AUSTRALIAN CONSTRUCTORS ASSOCIATION
ABN 63 065 806 948

3 February 2012

Committee Secretary
Senate Education, Employment and
Workplace Relations Committees
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Parliament House
CANBERRA ACT 2600

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Dear Committee Secretary

The Shortage of Engineering and Related Employment Skills

I have attached for the attention of the Committee, the submission of the Australian Constructors Association (ACA) to the Committee inquiry into the shortage of engineering and related employment skills in Australia.

The ACA is available to meet with the Committee to discuss its submission if requested.

Yours faithfully

Jim Barrett
EXECUTIVE DIRECTOR

Australian Constructors Association
ABN 63 065 806 948

THE SHORTAGE OF ENGINEERING AND RELATED EMPLOYMENT SKILLS

AN INQUIRY BY THE SENATE EDUCATION, EMPLOYMENT AND WORKPLACE RELATIONS COMMITTEES

INTRODUCTION

The Senate Education, Employment and Workplace Relations Committees have been asked to inquire into and report on the shortage of engineering and related employment skills.

In particular the Committee inquiry will focus on the nexus between the demand for infrastructure delivery and the shortage of appropriate engineering and related employment skills in Australia.

The Committee has been asked to consider the implications of:

- the shortage for infrastructure delivery and the impact on economic development, cost, efficiency, safety and disputation; and
- the long-term outsourcing of engineering activities by government on skills development and retention in both the private and public sectors.

The Committee has also been asked to consider options to address:

- the skill shortage for engineers and related trades, for infrastructure delivery using alternative procurement models
- to consider effective strategies to develop and retain engineering talent in the private and public sectors through industry training and development
- incentives to the private sector through the procurement process to undertake skills development and
- the consequences of skills shortage in the construction sector to the public sectors' capacity to effectively procure and manage infrastructure projects.

INTRODUCTION

The Australian Constructors Association (ACA) welcomes the opportunity to contribute to the Senate Education, Employment and Workplace Relations Committees inquiry into the shortage of engineering and related employment skills.

Analysis of the current shortage of professional engineers is a complex issue. It is a problem that has developed over the past two or three decades and it will not be resolved quickly. It has short, medium and long term dimensions, all of which will require different policy responses.

This is not a problem owned by a particular class of industry participant. It affects the community, asset owners, public and private sector clients, contractors, consultants and employees. It will also impact on those aspiring to join the industry whether they are currently at school, at university or a prospective migrant with well-developed skills.

And of course those in the current engineering workforce including those nearing retirement age.

In the following submission we refer to various data sets and source documents. Many of these refer to the engineering profession at large. Engineers are employed in a wide range of industry sectors. Our focus is the infrastructure sector. Whilst ACA member companies' capacity to bid for work can be limited by its ability to attract and retain the skills need to design, plan and construct a piece of infrastructure the skills shortage also affects the industry's clients particularly public sector clients.

We also note that the skills shortage affecting the construction industry is not limited to engineering skills and extends across a range of occupations, professional, technical, trade and non-trade. ACA members have embraced a range of strategies to deal with these shortages.

Professional engineers employed by public sector departments and agencies are responsible for bringing infrastructure projects to the market on behalf of the government of the day. This was highlighted in the 2008 report *Scope for Improvement,* published by Blake Dawson in partnership with ACA. The focus of that report was an examination of the factors leading to the poor scoping in Australian construction and infrastructure projects. The report noted,

"The inexperience and insufficient level of competence of those preparing scope documents are clearly identified by respondents as the most significant contributors to inadequate scoping. 83% of respondents felt the skills shortage in

Australia had an adverse impact on their ability to find skilled resources and expertise to develop scope documents properly".[1]

The shortage of professional engineers did not arise overnight and there have been many factors that have contributed to the current shortage. Equally resolving the shortage will not be easy. The short term demand is being met by the market and reflected in high salaries and a focus on overseas recruitment.

The impact is largely economic with the risk of projects being delayed and the costs of those projects escalating to the point where projects become too expensive for clients to proceed and/or margins are squeezed and contractors cannot afford to bid the work.

The medium and longer term solutions will need closer examination and a tailoring of public policy across a number of areas including education, training procurement policy and migration policy.

In the following submission, the Association presents its views on the engineering skills shortages confronting the sector.

