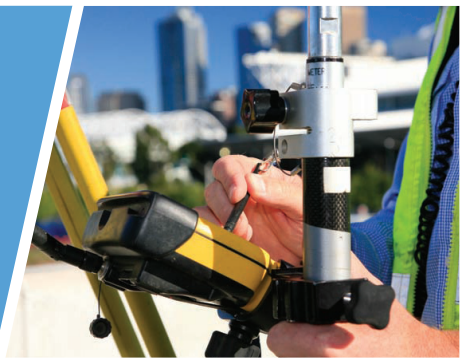
Determining the Future Demand, Supply and Skills Gap for Surveying and Geospatial Professionals

Prepared by BIS Shrapnel for Consulting Surveyors National



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BUSINESS RESEARCH AND FORECASTING

BIS Shrapnel welcomes any feedback concerning the forecasts or methodology used in this report as well as any suggestions for future improvement.

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Objectives of Study

In August 2012, BIS Shrapnel was engaged by Consulting Surveyors National (CSN) to undertake research into the capacity constraints that are likely to be faced by the surveying and geospatial industry over a 10 year period from 2011/12 to 2021/22.

This report represents the key outcomes of the above research agenda. The findings of the research will become the default strategy for the surveying profession over the next 10 years and will be used as a reference document by CSN in its future dealings with all levels of government, education service providers and other stakeholders.

This research is based on a detailed industry survey, ABS data as well as BIS Shrapnel internal research. BIS Shrapnel would like to thank everyone who participated in the industry survey and offered comments. The views expressed in this report, however, are those of BIS Shrapnel.

Methodology

The approach taken by BIS Shrapnel to forecast future skilled labour demand is similar to other demand forecasting exercises we have undertaken for clients associated with the building and construction sector. Firstly, we relate our estimates of 'base year' demand to an appropriate 'base year' activity indicator to derive a 'usage coefficient' per unit of end use sector activity. We then apply this usage coefficient to our forecasts of the activity indicator to derive forecasts of future demand.

For this study:

- Base year demand is estimated as the skilled employment in the surveying and geospatial industry in 2011/12. For this report, BIS Shrapnel was asked to consider surveying skills (by its main areas of specialisation), geospatial skills, surveying and geospatial technician skills as well as the demand for planners, engineers, environmental scientists, architects and ecologists at consulting surveying firms.
- "End use" activity indicators chosen for the specialist occupations are as follows:
  - Private house commencements for cadastral surveyors
  - Private multi-residential and non-residential buildings for construction surveyors
  - Utilities and transport engineering construction for engineering surveyors
  - Mining and heavy industry construction plus mining exploration investment for mining surveyors
  - Total construction (ie sum of residential, non-dwelling building and engineering construction) for 'other' surveyors (comprising hydrographic, photogrammetric and geodetic surveyors), geospatial specialists, surveying or spatial science technicians and 'other' professionals employed at consulting surveying practices.
- For each occupation in each state and territory, a usage coefficient was calculated by dividing the population of each occupation by the pertinent end use activity segment in 2011/12.
- Forecasts of future skilled labour demand were then generated by applying the "fixed" coefficients to BIS Shrapnel's projections of future activity in each end use activity segment. However, in this study, we have allowed for "dynamic" usage coefficients (ie coefficients

which change over time). Effectively, this means that we have incorporated labour productivity growth assumptions into the model. Our baseline model output is based on the national average productivity growth of 1.5 per cent per annum. Nonetheless, we also present results for a 2 per cent and 0 per cent productivity assumption to allow for sensitivity testing.

The model therefore assumes that future changes in demand for skilled labour in the surveying and geospatial industry are driven by changes in the identified activity indicator.

However, the total skilled surveying and geospatial workforce requirement to meet future construction activity will inevitably be increased by the attrition of the existing workforce through ageing effects, particularly through retirement and death. To allow for workforce attrition, we included assumptions regarding the approximate age profile of the workforce and the likelihood of retirement (both of which are based on the results of our national industry survey) or death of persons in each age group.

We then compared the expected demand for skilled labour with our projected levels of existing workforce. The difference between the total labour demand and the size of the existing workforce is referred to as the 'workforce gap' in this report. The gap, when positive, will need to be met by additional supply if projected levels of end use sector activity are to be achieved.

The final part of our methodology relates to estimating the potential new workforce supply. While possible sources of labour supply include new graduates and net migration from overseas, only the first source is considered explicitly in this report. Given data on current enrolments and completions in Geomatic Engineering (Surveying), Diploma and Advanced Diploma in surveying, projections of future graduate supply at the professional and para-professional level have been made.

The estimated total labour requirement or 'workforce gap' less the supply of additional skilled labour via new graduates is defined in this report as the 'net capability position'. If positive, it translates into a 'capability shortfall'. The presence of a capability shortfall implies that the surveying and geospatial industry needs to attract additional labour above that expected to be sourced from new graduates (for example, through immigration or via other labour supply boosting initiatives such as increasing productivity or reducing the rate of workforce attrition) if it is to achieve forecast levels of future construction activity. A negative capability shortfall implies a situation of 'capability excess/surplus'. In other words, the available skilled labour exceeds the future skilled labour workforce gap.

Key Findings

Our outlook for the key determinants of labour demand generally translates into increasing demand for skilled labour over the next three years before falling construction activity over 2015/16 and 2016/17 sees demand for skilled labour easing over this period. However, acceleration in activity over the subsequent two years is expected to see strong growth in skilled labour demand.

From an estimate of 14,574 professionals in 2011/12, total skilled labour demand is expected to rise to 15,143 persons in 2014/15 before falling to 14,077 in 2016/17 as construction activity weakens. Total skilled labour demand is then projected to rise and peak at 15,885 persons in 2018/19.

Given the forecast shape of labour demand, and the attrition of the existing workforce, the size of the total surveying and geospatial skilled workforce gap is expected to increase to 1,478 persons by 2014/15 before falling to around 1,000 persons by 2016/17. However, an expected

rebound in activity over the subsequent three years will drive demand for skilled labour higher. With ongoing attrition of the existing workforce around this time, increased demand for skilled labour will lead to a higher workforce gap. We expect the workforce to peak at 3,533 persons in 2018/19 with surveyors accounting for 70 per cent of this deficit. This means that an additional 2,474 surveyors, 608 spatial scientists, 271 technicians and 180 'other' professionals will be required to meet forecast levels of construction activity and to cover for the replacement of existing employees.

For New South Wales, given our forecast of labour demand, and the attrition of the existing workforce, the size of the total surveying and geospatial skilled workforce gap is expected to increase to 1,297 persons by 2014/15 before easing over the subsequent two years. However, an expected upturn in activity from 2017/18 will drive demand for skilled labour higher. With ongoing attrition of the existing workforce around this time, increased demand for skilled labour will lead to a higher workforce gap. We expect the workforce to peak at 1,822 persons in 2018/19 with surveyors accounting for 69 per cent of this deficit. Overall, an additional 1,255 surveyors, 312 spatial scientists, 154 technicians and 101 'other' professionals will be required in 2018/19 to meet forecast levels of construction activity and to cover for the replacement of existing employees.

For Victoria, we are forecasting decreasing demand for skilled labour over the next four years. From an estimate of 2,816 professionals in 2011/12, total skilled labour demand is expected to fall to 2,208 persons in 2015/16 before increasing and peaking at 2,819 in 2018/19 as construction activity strengthens. Total skilled labour demand is then projected to fall to 2,362 persons by 2021/22.

Hence, for Victoria, our expectation is for total skilled labour workforce gap to remain negative (ie in a surplus position) over the first half of the forecast period. However, the gap is expected to turn positive from 2017/18 and peak at around 427 persons. The presence of positive workforce gap in the second half of the forecast period suggests that skilled labour will need to be drawn into Victoria from other states and/or new supply if forecast levels of end use construction sector activity are to be achieved.

Given our projections of the workforce gap and graduate supply for surveyors, we estimate that Australia's 'net capability position' will be in deficit situation for the next nine years. We expect the net capability position to turn into a surplus situation only in 2021/22. The labour demand, labour supply and workforce gap for surveying and geospatial workforce is presented in the summary table.

The capability model described in this report suggests that over the next nine years the supply of new skilled surveyors will be insufficient to cover for the expected demand for surveyors to be generated by future construction activity as well as labour lost through workforce attrition. In other words, the new skilled labour supply of surveyors in Australia will not be enough to meet the forecast skilled 'workforce gap' for surveyors. The gap between the supply of, and demand for surveyors for nearly all of the forecast period, implies that, in theory, a capability shortfall will be prevalent in Australia in the decade ahead (see accompanying chart). With respect to surveying technicians, we expect a situation of capability surplus. That is, the supply of new graduates will exceed the workforce gap for surveying technicians.

In practice there will be no observable capability shortfall. Either labour demand will fall back to meet the constrained level of labour supply — implying that future construction activity will need to be cut back or foregone — or measures will be put in place that will boost labour supply to meet current expectations of future construction activity.

