

Working Paper

Pipelines into Professional Engineering Occupations

Prof Robin King, Consultant to ACED

December 2021

This working paper identifies and quantifies the ‘pipelines’ into professional engineering occupations in Australia. The focus is on estimating how many ‘new’ engineers – recent graduates, immigrants, and temporary residents – have entered the engineering workforce in recent years. The paper includes detail on the roles of temporary visa holders in providing a significant pool of engineers, and candidates for permanent migration.

The Australian government sourced data presented are the most recently available. Some cover the impact of COVID-19. The intention is to update the data and observations when the 2020 student and graduate data and 2020-21 immigration statistics have been published.

Introduction

In this working paper, ‘professional engineering occupations’ are those designated at ANZSCO skill level 1 (bachelor degree or higher qualification), and have ‘engineer’ in their name, plus related management occupations for which engineering qualifications and experience would be normally expected.

These occupations are primarily in the *Engineering Professionals (233)* and *ICT Professionals (26)* sub-code groups of the ANZSCO classification. Entry into them requires an Australian higher education qualification or overseas equivalent. The classification includes graduates recognised by Engineers Australia in the occupational categories of Professional Engineer and Engineering Technologist. Relevant bachelor degree programs in ICT are accredited by the Australian Computer Society (ACS).

ANZSCO occupational data do not distinguish experienced engineers from new graduates. Engineers Australia requires that to practice as a registered Professional Engineer or Engineering Technologist requires the degree qualification and at least five years of relevant experience¹. Experience is also relevant to applicants in the skilled migration programs.

The three ‘pipelines’ into professional engineering employment quantified in this paper are shown schematically in Figure 1.

Section 1 describes the pipeline of fresh domestic graduates (Australian nationals) and international graduates who have completed their qualification in Australia. The latter (‘on-shore graduates’) are eligible to remain in the country on a Temporary Graduate visa. Graduates may gain employment as ‘engineers’ without post-graduation experience. Most employers expect – and get – graduates capable of doing ‘useful work’ within a few months of commencing, as discussed further in Section 1.

The migration streams are discussed in Section 2. Overseas-educated engineers seeking Permanent migration (in the Skills stream) or residence on a Temporary Skills Shortage visa, are required to have a minimum number of years of relevant experience. Primary applicants for these streams have their qualifications and experience assessed by an appropriate authority, such as Engineers Australia or the ACS, against the relevant national standards. Most of these streams also require sponsorship by the

¹ Engineers Australia. [National Engineering Register | Engineers Australia](#)

prospective employer. There are, however, other migrants with engineering qualifications and experience who encounter significant barriers to engineering employment. These are discussed briefly in Section 2.3.

Section 3 brings together these data to provide estimates of the recent annual supply of engineers into the Australian workforce.