We discuss the supply of home-grown engineering skills which will rely on:

- engagement with primary and secondary school students,
- the attraction of students to university engineering courses and their successful completion of those courses,
- the increased engagement of women in the engineering profession,
- the potential to re-engage trained engineers who may have left the profession but who would welcome the opportunity to return.

Migration has also been an important source of skills for the construction industry and this is also discussed.

Engineering capability is a key driver in the success of all advanced economies. If Australia wants to be a smart country we need to invest in our engineering capability and this needs to be reflected in integrated policies that extend across all portfolios – education, employment and training, finance, infrastructure development etc. It also needs to be a national approach that embraces the states and territories and the private sector.

The development of a skilled labour force brings both public and private benefits. The costs of skills development must be shared by the enterprise, the government, the industry's clients and where relevant, the individual.

[1] Scope for Improvement 2008, Blake Dawson pp7

Expansion of the nation's engineering skills base will require appropriate investment by the public and private sectors and we discuss some potential commercial and regulatory drivers which may be considered.

ABOUT THE AUSTRALIAN CONSTRUCTORS ASSOCIATION

This submission is made on behalf of the Australian Constructors Association (ACA).

ACA represents Australia's major construction contractors. A list of members is included as an Annexure A to this submission.

ACA has 20 member companies - a company must operate nationally and have a minimum annual turnover of a billion dollars in to be eligible for membership. A pre-condition of membership is that the Chief Executive must represent the member on the Association's Board of Directors.

ACA member companies have a combined annual revenue in excess of $A50b and collectively employ nearly 100,000 people in their Australian and international operations.

ACA member companies operate in a range of markets including residential and non-residential building, engineering construction, process engineering, contract mining, engineering design, infrastructure development and maintenance, oil & gas operations and maintenance, telecommunications services and environmental services.

The Association's Mission is to promote a sustainable construction industry for the benefit of the Australian economy. Its key objectives are:

- To influence policy with respect to construction industry issues.
- To be the authoritative voice for construction contractors.
- To work with the public and private sectors to develop a sustainable pipeline of infrastructure work.
- To promote the highest standards of integrity, quality and safety across the industry.
- To promote the industry as a great place to build a career.

THE IMPACT OF THE SCHOOL

The 2011 report *The Engineering Profession*[2] prepared for Engineers Australia notes that the proportion of year 12 students studying advanced mathematics in Australia – a prerequisite for studies in engineering - has been falling for some time but has been masked to some degree by the increased retention of students to year 12.

In 2011 the Australian Research Council published its Linkage Project Report *Identification and Development of Strategies for Increasing Engineering Enrolments*[3] published under the banner *Engineering Choices, Engineering Futures.*

The report focused on the challenges to building young people's interest in engineering with an ultimate objective of increasing enrolments in university engineering programs.

The report notes that in many western nations including Australia it has proved difficult to attract sufficient numbers of students into engineering to meet national demand.

The project addresses the question *What do we need to know to understand young people's choice of a career in engineering? What factors come into play, in what combination, and when do they become important?*

The report examines three themes:

- Enriching the primary school experience
- Enthusing secondary school students and
- Encouraging intending tertiary students into engineering degrees.

The report notes:

"The overwhelming message of this and many preceding studies and reviews is that action needs to be taken to address this issue and a piecemeal approach should not be attempted. While short, medium and long term steps have been identified, it is essential that the solution is seen as a continuum of action from preschool to the end of secondary school and beyond. A plan of action needs to be in place which addresses the quality and inspiration of mathematics and science teaching and curricula from K-12. Only through a holistic approach can we ensure that a similar report to this one will not be written again in ten years time".

[2] The Engineering Profession, A Statistical Overview, Andre Kaspura, 8th Edition, 2011
[3] Report of the ARC Linkage Project LPO562653, The University of Newcastle, 2011

The report makes eight very practical recommendations and ACA suggests that these recommendations be endorsed by the Inquiry as stage one of resolving this problem. These recommendations are included as an Annexure B to this submission.

The Science and Engineering Challenge is a constructive example of these recommendations in action.

The Science and Engineering Challenge, or *The Challenge* as it is better known, is a program conducted by the University of Newcastle across Australia with the support of 21 other universities, Rotary International, Engineers Australia and until recently the Australian Government Department of Innovation, Industry, Science and Research.