Summary Table: Forecasts for Skilled Labour Demand and capability shortfalls for Surveyors and Surveying Related Professionals: Australia

(Baseline Scenario of 1.5% labour productivity growth, forecasts as at June)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Labour Demand by Specialist Occupation	Estimate	Forecasts									
Cadastral	3,330	3,509	3,962	4,272	3,961	3,843	4,356	4,605	4,077	3,591	3,540
Construction	1,570	1,563	1,555	1,620	1,544	1,435	1,499	1,612	1,569	1,481	1,495
Engineering	1,692	1,606	1,461	1,476	1,503	1,544	1,649	1,641	1,518	1,465	1,288
Mining	1,340	1,318	1,238	1,165	1,099	1,086	1,150	1,168	1,234	1,010	935
Other Surveyors	446	438	416	415	402	393	421	475	455	400	412
All Surveyors	**8,378**	**8,434**	**8,632**	**8,948**	**8,509**	**8,301**	**9,076**	**9,501**	**8,852**	**7,948**	**7,670**
Registered/Licensed Surveyors	*2,852*	*3,017*	*3,407*	*3,674*	*3,406*	*3,305*	*3,747*	*3,960*	*3,506*	*3,089*	*3,045*
Total Spatial Scientists	3,596	3,637	3,548	3,565	3,438	3,316	3,501	3,670	3,521	3,234	3,326
Total Technicians	1,395	1,446	1,443	1,440	1,372	1,335	1,472	1,490	1,375	1,297	1,332
Total 'Other' Professionals	1,205	1,207	1,181	1,191	1,156	1,125	1,196	1,225	1,173	1,110	1,141
Total Skilled Labour Demand	**14,574**	**14,723**	**14,804**	**15,143**	**14,474**	**14,077**	**15,245**	**15,885**	**14,922**	**13,589**	**13,470**
Existing Workforce (a)											
Cadastral Surveyors	3,330	3,213	3,098	2,983	2,867	2,752	2,641	2,530	2,419	2,308	2,197
Construction Surveyors	1,570	1,560	1,549	1,537	1,525	1,514	1,497	1,480	1,462	1,445	1,428
Engineering Surveyors	1,692	1,660	1,629	1,597	1,565	1,533	1,497	1,461	1,424	1,388	1,351
Mining Surveyors	1,340	1,315	1,290	1,265	1,240	1,215	1,185	1,156	1,127	1,097	1,068
Other' Surveyors	446	440	434	429	423	417	409	400	392	383	375
All Surveyors	8,378	8,189	8,000	7,811	7,621	7,430	7,228	7,026	6,824	6,622	6,419
Registered/Licensed Surveyors	*2,852*	*2,716*	*2,580*	*2,444*	*2,307*	*2,171*	*2,059*	*1,947*	*1,834*	*1,722*	*1,610*
Spatial Scientists	3,596	3,527	3,457	3,387	3,316	3,245	3,153	3,061	2,969	2,877	2,784
All technicians	1,395	1,375	1,351	1,327	1,302	1,278	1,249	1,219	1,190	1,161	1,131
'Other' Professionals	1,205	1,183	1,162	1,141	1,120	1,098	1,072	1,045	1,018	991	964
Total skilled labour	14,574	14,274	13,971	13,666	13,360	13,052	12,702	12,352	12,001	11,650	11,299
Workforce Gap											
Cadastral Surveyors	-	296	864	1,289	1,093	1,091	1,716	2,075	1,658	1,283	1,343
Construction Surveyors	-	3	6	83	19	(78)	2	132	107	36	68
Engineering Surveyors	-	(54)	(167)	(121)	(62)	11	152	181	93	78	(63)
Mining Surveyors	-	2	(53)	(100)	(141)	(129)	(35)	12	107	(87)	(133)
Other' Surveyors	-	(2)	(19)	(14)	(21)	(24)	12	75	63	16	37
All Surveyors	-	245	632	1,137	888	871	1,847	2,474	2,028	1,326	1,251
Registered/Licensed Surveyors	-	*301*	*828*	*1,231*	*1,099*	*1,134*	*1,688*	*2,013*	*1,671*	*1,366*	*1,434*
Spatial Scientists	-	110	91	177	122	71	348	608	552	358	542
All technicians	-	71	92	113	69	57	224	271	185	136	201
'Other' Professionals	-	24	19	50	36	27	124	180	155	118	177
Total skilled labour	-	450	833	1,478	1,115	1,025	2,543	3,533	2,921	1,939	2,171
New Supply of Surveyors	-	114	239	366	504	650	802	963	1,131	1,308	1,494
New Supply of Technicians	-	60	123	188	254	322	392	454	514	554	584
Surveyors Capability Shortfall (c)	-	**131**	**393**	**772**	**383**	**221**	**1,045**	**1,512**	**897**	**18**	**- 243**
Technicians Capability Shortfall (c)	-	**11**	**(31)**	**(75)**	**(185)**	**(265)**	**(168)**	**(183)**	**(329)**	**(418)**	**(383)**

(a) Existing workforce is generated by adjusting the size of the current skilled workforce for natural attrition rates such as retirements and death. Source: BIS Shrapnel, ABS

(b) Workforce gap is calculated as labour demand less existing workforce.

(c) Capability shortfall is derived by subtracting new supply from workforce gap. A positive number implies a shortage of labour
Numbers in brackets imply an excess supply as new supply exceeds the forecast workforce gap.

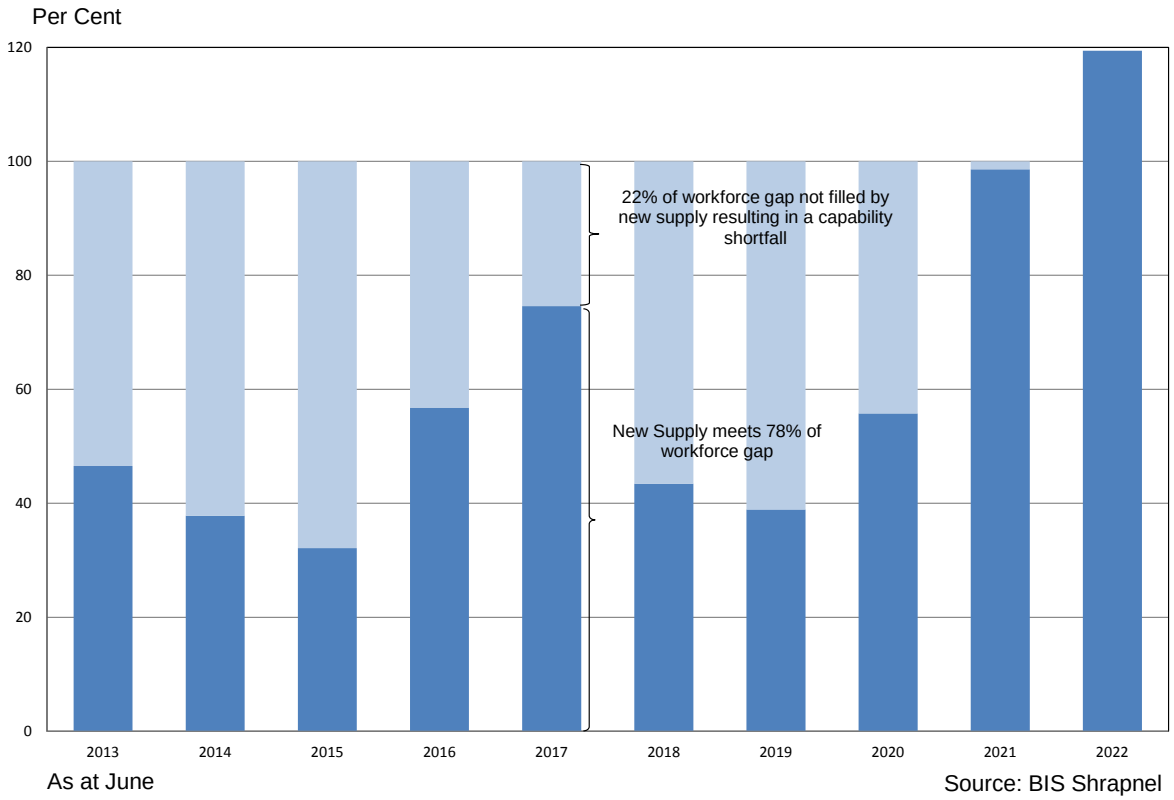
In either case, the quantification of the capability shortfall provides an important insight. First, it provides a simple measure of how much more labour (by specialist occupation) is required — whether through migration or through other supply-boosting initiatives — to meet forecast demand requirements. Alternatively, the capability shortfall could also be used to measure the "cost" of the labour constraint in terms of the value of the construction activity foregone if supply were not augmented.

BIS Shrapnel estimates that in 2018/19 (the period in which the capability shortfall is the greatest), $30.4 billion in construction work and 14,570 private house commencements will be put at risk from surveyor skills shortages.

It should be noted that the demand for skilled labour in the immediate period before the capability shortfall years is most likely understated. A capability shortfall for the total surveying and geospatial industry does not necessarily mean that the shortfall will be realised contemporaneously. For many occupations the demand for labour will necessarily precede the period where actual construction takes place (for example, the necessary design, measurement, calculations, plan and document presentation happens well before the construction phase). This means that, ideally, labour hiring should take place well before the emergence of capability shortfalls.

Given the time taken to develop new surveying hires (particularly new graduates) to a point of high capability (typically 4-6 years), the model suggests that hiring should be taken well in advance of the emergence of capability shortfalls if future capability requirements are to be met.