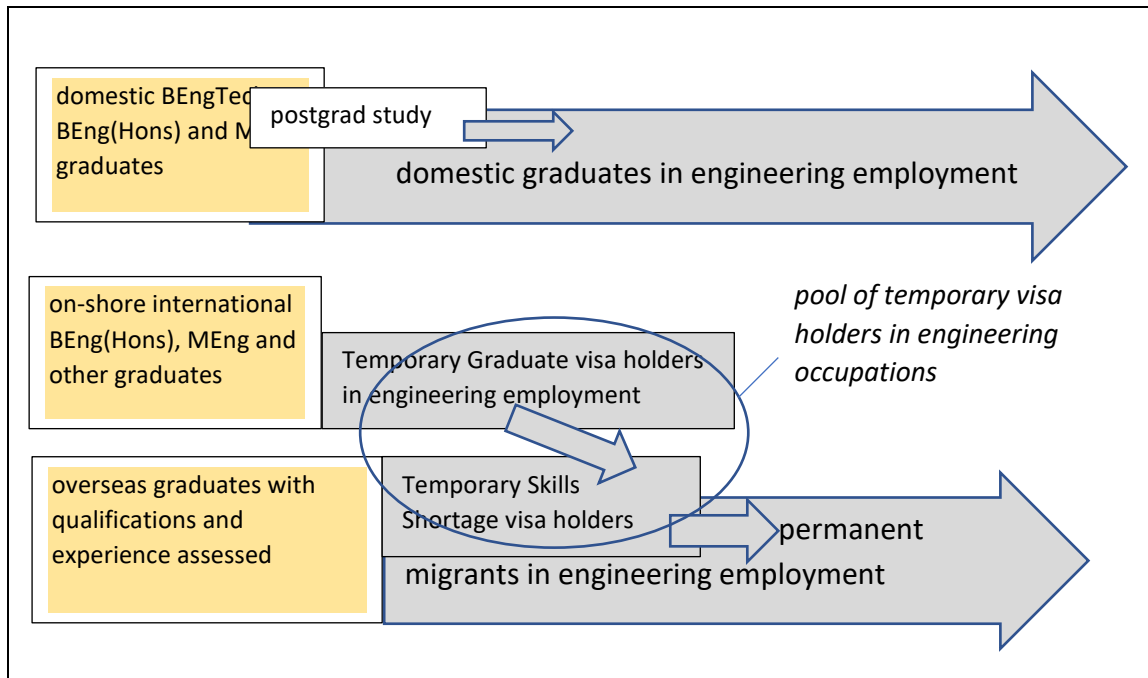


Figure 1 Schematic representation of the pipelines into the Australia engineering workforce

1. Engineering graduations from Australian Higher Education providers

The Commonwealth Department of Education, Skills and Employment (DESE) collects and publishes annual graduate data², against ASCED coded ‘fields of education’. The data for ‘FoE3 Engineering and Related Technologies’ are used by the Australian Council of Engineering Deans (ACED)³ and Engineers Australia⁴ in their statistical publications.

Table 1 shows the numbers of Professional Engineer graduates from accredited Bachelor (Honours) and ‘entry-to-practice’ Master degree programs, in the domestic, on-shore international and on-shore cohorts⁵. The 3-year Bachelor degree numbers include all FoE3 qualifications, only some of which are accredited at the level of Engineering Technologist. Bachelor degree graduations from non-engineering ICT degrees are not included, although it is acknowledged that some of these graduates may take up occupations with ‘engineer’ in their title.

² DESE. [uCube – Higher Education Data Cube - Department of Education, Skills and Employment, Australian Government \(dese.gov.au\)](https://www.dese.gov.au/cube)

³ ACED, 2020. *Australian Engineering Higher Education Statistics 2009-2019*. [ACED Engineering Statistics Dec 2020 v2.pdf](https://www.aced.edu.au/ACED-Engineering-Statistics-Dec-2020-v2.pdf)

⁴ Engineers Australia, 2019. *The Engineering Profession – a statistical overview 14th edition*. [The Engineering Profession, A Statistical Overview, 14th edition - 20190613b.pdf \(engineersaustralia.org.au\)](https://www.engineersaustralia.org.au/Professional-Engineering-Graduates-by-Branch-of-Engineering-May-2021-RKing.pdf)

⁵ More details for 2016 to 2019 are presented in *Professional Engineering Graduates by Branch of Engineering*. [ACED Graduates by Branch of Engineering May 2021 - RKing.pdf](https://www.aced.edu.au/ACED-Graduates-by-Branch-of-Engineering-May-2021-RKing.pdf)

Table 1 Annual domestic and international graduations for ‘entry to practice’ PE degrees, and 3-year degrees in engineering and related technologies, 2016 – 2019

qualifications	2016	2017	2018	2019
4 -year Bachelor degrees and Master degrees (EA accredited)*				
domestic graduations	6,242	6,972	7,518	7,344
international on-shore graduations	3,668	4,790	5,843	6,417
off-shore graduations	825	987	1,067	1,139
3-year Bachelor degrees**				
domestic graduations	544	549	578	524
international on-shore graduations	303	329	434	486

* ACED member providers only; there were less than 50 additional graduates (mostly on-shore international students) each year, from a small number of private providers.

** 3-year degree data includes graduations in FoE3 outside engineering (primarily in Civil Aviation). 3-year Information Technology (FoE2) qualifications are not included.

Graduates (from both domestic and international cohorts) are routinely surveyed during the year after graduation. The surveys report that most engineering graduates of Bachelor degrees are employed (86.6% of 2020 graduates) and 80.3% have full-employment; others progress to postgraduate study (14.3%) including research. A minority of the full-time employed graduates (22%, in 2020) reported that their skills were not fully utilised. These are likely to include engineering graduates who never work in an engineering occupation.

Evidently, the majority of engineering graduates are satisfactorily employed in engineering work. The most recent national employer satisfaction survey placed engineering graduates top of all fields of education, with 90% of employers rating graduates ‘satisfactory’ or better. Further details of these survey results may be found in ref. 3.

While most international on-shore graduates return to their home countries after graduation, some will remain in Australia for postgraduate study or employment. In either case they will need to meet applicable visa requirements. Their contribution to the temporary engineering graduate workforce is discussed below.