The Challenge engages students to explore scientific and engineering principles through fun and practical activities requiring team based problem solving skills. *The Challenge* starts at the local level as a competition between schools in a region, progressing to a state-wide final. Winners of each of the State Challenges then compete with schools from all over Australia in the Grand National Challenge.

The main aim of *The Challenge* is to change perceptions of Year 10 students about what a career in science and engineering involves. Through their participation in *The Challenge* they better appreciate that success in these careers requires innovation, creativity, teamwork and problem solving skills, they may not have previously associated with these careers. The outcome is to encourage students to continue to study physics, chemistry and mathematics in Years 11 and 12, to keep open their career options.

The program currently engages over 20,000 students across Australia each year. The Australian Constructors Association (ACA) was the first national sponsor of the Science and Engineering Challenge.

The Commonwealth Government had made a significant contribution to the funding of this program over a number of years but this funding ceased in 2011.

Given the success of the *Challenge*, its strong community and private sector support base, we could strongly recommend that the Commonwealth re-commit to funding this program.

WOMEN IN ENGINEERING

The Engineer's Australia *Engineering Profession*[4] report noted

"The gender imbalance in engineering has its genesis in insufficient applications, that is, interest in engineering and related technologies courses. Universities have increased offer rates to maintain the female share and the female share of acceptances has also been maintained, but without additional and significant growth in female applications, little change is likely.

The gender imbalance is particularly acute among the best students, that is, those with TES scores 90 and over. The share of acceptances of engineering and related places by males is the highest of any discipline by a large margin but the share of acceptances from females is the lowest of all but one other discipline. More females obtain high TES scores than do males.

The report notes that between 2009 and 2010 male applications increased by 2.1% but female applications fell by 3.9% resulting in a combined outcome of 1.3% growth. The female share of applications fell from 13.4% in 2009 to 12.7% in 2010.

Only 4.6% of girls with TES scores over 90 accepted places in engineering and related technologies, compared to 23.8% of all males with TES scores of 90 and over.

In the construction and resources sectors the industry's culture of long hours and the remote nature of the industry's operations has no doubt had a more negative impact on the attraction of women into engineering careers.

Increasing the participation of women in engineering, particularly in construction, infrastructure and resources sectors will require industry leadership, specialised recruitment strategies, a re-balancing of workplace culture and improved workplace policies, systems and procedures.

Further collaboration between the private and public sectors including the education sector should be encouraged and promoted.

[4] The Engineering Profession, A Statistical Overview, Andre Kaspura, 8th Edition, 2011, Engineers Australia, pp27

ENGAGING ENGINEERING GRADUATES

Graduate Careers Australia (GCA) collects data from new graduates about four months after the completion of their studies through the Australian Graduate Survey (AGS).

The median starting salary for full-time employed graduates was $49,000. For engineering graduates the median starting salary was somewhat higher with a substantial proportion in full time employment:

Field of Education	Median Starting Salary	In F/T Employment
Aeronautical engineering	$55,300	77%
Chemical engineering	$60,000	67.2%
Civil engineering	$55,000	93.1%
Electrical engineering	$60,000	76.4%
Electronic/Computer Engineering	$53,500	78%
Mechanical engineering	$56,000	79.9%
Mining engineering	$79,000	89.1%
Other engineering	$56,000	83.8%

ABS data[5] on the number of employed and unemployed for selected professional groups suggests that for engineering professionals 134,500 were employed and only 2,900 unemployed with an Occupational Unemployment Rate of 2.1%.

A Department of Education, Employment and Workplace Relations report[6] (June 2011) on Skills Shortages, reported that for Engineering Professions only 41% of vacancies were filled, a deterioration of 10% as an annual change.

The Engineering Profession Report[7] notes that of the engineering labour force (i.e. people with formal educational qualifications in engineering) about 57% were employed in engineering occupations. These statistics date back to 2006 so they can hardly claim to reflect the current labour market .

However, in an Engineering Pathways Seminar Background Paper (November 2011), Skills Australia reported

"In 2007, only 54% (175,300) of the engineering labour force were employed in an engineering occupation and by 2010, this figure had reached 58.2% or

[5] Australian Bureau of Statistics, Quarterly Labour Force Survey (Cat No 6291.0.55.003), average over four quarters to February 2011
[6] Department of Education, Employment and Workplace Relations, Skills Shortages, Australia, June 2011
[7] The Engineering Profession, A Statistical Overview, Andre Kaspura, 8th Edition, 2011, Engineers Australia p6

213,200. To alleviate skills shortages in engineering occupations it may be necessary to consider ways to encourage people with engineering qualifications to enter and remain employed in engineering occupations".