Total Surveyors Workforce Gap, Graduate Supply and Net Capability Position: Australia



CHAPTER ONE

Introduction

1. INTRODUCTION

In August 2012, BIS Shrapnel was engaged by Consulting Surveyors National (CSN) to undertake research into the capacity constraints that are likely to be faced by the surveying and geospatial industry over a 10 year period from 2011/12 to 2021/22. Specifically, the CSN requested independent, detailed, thoughtfully researched and quantifiable responses to the following questions and tasks:

- What is the current demand for surveyors, geospatial specialists, and surveying and spatial technicians?
- Differentiate the current demand for surveyors by areas of specialisation ie Cadastrals, Construction Surveyors, Engineering Surveyors, Mining Surveyors and 'other' surveyors (comprising geodetic, hydrographic and photogrammetric surveyors) as well as by registered or licensed surveyors.
- Identify the current demand for 'other professionals' such as planners, environmental scientists, engineers, architects and ecologists at consulting surveying practices.
- What is the expected demand for the different categories of surveyors, geospatial specialists, and surveying and spatial technicians over 2011/12 to 2021/22?
- What is the expected demand for 'other' surveying-related occupations at consulting surveying practices over 2011/12 to 2021/22?
- Model the attrition of existing skilled surveying population, geospatial workforce, and surveying and spatial technicians for the next ten years due to ageing in particular retirements and death.
- Calculate the gap between future demand for surveying and geospatial workforce and the size of the existing workforce (once adjusted for attrition rates) by specialist occupation.
- Model future new supply of surveyors and surveying technicians.
- Will future new supply meet the workforce gap for surveyors and surveying technicians?
- If not, what are the expected skills shortages for surveyors and surveying technicians over the next 10 years?

This report represents the key outcomes of the above research agenda. The findings of the research will become the default strategy for the surveying profession over the next 10 years and will be used as a reference document by CSN in its future dealings with all levels of government, education service providers and other stakeholders.

This research is based on a detailed industry survey as well as BIS Shrapnel internal research. BIS Shrapnel would like to thank everyone who participated in the industry survey and offered comments. The views expressed in this report, however, are those of BIS Shrapnel.

The structure of the report is as follows:

- Following this introduction, **Chapter 2** provides a description of the methodology used in this report. Chapter 2 also describes the demand drivers for each category of surveyors and shows how we translate future activity in the underlying labour demand drivers into skilled labour demand. In addition, we demonstrate how we model the attrition of existing workforce over the next 10 years. Concepts used in this report such as 'workforce gaps' and 'capability shortfall/ surplus' are also defined. The limitations of the forecasting model and key assumptions made in the analysis are also made explicit in this chapter.
- **Chapter 3** provides an overview of the macroeconomic environment. This chapter provides a discussion of the economic parameters on which the underlying labour demand drivers are based and includes a brief commentary of the logic and key drivers, plus forecasts of key economic variables for the Australian, New South Wales and Victorian economies.
- **Chapter 4** presents the output of the skills demand and supply model for Australia and discusses some of its implications for the surveying industry and the broader economy. BIS Shrapnel's estimate of the size of the current skilled surveying and geospatial workforce in Australia — the effective starting point of the model — is presented first. This is followed by a discussion of the key determinants of skilled labour demand. Finally, model output is presented showing how these forecasts translate into a total requirement for skilled labour for surveyors and geospatial professionals. Any gaps in skilled workforce are subsequently quantified followed by a calculation of a capability shortfall (or deficit) for the industry.
- **Chapters 5 and 6** presents the results of the skills demand model for New South Wales and Victoria respectively. As there is no data on the flow of new graduates into the surveying and geospatial industry by state and territory, we do not calculate a capability shortfall (or surplus) at the state level.
- **Chapter 7** presents the consulting surveyors' case study results and addresses how surveying firms have changed in the last 10 years and what surveying firms will look like in 10 years time. This chapter is authored by Dr. Veronica Bondarew, Chief Executive Officer of Consulting Surveyors National.
- **Bibliography**
- **Appendix**

Sources of data

The population of surveyors and geospatial workforce by industry division by state/territory as at 2011/12 was sourced from the 2011 Australian Bureau of Statistics (ABS) Census data. The workforce attrition rates, the size of surveying population by specialist occupation and the size of 'other' professionals at consulting surveying firms are based on the industry survey.

The ABS is also the primary data source for employment, real gross value added, investment (including engineering construction) data, and for a range of other economic variables.

Forecasts of the economic variables in this report were mostly sourced from BIS Shrapnel reports, including *Economic Outlook* and *Long Term Forecasts: 2012 – 2027* report. Forecasts of the underlying activity indicator (ie the main determinants of skilled labour demand) were also sourced from BIS Shrapnel reports including *Engineering Construction: 2011/12 to 2025/26, Building in Australia 2012–2027, Long Term Building Work Done Forecasts*, *Mining and Heavy Industry Construction in Australia 2011/12 – 2025/26*, *Mining in Australia 2012 – 2026* plus other unpublished forecasts and from BIS Shrapnel internal research.

CHAPTER TWO

Methodology

2. METHODOLOGY

The objective of this report is to quantify the demand for skilled surveying and geospatial labour annually over the decade to 2021/22 and identify any skills capability gaps in the surveying and geospatial industry given forecasts of future construction activity. Note that in this report, we often refer to the sum of the population for surveyors, geospatial specialists and surveying and geospatial technicians as surveying and surveying-related workforce or surveying and geospatial workforce.

2.1 Defining the current skilled surveying and surveying-related workforce

In order to quantify a skills capability shortfall or surplus, we need to define at the outset the skills being considered and the size of the defined skilled surveying and surveying-related workforce. For this report, BIS Shrapnel was asked to consider surveying skills (by its main areas of specialisation), geospatial skills, surveying and geospatial technician skills as well as the demand for planners, engineers, environmental scientists, architects and ecologists at consulting surveying firms.

We sourced the population data for surveyors, spatial scientists, and surveying or spatial science technicians as at June 2012 from the Australian Bureau of Statistics (ABS). This data was provided by industry sector by state. To distribute the surveying population into its main areas of specialisation (ie cadastral, construction, engineering mining and 'other' surveyors), BIS Shrapnel conducted a national survey of consulting surveying firms, as well as Construction, Mining, EGWWS (Electricity, Gas, Water and Waste Services), Government and the Transport industry sectors. Together, these industries accounted for 95.2 per cent of all surveyors. A copy of the questionnaire used in the survey is provided in Appendix A.

Table 2.1: Estimate of the Size of Surveying and Surveying-Related Workforce by state, as at 2011/12

Specialist Occupation	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	Total
Surveyors									
Cadastral	1,301	592	673	190	295	126	77	76	3,330
Construction	305	372	459	82	329	9	1	13	1,570
Engineering	489	393	362	107	307	16	1	18	1,692
Mining	235	97	404	64	524	15	1	0	1,340
Others	77	134	106	18	91	11	0	10	446
Total Surveyors	**2,405**	**1,588**	**2,005**	**462**	**1,545**	**177**	**80**	**116**	**8,378**
o/w Registered/Licensed Surveyors	*1,067*	*521*	*579*	*171*	*258*	*111*	*77*	*68*	*2,852*
Total Spatial Scientists	**841**	**707**	**783**	**217**	**683**	**117**	**57**	**191**	**3,596**
Technicians									
Surveying Technicians	366	185	263	78	151	33	13	26	1,116
Spatial Technicians	92	46	66	20	38	8	3	7	279
Total Technicians	**458**	**231**	**329**	**98**	**189**	**41**	**16**	**33**	**1,395**
Total Skilled Surveying and Geospatial Workforce	**3,704**	**2,526**	**3,117**	**777**	**2,417**	**335**	**153**	**340**	**13,369**
Other Professionals (a)									
Planners	120	77	80	20	56	8	3	6	370
Engineers	155	125	126	31	88	11	5	9	550
Environmental Scientists	35	28	34	8	24	3	2	3	137
Other (include Architects)	30	60	28	7	18	2	1	2	148
Total Other Professionals	**340**	**290**	**268**	**66**	**186**	**24**	**11**	**20**	**1,205**
Total	**4,044**	**2,816**	**3,385**	**843**	**2,603**	**359**	**164**	**360**	**14,574**

o/w: of which

Source: BIS Shrapnel, ABS, CSN

(a) These are other professionals employed at consulting surveying firms

Skills Demand Study – Definitions and Conventions

Skilled surveying and geospatial workforce comprises surveyors, geospatial scientists, and surveying and spatial technicians.

Total skilled workforce constitutes skilled surveying and geospatial workforce plus the number of planners, engineers, environmental scientists employed at consulting surveying firms.

Existing skilled workforce is defined as the current size of the skilled workforce.

Current demand for skilled labour is assumed to equal the size of the existing workforce.

Future workforce represents existing workforce (adjusted for natural attrition rates through ageing) over the forecast horizon.

Future demand for skilled labour is based on BIS Shrapnel's forecasts of the key determinants of skilled workforce.

Workforce gap is defined as the difference between the demand for future labour and the size of the existing workforce. If the demand for labour exceeds the size of the existing workforce then we have 'positive' workforce gap. A positive workforce gap implies that the existing workforce will not be sufficient to cover for expected future demand. When the size of existing workforce exceeds the demand for skilled labour, then a 'negative' workforce gap arises implying that the future workforce will more than cover for the expected future demand in skilled workforce.

New labour supply is defined as the additional labour supply from new graduates, net migration from overseas and other labour supply boosting initiatives (eg re-training, productivity improving measures, slower rates of attrition etc). Only the first source is considered explicitly in this report.