2. Inward migration into engineering occupations

2.1. Permanent migration (Skill stream)

Australia’s migration system is complex, and changes quite frequently to meet new requirements. Most visas issued for Permanent migration address medium and long-term skills shortages (MLTSSL). Appendix 1 provides the current list of these occupations, and the assessing authority, in the areas of Engineering and Information Technology. Most branches of Engineering are included at the professional occupation level (ANZSCO level 2). The following data and commentary are taken from Australian Government migration reports⁶ and supporting data sets.⁷

Table 2 provides details for the Skill stream of the Australian migration program, together with the total migration program ‘outcome’ (i.e. numbers of places granted). Except where noted, the outcomes

⁶ Australian Government Department of Home Affairs. Annual Migration Program Reports to 2020-21 can be linked from <https://www.homeaffairs.gov.au/research-and-statistics/statistics/visa-statistics/live/migration-program>

⁷ Australian Government data.gov.au. Annual Migration statistics for 2016-17 to 2019-20 may be linked from [Australian Migration Statistics - Datasets - data.gov.au](https://data.gov.au/dataset/australian-migration-statistics-datasets)

include both Primary and Secondary applicants (family members). In the Skill stream, only the Primary applicants are assessed against qualifications and experience requirements.

In the years to 2018-19, the permanent migration program as a whole shrunk from 189,770 to 160,323. Primary applicants in the Skill stream made up close to 31% of the total migrants during those years. That proportion was maintained during 2019-20, albeit within the smaller overall program.

In 2020-21, the number of permanent migrants was restored to about 160,000 but, presumably due to COVID-19, the relative size of the Skills stream was significantly reduced. In contrast the Family stream increased considerably with its Partner category making up 93.5% of the stream.

The Skill Stream has seven sub-streams, as listed in Table 2, with outcome numbers for the last six years. In 2019-20 (the latest year for which detailed statistics are available) the majority of migrant visas (including their Secondary applicants) in the Skill Stream are granted to Professionals (60%), with Technicians and Trades Workers (17%), and Managers (9%). Most Primary applicants are male, 61.1% in 2019-20, a lower proportion than previous years.

The lower part of Table 2 shows the annual numbers of successful Primary applicants, and the proportion of these making their application from outside the country. This was approximately 35% up to 2018-19, but fell to 20.4% in 2019-20 because of COVID-19. The 2020-21 data shows recovery of this sub-cohort, but the exact proportion for Primary applicants is not yet known. The estimate of 46% (which is typical of previous years) suggests that there were 36,625 Primary applicants.

Based on a statement in the most recent EA Statistics report (ref 4), the proportion of Primary applicants who are successfully assessed for engineering occupations is estimated to be 10% of each year's total. The results of using this estimate, and the corresponding proportion of Primary applicants who are 'new to Australia' are shown in the bottom two rows of Table 2. These numbers are used in Section 3 to calculate the migrant component of engineer supply.

Table 2 Migration program outcomes, with Skill stream details, and estimated numbers of engineers, 2015-16 to 2020-21 (figures in italics are estimates)

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Migration program total	189,770	183,608	162,417	160,323	140,366	160,052
Skill stream – sub-streams						
Skilled independent	43,994	42,422	39,137	34,247	12,968	7,213
Employer sponsored*	48,250	48,250	35,528	42,012	29,261	23,503
State/Territory Nominated	24,650	23,765	274	25,346	21,495	14,268
Regional	4196	1,670	1,574	674	23,372	13,585
Business Innovation/Investment	7,260	7,260	7,260	7,261	4,420	11,198
Global Talent (independent)	n/a	n/a	n/a	n/a	4,109	9,584
Distinguished Talent	200	200	200	200	200	269
Skill stream total	128,550	123,557	111,099	109,713	95,843	79,620
Primary applicants	60,735	56,817	50,046	50,675	43,944	36,625
% of Primary applicants in total	47.2%	46.0%	45.0%	46.2%	45.9%	46.0%
% of Primary applicants applying from outside Australia	33.5%	35.2%	38.9%	32.2%	20.4%	28.8%
Estimated # of Engineers (10% of Primary applicants)	6,074	5,682	5,005	5,068	4,394	3,663
Estimated # of Engineers who are 'new to Australia'	2,033	2,004	1,945	1,631	895	1,055

*In 2019–20, the Employer Sponsored visa category did not include regional migration visas. A new Regional visa was introduced in 2019-20.

Further features of the Skill stream in the past two years have been the introduction and growth of the Global Talent stream and significant increase in the Business Innovation/Investment stream. In 2020-21, the latter sub-stream had approximately 90% of outcomes (including Secondary applicants) from outside Australia, which is very out of line with the Skill stream overall.