Those people with engineering qualifications not working in engineering professions may well of course be working in related occupations or in occupations that make use of those skills.

However it does highlight that there may be a section of the labour market which may transition back to the profession if appropriate bridging arrangements were in place.

MIGRATION

Skilled migration has always played an important role in the skilling of Australia. The Engineering Profession report[8] notes that the 2006 census revealed that 46% of the engineering profession was born overseas. This of course includes the children of earlier generations of migrants not only people who migrated to Australia as engineers.

The report argues that skilled migration has been the Australian Government's main response to skills shortages in the engineering sector. Over the 2009-10 period there were 6,712 permanent visas granted to engineers.[9] The skilled occupations list (SOL) used by the Department of Immigration and Citizenship governs independent skilled permanent migration and most engineering occupations are currently on the SOL. The current Australian migration program has a strong skilled migration stream.

In addition to permanent migration Australia has a temporary program of visas which include an entitlement to work. One of these, the employer-sponsored subclass 457 visa is used extensively in the construction and resources sector and is often supported by formal labour agreements between major employers and Government.

Statistics obtained from the Department of Immigration and Citizenship report that in the 2010/11 financial year 3,830 engineers were granted subclass 457 visas. (See Annexure C).

Interestingly the Subclass 457 program has become a pathway to permanent migration with more than 50% of visa holders achieving permanent residency under employer sponsored arrangements.

We make no recommendations on this issue other than to note that the migration program makes an important contribution to the engineering skills of Australia. The temporary program allows the industry to respond to particular peaks in demand for skills.

[8] The Engineering Profession, A Statistical Overview, Andre Kaspura, 8th Edition, 2011, Engineers Australia p9
[9] ibid, p.55

ANOTHER OPTION – VET TO UNIVERSITY?

There is one other option that warrants further investigation. This utilises Diplomas and Associate Degrees developed and offered through the VET system with articulation into University courses.

This has the potential to provide a career path for employees currently engaged in the construction industry who may wish to advance their qualifications.

To succeed it will require the University sector and VET sectors to collaborate and preferably focus on areas of significant shortage. There will no doubt be pockets of support for this approach but we remain cynical that these two sectors can cooperate to produce an effective outcome without strong support from the Government and employers.

Skills Australia reports that fewer students transfer from VET to Higher Education in engineering than in other fields.

"Research suggests that this is because automatic entry for VET graduates to engineering qualifications is not offered by any university. Due to the high degree of diversity in VET qualifications, consideration of entry and credit is on a case-by-case basis".[10]

It is reported that articulation is especially difficult for students who do not have a sound background in mathematics and fundamental sciences.[11]

[10] Watson and McIntyre, *Scaling up*, p.61
[11] ibid, p.9

PROCUREMENT POLICY

We note that the members of the Australian Constructors Association operate in a range of markets including residential and non-residential building, engineering construction, process engineering, contract mining, engineering design, infrastructure development and maintenance, oil & gas operations and maintenance, telecommunications services and environmental services.

However, much of the discussion (and data) referenced in the earlier sections of this submission concerns the shortages of engineering skills in the profession at large, including different disciplines across a range of industry sectors. Whilst we restrict our discussion to the impact on contractors operating in the construction and resources sector, it has in equal measure impacted on the clients of the industry including public works departments, road and rail authorities, water authorities, education and health departments and defence departments.

As noted earlier in this submission, the development of a skilled labour force brings both public and private benefits. The costs of skills development must be shared by the enterprise, the government, the industry's clients and where relevant, the individual.

In an endeavour to address Australia's Engineering Skills Shortage, the Australian National Engineering Taskforce[12] (ANET) has published a number of reports and more recently developed an industry discussion paper that outlines a number of options that could be built into the procurement of larger government funded (public sector) projects.

The paper discusses five options:

1. Prequalification of contractors that requires a level of training or number of graduates in a structured graduate program and/or number of cadetships
2. Tender requires a level of training or number of graduates in a structured graduate program and/or number of cadetships
3. Tender requires a training plan which includes a structured graduate program and/or number of cadetships
4. A percentage of the capital costs of the project are required to be spent on training (not forwarded to a central fund)
5. Government provides an R & D style tax concession for training of designated occupations identified as shortages.