Net capability position is the difference between the estimated workforce gap and the supply of additional skilled labour via new graduates. If the net capability position is positive, we refer to it as 'capability shortfall'. The presence of a capability shortfall implies that the surveying and geospatial industry needs to attract additional labour above that expected to be sourced from new graduates — such as through immigration or via other labour supply boosting initiatives (eg by increasing productivity or reducing the rate of workforce attrition) — if it is to achieve forecast levels of construction activity. If the net capability position is negative, it represents a situation of 'capability excess/surplus' ie the industry has more than enough capacity to undertake the expected future levels of activity.

The 2011/12 estimates of surveying and surveying-related workforce by state is provided in table 2.1. The total surveying and geospatial workforce in the specified skilled occupations was 13,369 persons. In addition, based on the industry survey results, we estimate that there were 1,205 'other' professionals such as planners, engineers and environmental scientists employed at consulting surveying practices.

Of the 13,369 skilled persons employed in the surveying and geospatial industry, 63 per cent (8,378) are surveyors with spatial scientists and surveying and spatial science technicians making up 27 per cent and 10 per cent of the total population respectively. We estimate that cadastral surveyors account for nearly 40 per cent of all surveyors at the Australia level. This is followed by engineering surveyors (20 per cent), construction surveyors (19 per cent), mining surveyors (16 per cent) and other surveyors (5 per cent). In addition, we estimate that there are two non-licensed surveyors practicing for every licensed surveyor at the national level.

2.2 Forecasting the future skilled labour demand for surveyors and surveying-related professionals

The approach taken by BIS Shrapnel to forecast future skilled labour demand is similar to other demand forecasting exercises we have undertaken for clients associated with the building and construction sector. Firstly, we relate our estimates of 'base year' demand to an appropriate 'base year' activity indicator to derive a 'usage coefficient' per unit of end use sector activity. We then apply this usage coefficient to our forecasts of the activity indicator to derive forecasts of future demand.

In this case:

- Base year demand is estimated skilled employment in the surveying and geospatial industry in 2011/12.
- "End use" activity indicators chosen for the specialist occupations are as follows:
  - Private house commencements for cadastral surveyors
  - Private multi-residential and non-residential buildings for construction surveyors
  - Utilities and transport engineering construction for engineering surveyors
  - Mining and heavy industry construction plus mining exploration investment for mining surveyors
  - Total construction (is sum of residential, non-dwelling building and engineering construction) for 'other' surveyors (comprising hydrographic, photogrammetric and geodetic surveyors), geospatial specialists, surveying or spatial science technicians and 'other' professionals employed at consulting surveying practices.
- For each occupation in each state and territory, a usage coefficient was calculated by dividing the population of each occupation by the pertinent end use activity segment in 2011/12.
- Forecasts of future skilled labour demand were then generated by applying the "fixed" coefficients to BIS Shrapnel's projections of future activity in each end use activity segment. However, in this study, we have allowed for "dynamic" usage coefficients (ie coefficients which change over time). Effectively, this means that we have incorporated labour productivity growth assumptions into the model. Our baseline model output is based on the national average of productivity growth of 1.5 per cent per annum. Nonetheless, we also present results for a 2 per cent and 0 per cent productivity assumption to allow for sensitivity testing.

The model therefore assumes that future changes in demand for skilled labour in the surveying and geospatial industry are driven by changes in the identified activity indicator.

As mentioned in chapter one, forecasts of the key determinants of labour demand were sourced from BIS Shrapnel reports, including *Building in Australia 2012–2027*, *Engineering Construction in Australia 2011/12 – 2025/26*, *Mining and Heavy Industry Construction in Australia 2011/12 – 2025/26*, *Mining in Australia 2012–2027*, *Long Term Building Work Done Forecasts*, plus other unpublished forecasts and from BIS Shrapnel internal research.

2.3 Modelling existing workforce attrition

The total skilled surveying and geospatial workforce requirement to meet future construction activity will inevitably be increased by the attrition of the existing workforce through ageing effects, particularly through retirement and death. To allow for workforce attrition, we included assumptions regarding the approximate age profile of the workforce and the likelihood of

retirement (both of which are based on the results of our national industry survey) or death of persons in each age group.

The probability of death in each age group was assumed based on the latest available morbidity statistics from the ABS and, for simplicity, we assumed a zero death rate for ages under 60 (the very low morbidity rate for ages under 60 have an insignificant impact on the model results).

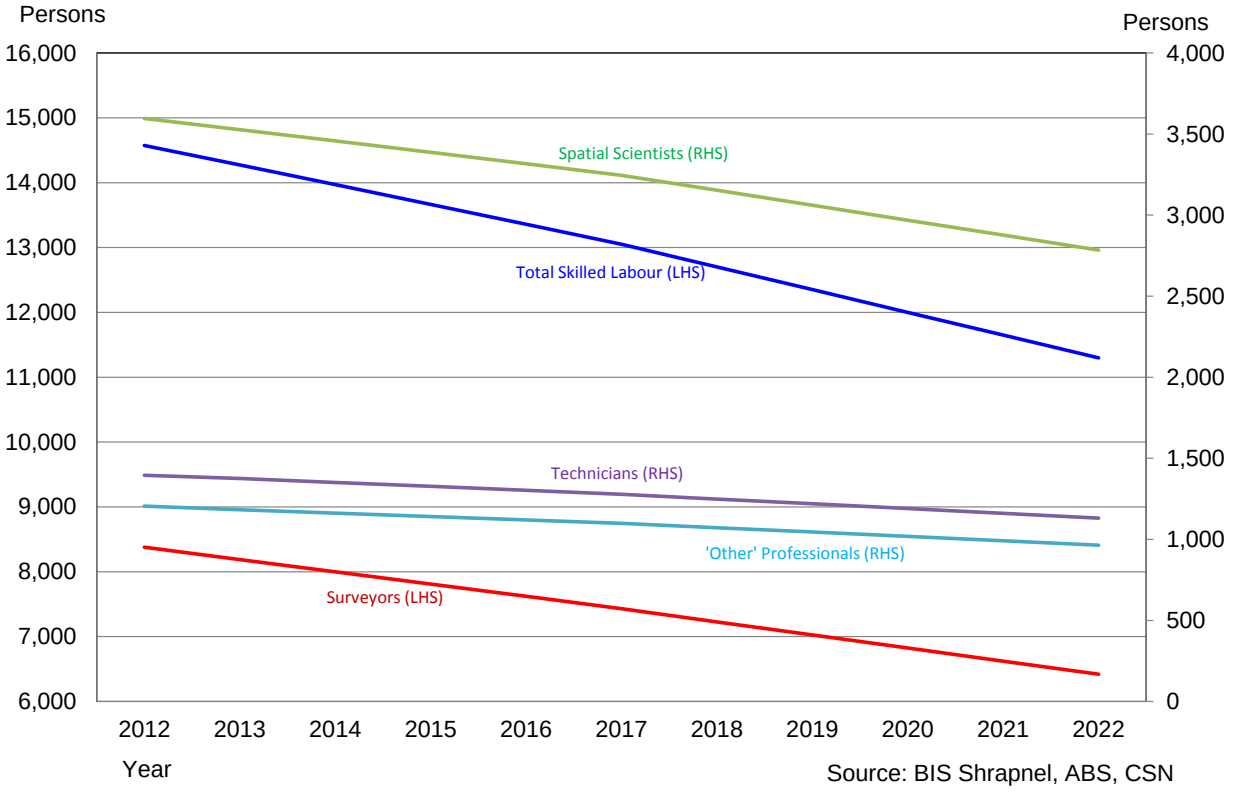
The retirement and death assumptions for the aggregate workforce are shown in table 2.2 and are used uniformly across all states and territories. There will be different rates of workforce attrition across states and territories, however, given different estimates of the skilled surveying and geospatial workforce.

Table 2.2: Surveying and Geospatial Workforce Attrition Assumptions

Age Bracket	Proportion of age bracket retired (%)	Death Rate (per 1000 population)
15-24	3%	0.0
25-34	5%	0.0
35-44	6%	0.0
45-54	11%	0.0
55-59	23%	0.0
60-64	43%	6.3
65-69	78%	10.0
70+	95%	46.6

Source: BIS Shrapnel, ABS, CSN

Chart 2.1: Australia
Ageing of Existing Surveying and Surveying-related Workforce



Source: BIS Shrapnel, ABS, CSN

The total current skilled surveying and geospatial workforce, under these assumptions, is expected to decline by 22 per cent between 2011/12 and 2021/22 (see chart 2.1). The annual rate of decline expected to increase to 3 per cent per annum from 2017/18 as a higher proportion of persons enter the older age groups. It should be noted that while the existing skilled workforce is expected to decline in personnel terms, the measure of skills and experience lost is likely to be far greater as the retirees will be concentrated in relatively "high skill/experience" occupations. This report does not attempt to quantify this arguably greater loss but acknowledges that it is a key issue facing the industry particularly for the surveying profession.

