contract management experience in engineering procurement, arguing that 'these skills are vital, but are not a substitute for technical engineering expertise'.⁴⁸

4.35 The Australian National Engineering Taskforce, of which Engineers Australia is a member, supports these observations, reminding the committee that the Orgill report into the Building the Education Revolution (BER) identified only the Queensland Government as an informed purchaser of capital works projects.⁴⁹ The committee is very familiar with these conclusions, as it also conducted an inquiry into the BER and was alarmed at the waste of resources through mismanagement, particularly in New South Wales.⁵⁰

4.36 Finally, the committee notes that filling positions that do still exist in the public sector is difficult, with recruiters facing the same challenges as their private sector counterparts. Mr Craig Woolridge, representing the Australian Institute of Traffic Planning and Management explained to the committee the difficulty in recruiting quality staff in the public sector:

Within government organisations, whether they be state or local government ones, we are seeing significant problems in recruiting staff. In my role at the department of transport I have a 25 per cent vacancy rate. While we have tried recruiting locally and nationally, that has failed. Primarily, the people that we after have 10-years-plus experience. Getting

46 Australian National Engineering Taskforce, *Engineers Survey*, March 2010, p. 4.

47 Engineers Australia, *Submission 67*, p. 12.

48 Engineers Australia, *Submission 67*, p. 12.

49 Australian National Engineering Taskforce, *Submission 73*, p. 21.

50 Education, Employment and Workplace Relations References Committee, *Primary Schools for the Twenty First Century Program*, Final Report, March 2011.

graduates is a bit easier. Obviously, some companies and governments have taken advantage of the slowdown in other countries through the GFC. We would see that as a temporary initiative and, obviously, as economies around the world do pick up those opportunistic pick-ups will not be there in the numbers that they have been in recent times.⁵¹

Committee view

4.37 It is clear that public sector capability to act as an informed purchaser and adequately scope and oversee large infrastructure and construction projects has been severely eroded over the past decades.

4.38 The committee accepts that the federal government, along with state, territory and local governments have decided over recent decades to outsource much of their engineering skills. However, a role that government cannot outsource is quality decision making, efficient use of taxpayer money and properly scoped requests for tender. For this reason the committee believes that governments of all levels should enhance their engineering capacity.

4.39 The committee agrees with a recommendation made by Engineers Australia that senior technical specialist roles could be created to provide a technical career pathway (in tandem with traditional managerial/generalist career pathways) for those seeking to build specialist knowledge while continuing to enjoy career progression in the public sector. This would reduce the incentive for experienced engineers to move to the private sector.⁵²

4.40 The committee notes the recommendations made by the Australian National Engineering Taskforce that:

- the Federal Government increase its engineering capacity to ensure that it is an informed purchaser of engineering infrastructure, in line with the recommendations of the Building the Education Revolution Implementation Taskforce, and establish a small Procurement Unit, residing within the Department of Finance and Deregulation.
- the Federal Government, through that Procurement Unit conduct an audit of its procurement capability across all agencies.
- the Federal Government take to the relevant Standing Council of COAG a proposal that all States and Territories conduct their own audit, to ensure that the community is receiving value for-money in infrastructure delivery; and
- that following this audit, the Federal Government put in place a series of requirements for baseline engineering competence and capacity in

51 Mr Craig Woolridge, National Vice President, Australian Institute of Traffic Planning and Management, *Proof Committee Hansard*, 27 March 2012, p. 29

52 Engineers Australia, *Submission*, p. 13.

jurisdictions, including local government, for the management of projects funded by the Federal Government.⁵³

Recommendation 6

4.41 The committee recommends that the government consider creating senior technical engineering roles in the Australian Public Service. This measure would ensure that highly qualified technical engineers may continue to build upon specialist knowledge while enjoying career progression in the public sector.

Recommendation 7

4.42 The committee recommends that the Department of Finance and Deregulation reviews the Commonwealth Procurement Guidelines to ensure that the government is an informed purchaser of engineering infrastructure and that appropriate advice is provided in relation to procurement decisions that require specialist technical knowledge.

Conclusion

4.43 The engineering skills shortage has a significant impact on Australia's economy, workforce, infrastructure and project delivery. The 82 submissions received by the committee are a testament to how the engineering skills shortages are impacting a whole range of groups in Australia. The committee received submissions from industry groups, consulting firms, employer groups, governments, universities and training providers. In this chapter the committee has provided a snapshot of the effect that the engineering skills shortages are having.

4.44 The shortage has resulted in poorly conceived and poorly delivered projects by both the public and private sectors, culminating in cost blow outs and delays. In part this is because of a decreased engineering capability in the public sector – which impacts on the quality of tender selection and indeed even on the request for tender proposal itself. However, the committee also heard that poorly delivered projects are also a feature of private enterprise.

4.45 The demand for engineering skills by the mining and resources industries has impacted on the capacity of other sectors, as engineers migrate to more lucrative fields. The manufacturing sector and local government sectors are particularly impacted by this trend.

4.46 The skills shortage has serious flow on effects for the training of engineers. Many industries feel like they do not have time to train graduates, particularly as graduates with more than three or four years' experience are highly employable and likely to move to another job. Training and development for experienced staff can fall by the wayside amidst high workloads and low retention rates, further worsening an already deficient situation.

53 The Australian National Engineering Taskforce, *Submission 73*, p. 47.

4.47 Having established the depth and breadth of the problem that engineering skills shortages pose, the committee now turns to consider its specific causes and what might be done to address them.