The ACA response to these options is set out below.

[12] ANET is a coalition formed to investigate the shortfall in engineering capacity. Its members include the Association of Professional Engineers, Scientists and Managers Australia, Engineers Australia, Consult Australia, the Council of Engineering Deans and the Australian Academy of Technological Sciences and Engineering.

Use of Procurement Policy to Drive Change

It is not uncommon for Government's to use procurement policy to lift industry standards.

Examples include the introduction of quality systems, heath and safety systems, environmental management systems and of course financial systems.

These policies are based on the principle that higher standards provided by service providers will ultimately achieve long term benefits for the Government as a client. The cost of developing these systems is a cost to the business of the service provider. However, the Government is prepared to pay for these extra costs through relief at the tender box i.e. the client ensures service providers only compete against other service providers who have also invested in lifting standards and therefore the premium is reflected in the prices offered by all bidders.

Procurement policy works where it is applied uniformly across a large market as part of a whole of government approach. The government must have the discipline to ensure all of its construction departments and agencies apply the policy uniformly and consistently. Over time other service providers will understand that to compete in these markets they will need to raise their standards to comply with the government's requirements.

The Commonwealth's capacity to utilise procurement policy to drive reform is limited by its presence in the market as a client of the industry. The reality is that whilst a significant client, much of the Commonwealth expenditure on infrastructure whether it be education, health, transport etc is exercised through grants to the States and Territories supported by deeds of arrangement (indirect funding).

Where the Commonwealth is able to harness the purchasing power of its direct and indirect spending on infrastructure it can be a significant driver of change.

Prequalification of contractors that requires a level of training or number of graduates in a structured graduate program and/or number of cadetships

Australia's Commonwealth and State/Territory Government's via their procurement policies pre-qualify contractors as a pre-condition for bidding for work.

These prequalification processes may test a company's financial capability, technical competence, its systems - including health and safety, quality, human resources and skill development programs (including issues such as indigenous

employment), environment etc - and its ability to manage the significant risks of a particular category of infrastructure.

It is not uncommon for companies to be graded to enable them to bid for work up to a certain value or scope and over time to progress to higher value and more complex projects as their capability is demonstrated.

Although pre-qualification can be rigorous, expensive and time-consuming, it is also beneficial to contractors as when they bid for work they invariably bid against companies who have made a similar level of investment in their organisations' systems, equipment and education and training systems – like v like.

In this context a pre-qualification criteria requiring a level of training or number of graduates in a structured graduate program could work if it was properly structured and uniformly applied.

It is also important that in setting the benchmark the pre-qualifcation criteria is set high enough to achieve a significant increase as the majority of ACA member companies already have well-developed graduate programs.

However, we note that whilst prequalification is common in public sector clients it is less common for private sector clients and that is a potential weakness with this proposal.

If a majority of a company's work is in the public sector and the criteria is uniformly applied it will impact the competitors in that market in a consistent and measured way.

However, the costs of these programs are also a working overhead and may be a liability when competing for work against competitors who have not made a commitment to this initiative and who may therefore be at a significant price advantage.

Tender requires a level of training or number of graduates in a structured graduate program and/or number of cadetships

Our comments on this proposal are similar to those of the preceding proposal.

The significant difference between pre-qualification and a tender is that the tender is very project focused and therefore minimum targets can be specified. Provided that all bidders are required to meet the same standard in relation to the project tendered the proposal could have merit.

It is important to recognise that in both of these proposals the contractor has committed to increasing its cost base (at the expense of its competitiveness) but this is offset by a willingness of the client to may a higher price at the tender box.

This satisfies the principle stated earlier that the development of a skilled labour force brings both public and private benefits and the costs of skills development must be shared by the enterprise, the government, the industry's clients and where relevant, the individual.

Tender requires a training plan which includes a structured graduate program and/or number of cadetships

We believe that this proposal has merit provided that the outcome is a genuine increase in the number of graduate/cadet engineers.

It will be most effective on projects that extend over a number of years.

For example a tender may require a contractor to engage an additional X number of graduate engineers during the life of a project that may be completed in less than 12 months.

If the contractor bids for a new project that also requires the recruitment of X+X graduate engineers the company may receive no credit for the graduates already employed.

It is important therefore that if these programs need to be carefully thought through and their structure discussed with employers before being set in stone.