2.4 Modelling new graduate supply

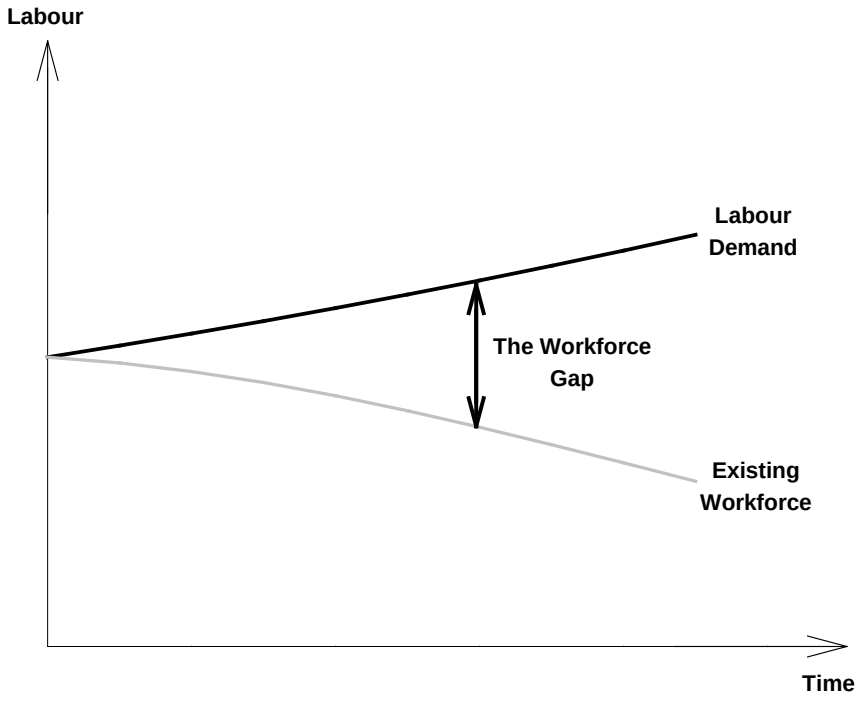
The changing demand for surveying and surveying-related skills (due to changes in construction activity) and the need to replace personnel lost through workforce attrition, results in an additional labour requirement or "workforce gap". This is shown conceptually in chart 2.2.

The workforce gap, when positive, will need to be met by additional labour supply if forecast levels of end use sector activity are to be achieved. Possible sources of labour supply include:

- New graduates
- Net migration from overseas, and/or
- Other labour supply boosting initiatives (eg re-training, productivity improving measures, slower rates of attrition etc)

All of these supply sources are important in meeting future surveying and geospatial workforce requirements. However, only the first source is considered explicitly in this report. As most of the skill requirements for the chosen occupations are based on engineering and related disciplines, we utilise Higher Education data supplied from the Department of Education, Employment and Workplace Relations (DEEWR) and published in Engineers Australia's *2012 Statistical Overview*.[1]

Chart 2.2: The Workforce Gap



[1] Engineers Australia (2012), *The Engineering Profession: A Statistical Overview*, Ninth Edition.

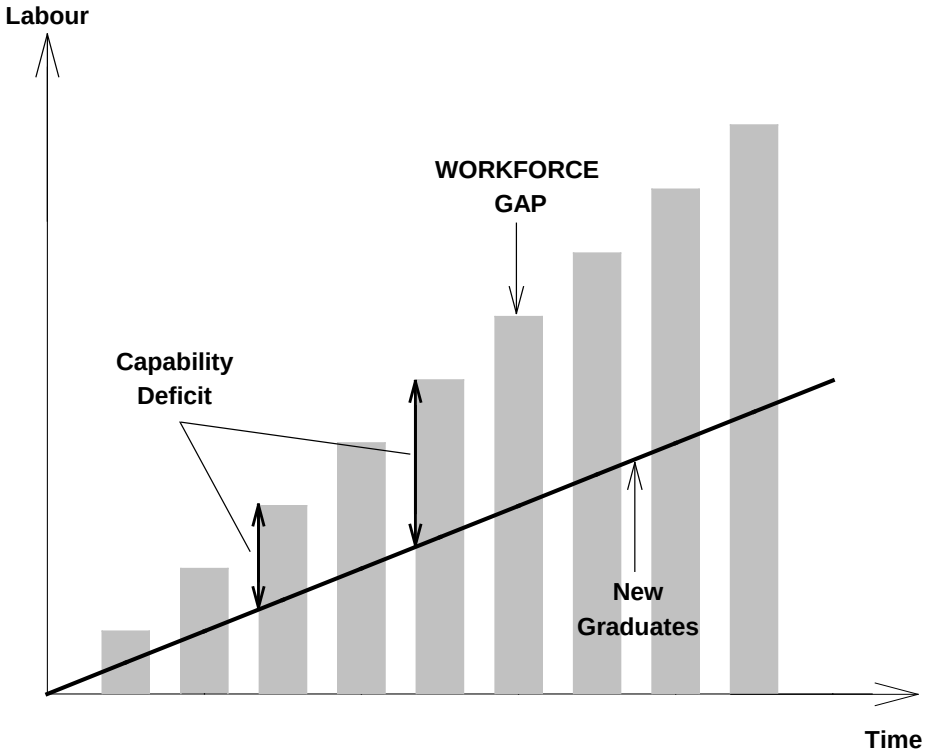
We have chosen to use only data relating to undergraduate enrolments and completions for domestic students. Near term forecasts of undergraduate completions for geomatic engineering — the key source of supply for the surveying and geospatial industry — are based on current course enrolments and completion rates. Longer term, we have assumed that the supply of new graduates will stabilise around a historical trend. The forecasts were then fine-tuned by incorporating student enrolment and completion numbers provide by RMIT, UNSW, University of Southern Queensland and University of Newcastle, University of Melbourne, University of South Australia and Curtin University.

In addition to university graduates, we also considered data on vocational course enrolments and completions. Although the minimum qualification for employment as a surveying or spatial science technician is Certificate III, we have only considered completions of Diploma or higher qualifications included in Engineers Australia (2012) as adding to the supply of para-professionals for the industry. Our forecast of growth in vocational completions is assumed to follow a similar trend to that of university graduate completions, notwithstanding that this source of supply has seen very strong growth recently, particularly in the three years to 2009.

2.5 The capability shortfall or surplus

The estimated total labour requirement or 'workforce gap' less the supply of additional skilled labour via new graduates is defined in this report as the 'net capability position'. If positive, it translates into a 'capability shortfall'. The presence of a capability shortfall implies that the surveying and geospatial industry needs to attract additional labour above that expected to be sourced from new graduates — through immigration or via other labour supply boosting initiatives (eg by increasing productivity or reducing the rate of workforce attrition) — if it is to achieve forecast levels of future construction activity. A negative capability shortfall implies a situation of 'capability excess/surplus'. In other words, the available skilled labour exceeds the future skilled labour workforce gap.

Chart 2.3: The Capability Shortfall (Surplus)



It is important to note that the capability shortfall (or surplus) is a theoretical construct. In reality there will be no observable capability shortfall. In practice, either labour demand (and construction activity) will fall back to meet the constrained level of labour supply — implying that some future construction activity will need to be cut back or foregone — or measures will be put in place that will boost labour supply to meet projected construction activity.

Although theoretical, calculating the capability deficit provides important insights. First and foremost, it provides a simple measure of how much more labour is required through migration or through education and re-training to meet current expectations of future construction activity. Alternatively, a capability shortfall could be used to measure the "cost" of the labour constraint in terms of the value of the construction activity foregone if supply were not augmented. Given the high 'multiplier' effects of construction activity — as well as costs associated with the presence of inadequate infrastructure delivery, this cost would have even stronger flow-on effects on the broader economy.

2.6 Limitations of the model and summary of key assumptions

The aim of the model is to quantify a skills capability shortfall or surplus for the surveying and geospatial industry based on reasonable assumptions regarding the future demand for skills (via forecasts of construction activity) and the future supply of skills (through new graduates). While BIS Shrapnel has taken care in the specification of the model, and the assumptions used, it is important to note some limitations of the model and to recap the key assumptions that have to be made. Improving upon the specification of the model or the choice of assumptions based on feedback to this report or via new sources of information would be a useful avenue for future research. Ideally, the model used here could be improved upon and run again periodically to assess if the capability outlook has changed.

In our view the main limitations of the model as specified are:

- **The measurement of requirements in terms of labour or 'personnel', not necessarily skills and experience.** The model used here quantifies a capability shortfall or surplus in terms of the number of persons required across the occupation groups considered. However, this does not take into account the range of skills or experience held by persons, not only between occupations, but within an occupation group. Retirees will always have much more skills and experience than the new personnel that replace them. This is particularly true when supply is focused on new graduates, but the impact may be lessened by the hiring of personnel via immigration, where existing skills and experience may be higher.

  In future, an "equivalent persons" index may be developed. This aim of the index would be to convert the "number of persons" measure to a measure of skills and capability. This index will require accurate measures of experience earned (eg number of years employed in the surveying and geospatial industry for each person, not just age) and some agreement on an appropriate scale that compares people with different measures of experience. The scale will explicitly reflect the pace at which people develop once hired and reach "high" levels of capability, and the point at which they reach a maximum contribution. We feel this is a valid area for further enquiry and development in future studies.

- **The timing of labour demand.** The model as specified quantifies the annual capability shortfall or surplus that is forecast to exist in the surveying and geospatial industry for each year to 2021/22 and is based on BIS Shrapnel's projections of construction activity in that year. However, for many surveying occupations, the demand for labour will necessarily precede the period where actual construction takes place (for example, the necessary design, measurement, calculations, plan and document presentations occurs well before

the construction phase). In the case of engineering skills, particularly, we believe that hiring should take place around 4-6 years before anticipated increases in skills demand to allow time for appropriate professional development that will meet workforce requirements. Together, this means that, ideally, labour hiring should take place several years before any anticipated peaks in the measured capability shortfall (which is based on construction work done). Even so, we suspect that the quantified capability shortfall or surplus provides a reasonable estimate of the true labour requirement, on average, across the forecast period.