Application to Permanent migration in the Skill stream requires a sponsor, or (for the Skilled Independent sub-stream) accumulation of points. Each sub-stream has specific requirements and restrictions; some require prior residence in Australia. Applicants who are in Australia at the time of their application must have a temporary residence visa.

The value of Australia's on-shore international education program is evident from fact that in 2019-20 Permanent migration in the Skill stream was granted to 9,992 former international students who had studied in Australia, including 1,313 (a third of the total) in the Global Talent sub-stream. There were also 6,587 Family visas issued to former international students.

Engineering and IT occupations feature in the DHA reports of the top-10 occupations of successful Primary Applicants for each sub-stream. Relevant data for the four largest sub-streams are provided in Appendix 2 for 2019-20. *'Software and applications programmers (including software engineers)'* are in the top-10 of all four sub-streams, while *'civil engineering professionals'* and *'industrial, production and mechanical engineers'* feature in the top-10 of three sub-streams. These numbers broadly support the 10% estimate of engineers amongst the visas granted to Primary Applicants.

The first year (2019-20) of the Global Talent sub-stream had 1,817 Primary applicants. Their occupational distribution was reported in ref.5 for that year as: *"Quantum Information, Advanced Digital, Data Science and ICT' (28%), 'MedTech' (26%), 'Energy and Mining Technology' (20%), 'AgTech' (9%), 'Space and Advanced Manufacturing' (8%), FinTech (6%), and Cyber Security (3%)"*. It is assumed that most of the migrants in this sub-stream have doctoral degrees in STEM.

2.2. Temporary migration – skills-related visas

Temporary visas have tightly defined restricted eligibility and terms. Two types are discussed here.

The **Temporary Skill Shortage** (subclass 482) visa aims to fill short and medium-term skills shortages and offers eligibility for subsequent application for permanent migration. Primary applicants for TSS visas must have at least two years of relevant experience, be sponsored by an employer, and work only for that employer or associated entity. The visa is issued for two years (short-term shortages), or for four years against the medium- and long-term skills shortage lists (see Appendix 3).

The Engineering and related occupations (including those in IT) of the Primary applicants for Temporary Skilled visas granted in the each of the five years to 2019-20 are shown in Table 3. The data extends into the first period of COVID impact. The numbers include individuals renewing their TSS visa or (at the time of application) hold a Temporary Graduate visa (see below).

The data presented shows that Engineers made up approximately 10% of all Primary applicants in 2015-16 and 2016-7, and a higher proportion in the subsequent years. The highest number of visas granted to Engineers over the period shown was 5,677 in 2018-19.

The penultimate row of Table 3 provides annual estimates of the numbers of 'new to Australia' engineers in this visa category. This estimate assumes that 25% of the TSS visas granted are renewals to current holders, and that half of the previous year cohort of Temporary Graduate visa holders progress to the TSS visa. On this basis the number of 'new to Australia' engineers in the TSS category would have been around 2,500 in recent years. This is plausible and is at least consistent with a pandemic affected downturn of 'new to Australia' TSS engineers arrivals in 2019-20. The assumptions in this calculation need further investigation.

Effectively, the TSS holders in Australia at any time are fulfilling employers' immediate needs and are forming a pool of in-country engineers from whom permanent migrants may be drawn. The estimated size of this pool is shown in the last row of Table 3. Assuming the visas are held for an average of two years, this pool was approximately 10,000 individuals in 2019-20. The pool may actually be much larger.

DHA does provide information about the flow from the national TSS pool into permanent migration, though not at occupational level. In 2019-20, 46.1% of the in-Australia Primary applicants for Permanent migration held, or had previously held, a Temporary Skills visa. This statistic has been used in making the estimates of 'new to Australia' permanent migrant engineers in Table 2.

Table 3 Temporary Skilled visa program – visas granted to ANZSCO Level 1 and 2 named engineering and related occupations, Primary applicants, 2015-16 to 2019-20.