A percentage of the capital costs of the project are required to be spent on training (not forwarded to a central fund)

The proposal could potentially influence the quality of training through accreditation procedures and helping to stimulate a competitive training market.

It could also encourage companies to intensify their training efforts, by increasing training capacity and raising training quality

However, we do not support the proposal because it is clumsy and would be difficult to administer in a market that is project focused.

To have any chance of success it would need the support of private as well as public sector clients and in our view private sector clients will not support a proposal that in effect serves as a vehicle for cross subsidization of smaller and less-sophisticated firms.

Beyond the contracting sector we believe the consulting profession would share the same concerns.

Government provides an R & D style tax concession for training of designated occupations identified as shortages.

The concession would need to be well-designed, transparent and administratively efficient if it was to be effective.

.We believe this proposal has merit and worthy of further development.

We would support a recommendation requesting The Treasury and the Australian Taxation Office to initiate development of a discussion paper detailing how the proposal might be advanced.

Advancing the Discussion on Procurement Policy

The Australasian Procurement and Construction Council (APCC) is the peak council of departments responsible for procurement, construction and asset management policy for the Australian and State and Territory Governments.

APCC is a national reference point for emerging issues in procurement. ACA recommends that APCC, working with the ACA, and the Australian National Engineering Taskforce partners together with Australian Local Government Association be given a reference to examine how national, state and territory and local government procurement policy could be efficiently and effectively utilized to address this issue.

Unfortunately there is no equivalent of APCC that draws together private sector clients. However, as public sector policy develops the Commonwealth could initiate an industry dialogue with ACA, the Property Council of Australia, the Minerals Council of Australia and other significant client groups.

ANNEXURE A

AUSTRALIAN CONSTRUCTORS ASSOCIATION MEMBERS COMPANIES

Abigroup Contractors Pty Limited

Baulderstone Pty Ltd

BGC Contracting Pty Ltd

Brookfield Multiplex Constructions Pty Ltd

CH2M Hill Australia Pty Ltd

Clough Limited

Downer EDI Limited

Fulton Hogan Pty Ltd

Georgiou Group Pty Ltd

John Holland Group Pty Ltd

Laing O'Rourke Australia Construction Pty Limited

Leighton Contractors Pty Limited

Leighton Holdings Limited

Lend Lease Pty Limited

Lend Lease Infrastructure Pty Limited

Macmahon Holdings Limited

McConnell Dowell Corporation Limited

Thiess Pty Ltd

UGL Limited

Watpac Limited

ANNEXURE B

RECOMMENDATIONS – SHORT TERM

Recommendation 1:

Creation of Industry-University partnerships to provide scholarships to students entering engineering degrees.

These scholarships should have a strong work experience component, provided by the companies sponsoring the students.

A main focus of the scholarships should be encouraging women to become engineers.

Recommendation 2:

HECS subsidisation in order to attract more students to engineering degrees.
This should be done in conjunction with better information for students of the essential and desired prerequisites to enter engineering studies.

Recommendation 3:

Facilitation the upskilling of engineering sub-professionals by appropriate articulation arrangements between TAFE and Universities.

This should be done by providing clear pathways from the engineering trades to technologists to professional engineers.

RECOMMENDATIONS – MEDIUM TERM

Recommendation 4:

We recommend improving students‘understanding of engineering as a profession by the involvement of the engineering profession in general, and Engineers Australia in particular in:

1. Organising visits to Year 12 students from professional engineers

2. Organising a media campaign to promote engineering as a profession debunking current myths and misconceptions

3. Creating a more modern web-based approach to engineering promotion highlighting the status and rewards of the profession

4. Providing mentoring and role models to schools as required.

Recommendation 5:

Investment should be placed on Science and engineering Outreach Programs which:

1. Improve students‘ awareness of engineering and engineers' work

2. Improve students‘ understanding of the enabling sciences leading to engineering careers

These Outreach Programs should be co-ordinated at a national level and organised to reach all Australians

Recommendation 6:

Careers advisors play a very important role in shaping young people‘s occupational choices. It would be advisable to improve their awareness of engineering choices and rewards. This can be achieved by:

Mobilising the resources of Engineers Australia to provide regular information and site visits for Careers Advisors in all of its Divisions throughout Australia

RECOMMENDATIONS – LONG TERM

Recommendation 7:

We recommend the development of an intervention strategy suitable for wide-scale implementation to enrich mathematics skills at primary school in order to increase the possibility of choice of a career in engineering. The goals of the intervention would be to:

1. Improve awareness of engineering and engineers' work within the school community

2. Increase children's interest in taking engineering in the future through an enriched maths experience

3. Enhance teachers’ ability to teach mathematics at a level that enables transition to secondary school maths

Recommendation 8:

The resources of Engineers Australia be mobilised to:

In conjunction with a Primary School Mathematics Intervention Strategy, develop a voluntary mentorship scheme for appropriately motivated and skilled engineers to assist in the classroom in relating mathematics to the real world in general and engineering in particular.