- **Treatment of other skills supply sources not explicitly considered.** The model does not explicitly attempt to quantify labour supply sources other than new graduates such as via immigration. In future, we believe a proper estimate of the impact of immigration on labour supply for the surveying and surveying-related workforce would require an extensive survey of both private sector and public sector organisations. In regard to this issue, however, we re-iterate that it is not the primary aim of the model, or this report, to suggest how best to meet any measured capability shortfall, but rather to quantify how large the problem may be.
- **Model does not consider 'under-employment' of labour.** The definition of employment used by the ABS is quite broad, and encompasses persons working as little as one hour a week.[2] This may have particular consequences in our derivation of workforce attrition, which is based on the number of people who have left the workforce entirely in each age group. This means that persons who are working as little as one hour a week will still be considered "employed" by the model. So while the model suggests 22 per cent of the skilled surveying and surveying-related workforce will retire by 2022, the reality, in terms of the decline in hours of work supplied, may even be larger.
- **Existing skills shortages not considered.** An explicit assumption of the model is that there is that the capability gap is zero in the base year. We have taken this approach because of the need to calculate appropriate usage coefficients. However, our industry survey suggests that skilled labour shortages not only exist already, but have become much worse over the last 3 years (particularly in regional and rural areas), and this should be kept in mind when considering the capability forecasts of the model.

2.6.1 Key assumptions used in the model

As stated, we have had to make several broad assumptions in the construction of the model. Some of these assumptions are more important than others in terms of their impact on the working of the model and the results generated. In our view, the key assumptions are:

1. The choice of end use activity indicator
2. Assumptions regarding likely graduate supply, and
3. Assumptions regarding the correct rate of productivity growth.

In addition to these, the results of the model also hinge on the accuracy of our construction activity forecasts. As mentioned, these are sourced from several BIS Shrapnel reports. The rationale of our forecasts are presented and discussed in chapters 4, 5 and 6.

[2] ABS (1996), *Standards for Labour Force Statistics*, Cat. No. 1288.0.

CHAPTER THREE

The Economic Environment – Australia, NSW and Victoria

3. THE ECONOMIC ENVIRONMENT – AUSTRALIA, NSW AND VICTORIA

3.1 The Australian economy

There was always going to be some slowing in the June and September quarters of 2012 following the very strong March quarter. The fact that the June 2012 quarter still produced growth of 0.6 per cent highlights what a great first half of 2012 the Australian economy had, underpinned by strong mining-related investment and solid growth in household expenditure. Overall, the Australian economy grew by 3.5 per cent in 2011/12.

GDP increased 0.5 per cent in the September 2012 quarter, with annual growth slowing to 3.1 per cent from 3.8 per cent through-the-year to the June quarter .

Cut-backs in government spending accounted for the biggest negative in the quarter, slicing 0.4 per cent off quarterly growth. Growth in household spending was only 0.3 per cent in the September quarter, with expenditure on retail goods declining 0.6 per cent, and expenditure on motor vehicle purchases and on most services increasing modestly. Not all of the reduction in expenditure in retail goods and travel occurred locally – there appeared to be larger declines in spending on overseas travel (and goods purchased during overseas holidays).

New business investment increased 5.6 per cent in the September quarter, due to growth of 8.9 per cent and 6.2 per cent respectively in private engineering construction and machinery and equipment expenditure.

A sharp rise in inventories and a rise in dwelling investment also contributed to the 0.5 per cent increase in Gross National Expenditure, with a positive external contribution as exports outpaced import growth. The 0.7 per cent increase in dwelling building looks like the start of what will be a gradual upswing through the next year. Recent approvals data is in line with our forecasts, and this should translate into rising commencements and activity over the next year.

By state, the results were very telling, with only New South Wales (+0.1 per cent) and Western Australia (+2.3 per cent) recording positive seasonally-adjusted growth in State Final Demand in the September quarter. However, in trend terms, Queensland and the Northern Territory also posted solid-to-strong growth.

3.1.1 Outlook for the Australian economy

While Australia did not have a financial crisis and avoided a recession, the GFC definitely had an impact on the Australian economy. In the three years immediately following the GFC, GDP growth averaged around 2 per cent, down from just above 3.5 per cent over the preceding seven years. The slower average growth rates reflected declining business and dwelling investment and markedly slower growth in household spending. Providing a significant offset, growth in public sector investment grew very strongly as the Commonwealth Government injected considerable stimulus.

As mentioned, GDP growth for 2011/12 increased to 3.5 per cent, reflecting increased growth in household spending and increased mining-related investment. However, dwelling investment and non-mining business investment has been flat to falling, and public sector investment has fallen sharply as the post-GFC stimulus wound down. Increased demand will gradually induce the next round of dwelling and non-mining business investment, with these industries expected to start advancing in six to twelve months time. Exports will also add to growth over the next few years, driven mainly by increased mining-related exports as the current round of investment projects enter the production phase.

Increased economic activity over 2013 to 2015 will progressively add to inflation pressures, prompting the Reserve Bank to start raising interest rates from late 2013, with interest rates

Chart 3.1: 2012 Stylistic Cycle

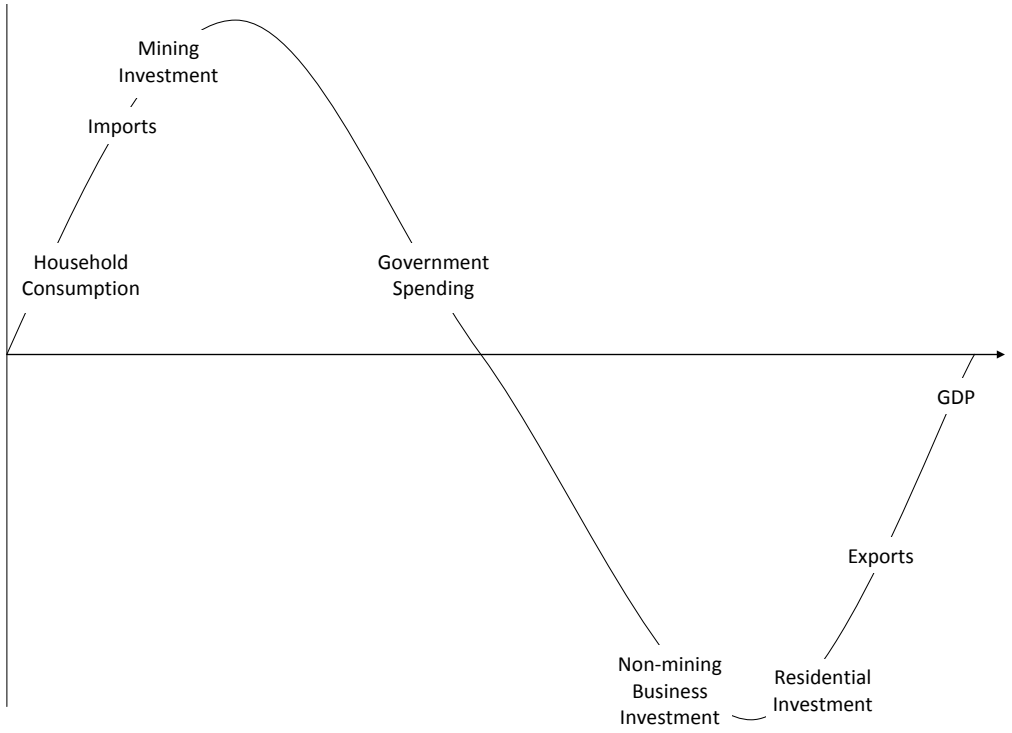
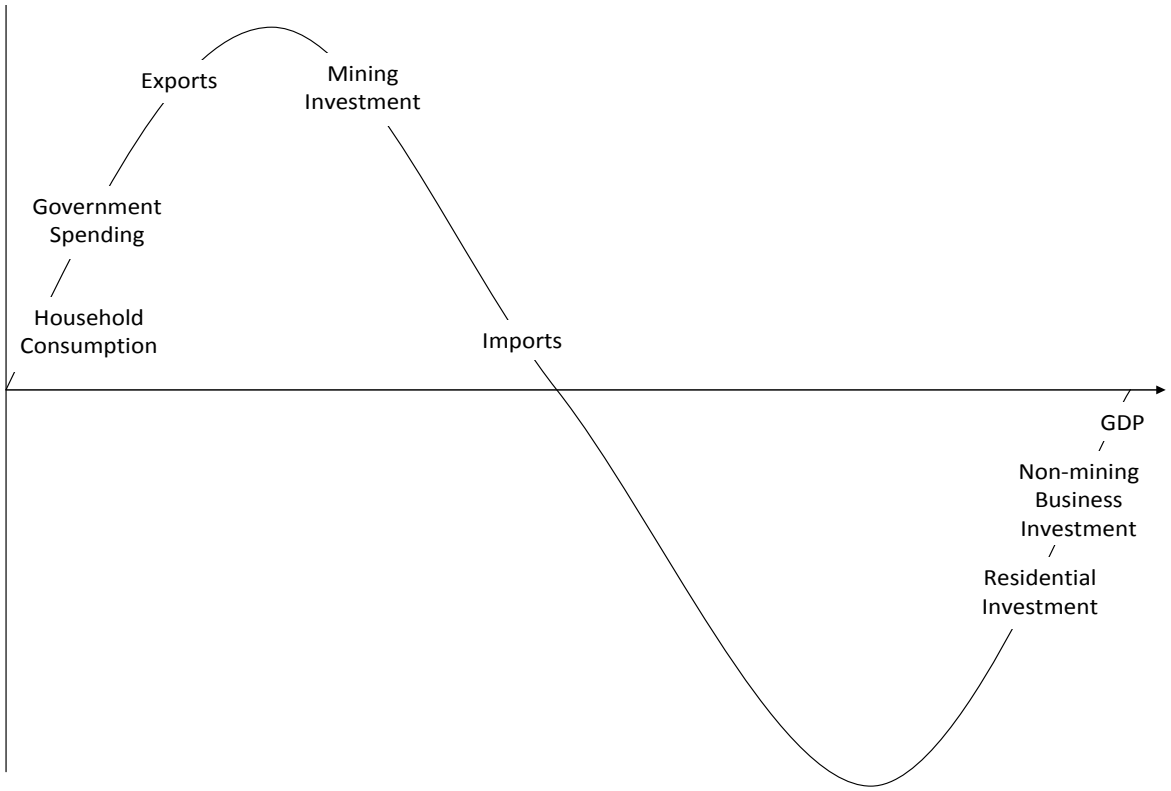