	2015-16	2016-17	2017-18	2018-19	2019-20
Total Temporary Skilled visas granted					
Primary applicants	45,395	46,480	34,446	41,221	28,414
Primary + Secondary applicants	85,611	87,580	64,470	81,975	55,060
ANZSCO occupational code and name					
1332 Engineering Managers	237	381	267	381	283
1335 Production Managers	153	115	102	105	92
2311 Air Transport Professionals	36	50	27	31	11
2312 Marine Transport Professionals	287	146	0	9	12
2322 Surveyors and Spatial Scientists	44	58	63	62	53
Total Engineering-related Managers and Professionals	757	750	459	588	451
2331 Chemical and Materials Engineers	26	17	34	43	39
2332 Civil Engineering Professionals	271	444	399	519	406
2333 Electrical Engineers	121	182	131	235	156
2334 Electronics Engineers	38	66	30	77	32
263111 Computer Network & Systems Eng's	208	202	212	310	259
2335 Industrial, Mechanical & Prod' Eng's	309	451	291	459	378
2336 Mining and Petroleum Engineers	75	100	79	125	111
2339 Other Engineering Professionals, <i>except</i>	235	296	248	373	236
233914 Engineering Technologists	19	33	52	54	45
2633 Telecom's Engineering Professionals	96	78	44	67	61
Total Engineering Professionals (above)	1,398	1,869	1,520	2,262	1,723
261313 Software Engineers	1,327	1,390	1,156	1,817	1,487
2632 ICT Support and Test Engineers	852	856	828	956	704
Total ICT Engineers	2,179	2,246	1,984	2,773	2,191
Total TSS visas issued in Engineering and related occupations listed above	4,353	4,898	4,015	5,677	4,410
<i>Estimated 'new to Australia' TSS Engineers</i>	<i>2,310</i>	<i>2,665</i>	<i>1,868</i>	<i>2,912</i>	<i>1,688</i>
<i>Estimated pool of Engineers with TSS visas</i>		<i>9,351</i>	<i>8,913</i>	<i>9,682</i>	<i>10,087</i>

Temporary Graduate visas (subclass 485) are available for recent international graduates. There are three streams, in summary:

- the Graduate Work stream is for work in an occupation on the skills shortage list, and lasts for up to 18 months;
- the Post-study Work stream applies to all graduates, and lasts for 2 – 4 years depending on qualification;
- the Second Post-study Work stream applies to graduates of regional institutions, and has duration between 1 and 2 years.

Holders are eligible to apply for subsequent Temporary Skills visas and Permanent migration. The 2019-20, migration data records that 7.4% of successful in-Australia applicants for Permanent migration were granted to holders of Temporary Graduate visas.

The numbers of Temporary Graduate visas granted in the first two streams are shown in the upper rows of Table 4. There are no published data on successful TG applicants' field of education. The number of engineers with TG visas can be estimated from graduation data, by the following steps:

- Bachelor and higher-level degrees in FoE3 (Engineering and Related Technologies) have been awarded to approximately 10% of the international students since 2016 (see top two rows of Table 4). These numbers include off-shore graduations.
- Most of the recent on-shore international FoE3 graduates have completed an accredited BEng(Hons) or entry-to practice-Master degree, increasingly the latter (see Table 1). Many of the on-shore cohort are known to be seeking migration into Australia.
- Taking these factors into account, it is estimated that 10% of the Graduate Work stream and 5% of the Post-study Work stream visa holders are awarded to engineering graduates who gain engineering work. The barriers to engineering employment of migrants in these and other migration programs and streams are discussed below.

Table 4 Temporary Graduate visas granted in total, and estimated numbers granted to engineers, 2015-16 to 2020-21

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
International Bachelor and higher degree graduates						
Total (including research)	94,250	98,437	106,988	123,901	137,321	no data
Engineering & Related (FoE3)	7,623	9,695	10,102	12,193	13,174	no data
Temporary Grad visas granted						
Graduate Work stream	12,425	9,419	8,149	9,213	8,982	7,512
Post-study Work stream	19,989	31,960	43,507	54,781	54,021	45,724
Total TG visas granted	32,414	41,379	51,656	63,994	63,016	53,223
<i>Estimated TG visas granted to engineers in engineering work</i>	<i>2,241</i>	<i>2,539</i>	<i>2,990</i>	<i>3,660</i>	<i>3,599</i>	<i>3,037</i>
<i>Estimated pool of engineers in engineering work with TG visas</i>		<i>4,781</i>	<i>5,530</i>	<i>6,650</i>	<i>7,259</i>	<i>6,636</i>

These proportions lead to the annual estimates in the penultimate row of Table 4 – approximately 3,500 in recent years. This is about half of the total of international on-shore BEng(Hons) and entry-to practice Masters graduates (Table 1), so is plausible, given the recent strong growth of the Masters programs. Graduates of non-accredited Master degrees and research degrees may also be awarded these visas.

Assuming these visas are held for two years, on average, these graduates form a pool of working engineers eligible for application to the Temporary Skills Shortage visa program and permanent migration. This is quantified in the last row of Table 4.

2.3. [Other migrants seeking engineering work](#)

Most of the streams and sub-streams of the migrant visa programs discussed above are directly linked to engineering employment though requirements for employer nomination or sponsorship. Two exceptions are the Post-study Temporary Graduate visa stream, and the skilled-independent sub-stream of the Permanent migration Skill program. In addition, holders of Humanitarian visas, Partner visas and Secondary applicants with engineering qualifications and experience compete in the general

employment market. While the numbers of individuals in all of these categories is not known, it is well known that many of them encounter significant barriers to engineering employment.