Develop strategies to more clearly clarify and define the term “engineer” in the eyes of the general community

Annexure C

Subclass 457 primary visa granted between 2006-07 and 2010-11 where the nominated occupation is ANZSCO 233 Engineering Professionals by client location

Client Location	Nominated Occupation ANZSCO	2006-07	2007-08	2008-09	2009-10	2010-11
Offshore	233111 Chemical Engineer	100	180	110	80	80
	233112 Materials Engineer	30	30	30	20	30
	233211 Civil Engineer	530	820	630	290	490
	233212 Geotechnical Engineer	0	0	0	0	80
	233213 Quantity Surveyor	80	110	100	80	130
	233214 Structural Engineer	0	0	0	0	70
	233215 Transport Engineer	0	0	0	0	40
	233311 Electrical Engineer	290	350	270	130	220
	233411 Electronics Engineer	210	160	110	80	70
	233511 Industrial Engineer	30	50	40	30	90
	233512 Mechanical Engineer	410	570	420	220	350
	233513 Production or Plant Engineer	90	120	80	60	110
	233611 Mining Engineer (excluding Petroleum)	140	200	140	40	120
	233612 Petroleum Engineer	130	130	100	110	150
	233911 Aeronautical Engineer	20	30	30	20	20
	233912 Agricultural Engineer	< 5	10	< 5	< 5	< 5
	233913 Biomedical Engineer	< 5	< 5	10	10	10
	233914 Engineering Technologist	220	250	230	80	100
	233915 Environmental Engineer	0	0	0	0	30
	233916 Naval Architect (Aus) / Marine Designer (NZ)	10	10	10	< 5	10
	233999 Engineering Professionals nec	230	290	250	140	320
	Offshore Total	**2 500**	**3 290**	**2 570**	**1 380**	**2 510**
Onshore	233111 Chemical Engineer	60	70	70	60	60
	233112 Materials Engineer	10	10	20	20	20
	233211 Civil Engineer	230	380	410	270	330
	233212 Geotechnical Engineer	0	0	0	0	40
	233213 Quantity Surveyor	50	80	90	80	120
	233214 Structural Engineer	0	0	0	0	40
	233215 Transport Engineer	0	0	0	0	10
	233311 Electrical Engineer	110	110	110	80	100
	233411 Electronics Engineer	90	80	70	40	40
	233511 Industrial Engineer	20	10	20	20	40
	233512 Mechanical Engineer	210	280	260	180	160
	233513 Production or Plant Engineer	30	60	50	30	50
	233611 Mining Engineer (excluding Petroleum)	40	70	60	30	50
	233612 Petroleum Engineer	50	50	60	50	50
	233911 Aeronautical Engineer	10	20	10	20	10
	233912 Agricultural Engineer	< 5	< 5	< 5	< 5	< 5
	233913 Biomedical Engineer	< 5	10	10	10	10
	233914 Engineering Technologist	90	110	110	70	50
	233915 Environmental Engineer	0	0	0	0	30
	233916 Naval Architect (Aus) / Marine Designer (NZ)	< 5	< 5	< 5	< 5	10
	233999 Engineering Professionals nec	120	150	120	80	130
	Onshore Total	**1 130**	**1 490**	**1 460**	**1 030**	**1 320**
Total		**3 630**	**4 780**	**4 030**	**2 410**	**3 830**

Source: Department of Immigration and Citizenship, 2012 (BE4744.01,
Note 1: Figures rounded to the nearest 10

Note 2: ANZSCO was introduced in DIAC on 1 July 2010. Applications lodged prior to that date using the Australian Standard Classification of Occupations (ASCO) 2nd Edition have been converted to an ANZSCO code using a standard DIAC mapping approved by the ABS.