Chart 3.2: 2017 Stylistic Cycle



peaking during 2015. This will cause growth in household consumption to slow during 2016, and cause dwelling and business investment to decline. By 2017, mining-related investment will be starting to ease back slightly from extremely high levels, household spending will once again be ticking along at a good clip, export growth will be solid, underpinned by increased mining output and a recovery in non-mining exports. Dwelling, non-mining business investment and Government expenditure will all be recovering after an extended period of underinvestment.

Despite all of the components of expenditure GDP going through cycles over the next five years, aggregate GDP growth is expected to be remarkably stable, not deviating far from its forecast annual average of 3.3 per cent. This reflects that the cycles in the various expenditure components are not expected to be synchronised, but will largely offset each other. Furthermore, imports cycling in line with domestic demand will play an important role in dampening the cycles in GDP (see charts 3.1 and 3.2).

Household consumption expenditure to grow in line with incomes, supported by population growth

Household consumption expenditure growth slowed sharply in the immediate aftermath of the GFC. This reflected a combination of lagged effects of high interest rates leading into the GFC, slower income growth, increased concern about high household debt and reduced perceived job security. The decline in household consumption expenditure growth was more marked than the decline in real household disposable income, resulting in a sharp increase in the household saving rate to its highest level since the 1980s. This reversed a long-running downward trend, which reflected households borrowing against the value of their home to boost current expenditure.

Over the past couple of years, households appear to have once again become comfortable with their financial position, such that growth in household consumption expenditure has increased to now be in line with growth in real household disposable income. As a result, the household saving rate has largely tracked sideways at a historically high level. However, a growing proportion of this expenditure on goods is flowing overseas due to the high Australian dollar, so domestic retailers' turnover remains relatively weak. This has meant that activity in Australia has not really benefited much from the increase in household consumption expenditure.

Further growth in household consumption expenditure is expected over the next two years, as increases in disposable incomes are matched by improving consumer confidence. We believe households have built up a considerable savings buffer after several years of high savings ratios, and believe this has created a degree of pent up demand. Improved financial security will see expenditure continue to pick up, and will likely see the saving rate begin a slow retreat from its current high levels. The ongoing growth in household consumption expenditure is expected to translate into increased retail turnover and activity in Australia over the next few years. However, the current high level of the Australian dollar means that there will continue to be further leakage of household spending overseas, such that we expect growth in retail turnover to remain below growth in total household spending for the next few years.

The increased expenditure (and strength in the broader economy) will see the Reserve Bank begin to increase interest rates through 2014/15. This will dampen consumer spending once more, with growth reaching a trough of 2.3 per cent in 2016/17. However, the effect on employment is expected to be mild, and a strong recovery in spending will take place the following year. Overall, household consumption expenditure is forecast to average growth of 3.3 per cent per annum over the five years to 2016/17.

Over the longer term, population growth is expected to be the primary driver of household expenditure. As such, slowing population growth is expected to see household consumption

expenditure growth moderate slightly over the following decade, averaging 3.1 per cent per annum between 2017 and 2022 and slowing further to 2.9 per cent between 2022 and 2027. Although the economy is expected to remain healthy through this period, we do not expect a return to the debt-driven increases in consumption that occurred through the late 1990's and early 2000's.

Existing dwelling shortage and ongoing population growth will support residential investment … once the recovery gets underway

While household consumption expenditure growth has recovered post GFC, households have not been willing to undertake the large outlays required to purchase new houses. As a result, dwelling investment has largely tracked sideways for the past decade. A decade of flat dwelling investment at the same time that population growth has been strong has resulted in the emergence of a significant dwelling shortage. This is especially the case in New South Wales, and increasingly so in Western Australia. The shortage is so severe that we expect it to underpin dwelling investment throughout the next decade or so.

In the near term, dismal confidence, excessive caution by households, and difficult funding conditions for developers is leading to declines in dwelling investment from already low levels. However, we expect these negative factors to dissipate gradually, supported by interest rate reductions over the past year. Therefore, we expect dwelling investment to start recovering from the end of this year. We expect that recovery to continue until late 2015, when higher interest rates stifle activity. However, the dwelling shortage is so severe that we expect dwelling building to bounce back quickly, posting solid average growth throughout the rest of the forecast.

The performance of dwelling investment will be important for the performance of the overall economy, with increased dwelling building activity supporting many other industries. The risk is that the recovery is slower coming than we are forecasting. If this does occur, the recovery, when it does come, will likely be larger and longer.

Business investment will be strong over the next five years and be a key driver of growth

Total business has been strong over the past few years, driven by rapid growth in mining-related investment. At the same time, however, non-mining business investment has fallen.

With commodity prices still exceptionally high and set to recover over the next two-to-three years, we expect mining-related activity to remain strong throughout the forecast period. This is all but assured over the near term, with the current round of projects locked in for the next few years.

Following a brief rally early in 2012, commodity prices resumed their downward trajectories as markets reacted to weaker demand and continued news of slower global economic growth over the past year. However, we believe that overall world GDP growth and commodity prices have reached their weakest point in this current post-GFC cycle. Global economic growth and commodity prices are expected to pick up from the December quarter 2012 and then gradually rise over the next two-to-three years – of course there are marked differences between the different commodities with regard to the magnitude and timing of price rises. Despite our forecast of a price recovery, many of the commodities are not expected to reach the high points they reached in early-to-mid 2011 (let alone the record peaks of 2007/08).

Even with the recent falls, commodity prices are still exceptionally high, and would have to fall at least as much again to seriously threaten a fall in minerals-related investment within the next two years. With many of the projects locked in or already underway, resource-related investment is expected to continue growing over the next two years. Furthermore, we believe

that our forecast for commodity prices is sufficiently high to prevent a sudden and sharp drop in resource-related investment in the second half of this decade.

In terms of non-mining business investment, there are three key factors currently holding it back: lack of confidence, lack of demand, and tight funding conditions. Only when one or more of these factors starts to improve will we see a sustained recovery in non-mining business investment. Our forecast is that this will start to occur late this year, supporting a recovery in investment from next year onwards.

The underinvestment in non-mining industries has persisted for so long that capacity pressures will be reached soon after demand picks up. We are already seeing this in some markets. For example, leasing rates in some commercial areas are starting to pick up. These emerging capacity constraints will drive the recovery in non-mining business investment.

We expect higher interest rates to lead to a decline in business investment in 2016, but then expect business investment growth to recover quickly thereafter.

The risk is that non-mining business investment remains weak for longer than forecast over the next couple of years. However, as with dwelling investment, the longer the recovery is delayed, the larger the subsequent surge is likely to be.

Strong business investment will be critical for boosting labour productivity and securing medium-term economic growth. Investment in building and engineering construction – to the extent that the later is not imported – will also generate significant activity and jobs throughout the rest of the economy.

Commonwealth and state government focus on tightening budget deficits will constrain government expenditure

The Commonwealth Government plans to return their budget to surplus (or balance) within the next couple of years, and then progressively reduce net debt as a share of GDP. Whether or not they achieve surplus this year or later, the fiscal contraction will subtract around 1 per cent from GDP growth – particularly impacting on domestically-focused industries that remain under pressure from low private sector demand.

The main reason for the Commonwealth Government's existing deficit is that revenue has fallen sharply as a share of GDP over the past few years, while expenditure has continued to increase. Revenue is expected to increase as a share of GDP over the next few years, reflecting economic recovery and the introduction of the Minerals Resource Rent Tax and the Carbon Tax. However, there are structural changes occurring in both company and the Goods and Services Taxes (GST) that mean Commonwealth Government revenue will not regain its pre-GFC share of the economy.

Across the board spending restraint will be required. One avenue that is being pursued is the scaling back of grants and subsidies to the State Governments. This reflects both lower growth in GST revenue (around a quarter of State Government revenue), and lower growth in other Commonwealth Government grants and subsidies (accounting for another quarter). This is occurring at a time that State Governments' own revenue sources (stamp duties, payroll taxes etc) are already low. The squeeze on State Government revenue is important because State and Local Governments account for around 80 per cent of General Government Investment and two-thirds of General Government spending on goods and services.