Engineers Australia has recently published research⁸ on the barriers to engineering employment faced by migrant engineers mostly without on-arrival employment. The survey of migrants and interviews with migrants, job recruiters and employers reveal very significant barriers. The major barriers relate to migrants' lack of local (Australian) experience, networks and individuals who can provide references. Migrants perceive that their international experience is not highly valued. The report identifies measures to address the barriers. Key points are provided in Appendix 4.

The report is directed towards realising the opportunity for Engineers Australia to take the lead on actions to break down the barriers that some migrants face, thereby improving their pathways to engineering employment and contribute to Australia's engineer shortage. The actions are directed towards creating a collective migrant talent pool, a body of trusted information, stronger networks for migrants and employers, and assistance for humanitarian visa holders with credentials assessment.

There may be opportunities for ACED and ACED members to support this framework with suitable short courses and microcredentials.

3. Estimates of the supply of engineers

Table 5 brings together the numbers developed above to estimate how many qualified individuals are available to enter the engineering workforce each year, as graduates or with the experience required for the migration and temporary visa programs referred to above. The data quantifies the schematic in Figure 1. The supply into the available workforce has two components: the 'permanent engineer supply' of new graduates and Permanent migrants; and the 'pool' of holders of temporary visa holders.

Table 5 Estimates of annual professional engineer supply from graduations, and Primary applicants for Temporary residence and Permanent migration, 2016-20

source of supply	2016-17	2017-18	2018-19	2019-20	2020-21
<u>Graduates</u>					
A: Domestic graduates (Table 1)	6,242	6,972	7,518	7,344	na
est. Temporary Graduate (TG) visas (Table 4)	2,539	2,990	3,660	3,599	3,037
<u>Permanent migration - Primary Applicants</u>					
B: estimated engineers (Table 2)	5,682	5,005	5,068	4,394	3,663
estimated 'new to Australia' engineers (Table 2)	2,004	1,945	1,631	895	1,055
Est. annual permanent engineer supply (A+B)	11,247	12,039	11,912	11,007	
<u>Temp. Skill Shortage visas – Primary Applicants</u>					
TSS visas granted to engineers, including renewals and previous TG holders (Table 3)	4,898	4,015	5,677	4,410	na
est. 'new to Australia' TSS holders (Table 3)	2,665	1,868	2,912	1,688	na
<u>Pool of engineers with Temporary visas</u>					
est. Temporary Graduate holders (Table 4)	4,781	5,530	6,650	7,259	6,636
est. Temporary Skill Shortage holders (Table 3)	9,351	8,913	9,682	10,087	na
Est. pool of engineers with Temporary visas	14,132	14,443	16,332	17,346	

⁸ Engineers Australia Oct 2021. *Barriers to employment for migrant engineers*. [Barriers to employment for migrant engineers \(engineersaustralia.org.au\)](https://engineersaustralia.org.au)

The permanent engineer supply

The nominal annual supply is the sum of domestic graduates and Permanent migrants, between 11,000 and 12,000 in recent years. This overestimates the actual supply by approximately 1,000, as it is estimated that 15% of the domestic engineering graduates never enter the engineering workforce. Note too that some graduates will progress to postgraduate work (including research) before taking up engineering work – these are not separately quantified.

The majority of the Permanent migrants each year will have had previous engineering employment in Australia, and some will have gained their engineering qualification in Australia.

The temporary engineer pool

It is estimated that Temporary Graduate visas are granted to about 3,500 (approximately 25%) of the on-shore international graduates of Australian engineering degrees per year. They contribute to the engineering workforce alongside domestic graduates, and gain post-graduation engineering work experience. Some of this group may experience the barriers to employment referred to in Section 2.3.

Approximately 5,000 Temporary Skill Shortage visas have been granted or renewed each year, some to holders of Temporary Graduate visas. It is estimated that (on average) about half of the TSS visas are granted to individuals already in Australia. This category supplies short, medium and long-term specialised skills for Australian engineering industry. Again, some of this group may experience the barriers to employment referred to earlier.

Taken together, these temporary visa programs would appear to have supported a pool of at least 16,000 engineers in the Australian engineering workforce, in recent years.

Observations

The estimates made in the above analysis need further refinement and validation in order to provide a more accurate and detailed picture of engineer supply. In particular, further information is needed on:

- The post-graduation pathways taken by domestic engineering graduates. It would be useful to know more about those going into non-engineering employment, or engineering employment overseas.
- The visa durations and occupational experiences of Temporary Skill Shortage visa holders. This information would improve the estimates of the size of the pool of TSS visa holders.
- The education and experience pathways taken by Temporary Skill Shortage visa holders into Permanent migration. This information would provide better estimates of the numbers of engineers who are 'new to Australia'.
- The Temporary Graduate visa stream. This is the first time this supply has been included in analysis of this kind, and the estimates given need validation.
- The number of engineers amongst Secondary applicants in all migration and temporary residence programs, including the numbers of Humanitarian and Partner visa holders.
- Attrition, including the number of Primary applicants who are granted visas (as reported here) but do not actually take them up, and the attrition rate of graduates from initial engineering employment.

Author's note

This paper has sourced information from the Department of Home Affairs website. The DHA is not responsible for any analysis or transformation of the data. The views expressed in this report are those of the author and do not represent those of the DHA.

This is a working paper: readers are invited to discuss its content and implications with the author, at robin.king@uts.edu.au

Appendix 1 Medium and Long Term Strategic Skills List

Source: Commonwealth of Australia Migration (LIN 19/051: Specification of Occupations and Assessing Authorities) Instrument 2019. <https://www.legislation.gov.au/Details/F2019C00855>

	Occupation	ANZSCO code	Assessing authority
1	construction project manager	133111	VETASSESS
2	engineering manager	133211	(a) Engineers Australia; or (b) AIM
26	surveyor	232212	SSSI
28	other spatial scientist	232214	VETASSESS
29	chemical engineer	233111	Engineers Australia
30	materials engineer	233112	Engineers Australia
31	civil engineer	233211	Engineers Australia
32	geotechnical engineer	233212	Engineers Australia
33	quantity surveyor	233213	AIQS
34	structural engineer	233214	Engineers Australia
35	transport engineer	233215	Engineers Australia
36	electrical engineer	233311	Engineers Australia
37	electronics engineer	233411	Engineers Australia
38	industrial engineer	233511	Engineers Australia
39	mechanical engineer	233512	Engineers Australia
40	production or plant engineer	233513	Engineers Australia
41	mining engineer (excluding petroleum)	233611	Engineers Australia
42	petroleum engineer	233612	Engineers Australia
43	aeronautical engineer	233911	Engineers Australia
44	agricultural engineer	233912	Engineers Australia
45	biomedical engineer	233913	Engineers Australia
46	engineering technologist	233914	Engineers Australia
47	environmental engineer	233915	Engineers Australia
48	naval architect	233916	Engineers Australia
49	engineering professionals (nec)	233999	Engineers Australia
142	ICT business analyst	261111	ACS
143	systems analyst	261112	ACS
144	multimedia specialist	261211	ACS
145	analyst programmer	261311	ACS
146	developer programmer	261312	ACS
147	software engineer	261313	ACS
148	software and applications programmers (nec)	261399	ACS
149	ICT security specialist	262112	ACS
150	computer network and systems engineer	263111	ACS
151	telecommunications engineer	263311	Engineers Australia
152	telecommunications network engineer	263312	Engineers Australia

Appendix 2 Top-10 occupations in the major sub-streams of the Permanent migration Skill stream

Over the past decade, engineering and IT occupations have featured strongly in the skills shortage lists. The Table below shows numbers and ranks of the top-10 occupations in four sub-streams of the Skills program for Permanent migration in 2019-20. The order is that of the skilled-independent sub-stream.

Top-10 occupations for Primary applicants to the major sub-streams of the Permanent migration Skill stream, 2019-20

Primary applicants - top 10 occupation list for Skilled Independent visas - 2019-20	Skilled indep'dent	Employer sponsored	State/Terr nominated	Regional	total (est.)
Software and Applications Programmers (includes Software Engineers)	987 (1)	768 (2)	956 (3)	272 (6)	2,983
Accountants	412 (2)	470 (6)	1,726 (2)	1,532 (1)	4,140
Registered Nurses	384 (3)	370 (7)	2,468 (1)	897 (2)	4,119
Industrial, Mech and Production Engineers	273 (4)	not top 10	193 (7)	174 (9)	640 + ?
ICT Business and Systems Analysts ²	243 (5)	333 (8)	433 (6)	not top 10	1,179
Computer Network Professionals (includes Computer Network and Systems Engineers)	234 (6)	not top 10	not top 10	not top 10	234 + ???
Civil Engineering Professionals	227 (7)	not top 10	438 (5)	211 (8)	876 + ?
Database and Systems Admin, ICT Security Specialists	211 (8)	not top 10	not top 10	not top 10	211+???
Other or General Medical Practitioners	186 (9)	not in top 10	168 (8)	not top 10	
*Other Engineering Professionals (does not include Chemical & Materials, Electrical, Electronic, Mining)	105 (10)	not top 10	546 (4)	not top 10	651 + ??
Totals in above engineering occupations	605	not known	1,179	> 385	> 1,910
Other (incl. other occupations in top 10 lists)	3,038	10,720	4,050	7,174	24,982
Total in each sub-stream	6,300	13,263	10,978	10,260	40,801

*Other Engineering is an occupational category. The branches (listed) would have their own line in the full dataset. Earlier years had Electrical, Electronics and Telecommunications Engineers in top-10 Regional lists.

The final column provides the total for each named occupation. These totals are all underestimates of the numbers of engineers for three reasons:

- none of the engineering occupations has a numeric entry in each sub-stream column
- the numbers of Software Engineers and Computer Network and Systems Engineers within the high demand ICT occupational groups are not known
- the 'Other Engineering' row masks the entries into several major branches of engineering.

Nevertheless, the Table shows that at least 1,900 of the 40,801 Primary applicants are in the named engineering fields. Applying Engineers Australia's 2015-16 estimate that 10% of successful applicants are engineers to the Primary applicant total produces an estimate of 4,394 professional engineers (including in ICT) for 2019-20. This appears to be reasonable.

Appendix 3 Temporary Skill Shortage Visa (subclass 482)

The information in this panel was extracted from: [Temporary Skill Shortage visa \(subclass 482\) Medium-term stream \(homeaffairs.gov.au\)](#) on 14 Dec 2021

Temporary Skill Shortage Visa (subclass 482)

This visa enables employers to address labour shortages by bringing in skilled workers where employers can't source an appropriately skilled Australian worker.

You can stay for up to 4 years. Hong Kong passport holders may stay up to 5 years.

With this visa, you can

- work in Australia for up to 4 years or up to 5 years if you are a Hong Kong passport holder
- study (you won't receive government assistance) travel to and from Australia as many times as you want while the visa is valid
- if eligible, apply for permanent residence

You must

- be nominated to work in an occupation on the list of eligible medium and long-term skilled occupations
- have at least 2 years relevant work experience in your nominated occupation or a related field
- have a relevant skills assessment if this is required for your occupation
- work only for your sponsor or associated entity, unless you are exempt
- meet minimum standards of English language proficiency unless you are exempt from needing to show this

Appendix 4 Barriers to employment for migrant engineers

The following points are extracted from the Engineers Australia research report [Barriers to employment for migrant engineers \(engineersaustralia.org.au\)](#).

- The survey of 775 skill visa holders (86% without on-arrival employment) and 42 humanitarian visa holders found that it took an additional 2 years for all of the latter group to gain engineering employment.
- Three of the top four biggest barriers are identified as ‘local’ – experience, networks, and references. Number two is that “international experience is not valued”.
- Humanitarian visa holders rated (non-Australian) qualifications and English language skills as significant barriers.
- Awareness (and hence use) of support services (particularly from Federal government) was very low. The difficulty of getting good advice was highlighted in survey data and interview quotes.
- With employers having preferences for local credentials, most migrants are not in a good position to identify what they need and gain them quickly.
- Migrants believe they bring benefits to employers – specific skills/knowledge; fresh perspective; industry experience. These benefits need to be promoted to “*overcome employer bias towards locals*”.
- The recruiters’ interviews provided evidence of employers’ conscious and unconscious bias against hiring migrants, and lack of (collective and long-term) investment in the solving the engineer skills shortage.
- The latter point appeared to be contradicted by employers’ positive views on supporting a “*collective talent pool of migrant engineers*”, potentially led by Engineers Australia.
- Employers favour employees with relevant (local or international) experience to their specific tasks; which “*migrants rarely have*”. [Although the Skills migration program is intended to do that.]

The report identifies and elaborates on “*seven specific that must be addressed*”:

1. *A lack of local knowledge and experience*
2. *Perceived cultural differences in soft skills*
3. *Visa or sponsorship working rights issues*
4. *A lack of people who can ‘vouch’ for them locally*
5. *Certification queries*
6. *‘Flight risk’ concerns*
7. *Tendency to hire ‘networks’ at senior-level roles.”*

The report concludes with a statement about the “*opportunity for Engineers Australia to take leadership and position migrant engineers as a solution to the skills supply needs*”, by addressing six action points. These are directed towards creating a collective migrant talent pool, a body of trusted information, stronger networks for migrants and employers, and assistance for humanitarian visa holders with credentials assessment.