The ageing of the population will put added pressure on the fiscal position, particularly from around the turn of this decade. First, growth in the labour force will gradually drop behind population growth, as a larger share of the population moves into retirement. This will slow growth in the economy and tax receipts unless there are offsetting increases in age-specific

participation rates, population growth, and/or productivity growth. Second, despite some policy changes to try and limit the growth, expenditure on healthcare services and superannuation will continue to outstrip growth in the population and the wider economy. Health expenditure growth will also be underpinned by the long-standing tendency for the demand for health services to increase with incomes and for costs to increase as new technologies are developed. While all levels of Government will try to limit spending growth by restricting wage growth, public sector wage growth will likely keep pace with private sector wage growth over the medium term.

Because it is extremely difficult and politically unpalatable to rein in ongoing (or recurrent) expenditure, we expect public investment to bear the brunt of the fiscal restraint. This will deny the domestic economy a much-needed source of demand over the next few years, and result in a significant under-investment in infrastructure, thus undermining medium-term economic growth – as occurred during the 1990s.

Public investment will likely pick up in the second half of this decade as mining royalties increase in Western Australia and Queensland. However, the other states will be very dependent on the Commonwealth Government, who in turn might be forced to find new revenue sources or expand the existing ones.

Australia's close ties to Asia help buffer us against events in Europe

Europe continues to deteriorate. With high unemployment, sustained sovereign debt, competitive disparities, and contracting industry and output – is it possible the Euro Zone is through the worst of it? We expect the third quarter to show further deterioration in the Euro Zone. However, Euro Zone competitiveness, at the aggregate level, has improved since 2008. Meanwhile, the United States is not bad, but not good either. It is performing below potential. With unemployment remaining high and inflation under control, we expect to see additional monetary easing in coming weeks. Asia too is performing below potential, with a general slowing in the region as weak external demand from the United States and Europe takes its toll. In response, we expect China to do whatever it takes to maintain growth in the comfort zone.

For example, with a run of recent poor data, Chinese government officials have decided to flex a little more muscle. Over the past few weeks, Chinese provinces have announced a total of $1.3 trillion (US dollars) worth of infrastructure spending plans over the next three years to step up growth. In addition, Chinese premier Wen Jiabao introduced policies to boost growth during the second half of 2012. China's efforts to improve or stabilise growth may also extend beyond its borders. Efforts to continue purchases of European government debt or encouraging more Chinese investment abroad are likely to gain traction.

We expect the third quarter of 2012 to be the trough for Asia, and China in particular, with further government stimulus and infrastructure spending to pick up domestic growth beginning in the fourth quarter onward. The increased activity in China will have flow on effects to the rest of Asia, picking up growth across the region in general. Overall, we expect China to finish 2012 with 7.8 per cent GDP growth.

The upshot is that, over the next five years, the volumes of exports of goods and services are forecast to increase at an average rate of 6.8 per cent per annum and will be driven by increased capacity from investment coming on-stream, ongoing recovery in the global economy, and robust demand from China and India. Meanwhile, rural exports are likely operating at close to their peak, and will therefore cycle around current levels over the next five years. As world demand picks up over the forecast period, growth of non-commodity manufacturing and services exports (mainly tourism and education) will show moderate growth.

Strengthening consumer and business demand in Australia will see merchandise imports continue to grow, particularly as the Australian dollar remains strong. Overall, import growth is expected to average 6.4 per cent per annum over the next five years.

Table 3.1: Australia – Key Economic Indicators, Financial Years

Year Ended June						Forecasts					Average
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2017-22
Selected Expenditure Categories											
Private Investment											
– Dwellings	1.9	-1.5	1.2	2.2	-3.7	0.5	6.5	6.5	-2.3	-2.3	3.1
– New Non-Dwelling Construction (+)	6.3	12.3	-10.1	11.7	37.5	12.3	-0.6	1.1	-4.1	-8.5	1.5
– New Non-Dwelling Building (+)	11.6	-4.1	-14.6	0.6	14.3	3.4	3.1	9.1	-0.9	-2.8	1.5
– New Engineering Construction (+)	1.3	29.5	-6.7	19.3	50.9	16.1	-2.1	-2.2	-5.5	-11.3	1.4
Total New Private Investment (+)	**8.7**	**1.2**	**-2.4**	**5.2**	**13.6**	**6.5**	**4.3**	**5.6**	**-2.1**	**-1.6**	**2.9**
New Public Investment (+)	**10.3**	**7.7**	**23.1**	**-1.9**	**-2.4**	**-6.5**	**-4.1**	**2.9**	**5.1**	**7.6**	**3.3**
Gross National Expenditure (GNE)	**6.0**	**0.6**	**2.2**	**4.3**	**5.2**	**3.1**	**3.2**	**3.9**	**1.3**	**2.4**	**3.1**
GDP	**3.8**	**1.6**	**2.1**	**2.4**	**3.5**	**3.3**	**3.1**	**4.0**	**3.0**	**3.3**	**3.3**
Inflation and Wages											
CPI (Yr Avg)	3.4	3.1	2.3	3.1	2.3	2.8	2.9	3.3	3.1	2.6	2.8
Labour Price Index (Yr Avg)	4.1	4.1	3.1	3.8	3.6	3.7	4.1	4.3	4.1	3.7	3.9
Average Weekly Earnings (Yr Avg)	4.9	5.5	5.6	4.2	4.3	4.0	4.7	5.3	4.9	4.7	4.7
Employment											
– Employment Growth (Yr Avg)	3.0	1.7	1.1	2.5	1.1	1.1	2.3	2.8	1.1	1.2	1.6
– Unemployment Rate (May) (%)	4.3	5.8	5.2	5.0	5.2	5.3	4.9	4.7	5.5	5.2	4.4
Labour Productivity Growth											
– Total	0.7	-0.1	1.0	-0.1	2.4	2.1	0.8	1.2	1.8	2.1	1.7
– Non-farm	0.6	-0.4	1.1	-0.2	2.3	2.2	0.8	1.4	1.8	2.2	1.7
Exchange Rates											
– US$ per A$ (Yr Avg)	0.90	0.75	0.88	0.99	1.03	1.03	1.02	1.04	0.96	0.89	0.86

+Expenditure on new assets (or construction work done). Excludes sales (or purchases) of second hand assets.

Main Risks to Growth Outlook

The current debate surrounds commodity prices. In particular, where they will go from here and what impact they will have on the Australian economy. Our forecast is that most commodity prices are probably around their trough, and are likely to bounce back this year as short-term supply and demand imbalances work themselves out. This risk is that industrial production in China and other key markets does not recover to the extent that we are forecasting, resulting in lower commodity prices than we are forecasting. However, we do not see a lot of scope for commodity prices to hold down at current or even lower levels for any meaningful period of time.

Irrespective of what happens to prices over the next few months, we do not see it having a large impact on our forecast for growth in mining-related investment over the next two years – this work is largely locked in. Rather, it would be our forecast for the second half of this decade that would be most at risk.

Events in Europe are the other headline grabber at the moment. We expect to continue to hear a lot more bad news out of Europe over the next few years, and that is reflected in our forecasts. There is a non-trivial risk that the European situation deteriorates such that financial markets freeze up like they did in 2008, confidence falls and commodity prices decline. This would have a significant impact. However, as we saw in 2008, the most severe effects tend to

be short lived, with the Australian dollar likely to fall in that situation, along with interest rates, and the Reserve Bank has a large toolkit to keep financial markets operating. Furthermore, the Federal Government has a lot of scope to loosen fiscal policy to support growth here in Australia if needed.

Less severe, there is the risk that our forecast recovery in dwelling building does not take hold late this year. If the leading indicators over the next few months do not support this recovery, then we expect the Reserve Bank to be more aggressive in lowering interest rates, which should further underpin the recovery in dwelling building – albeit a few months later than we are forecasting.

3.2 The New South Wales economy

The performance of the New South Wales economy over the next six months will be critical to aggregate Australian GDP growth. In one sense that is obvious, given that New South Wales remains the largest of the states and territories in terms of Gross State Product (GSP), accounting for just below 32 per cent of Australian GDP. However, compared to the other states, the outlook is very finely balanced.

The New South Wales economy is at a cross roads, with the potential to gain momentum from here, but also the possibility it will stumble once again. There are signs that the long-awaited green shoots of a recovery in dwelling building in the state are finally here. If this continues, as we forecast, then it will underpin growth in the rest of the state, and the Reserve Bank probably will not need to lower the cash rate below 3 per cent. However, if—as has so often been the case—these indicators falter, we expect the Reserve Bank to lower interest rates further this year in order to stimulate domestic demand.

Current state of play for the New South Wales economy

State Final Demand (SFD) increased by 2.3 per cent year-on-year for the year ended June 2012, broadly in line with Gross State Product, which increased by 2.4 per cent. This growth was reasonably broadly based, with household expenditure and engineering construction activity (mainly coal, minerals, roads and telecommunications work) driving the growth. Export volumes have also been good, reflecting growth in both agriculture and minerals exports. In contrast, dwelling and non-dwelling building has remained flat to falling — the latter exacerbated by the winding down of the Building the Education Revolution stimulus.

The solid growth in household expenditure — which includes spending by New South Wales residents overseas — has finally started to be reflected in increased retail turnover in the state, even though weak net tourist spending continues to detract from growth. Despite positive retail turnover growth, employment in the retail trade industry has continued to decline. Overall, total employment in the state is up 1 per cent compared to this time last year—slightly stronger than the Australian total of 0.6 per cent.

Outlook for the New South Wales economy

We forecast dwelling building to increase steadily over the next two-to-three years, underpinning demand in the wider economy and supporting employment growth.

Underlying this view is that population growth has run well ahead of the supply of houses in the state. New South Wales' population increased by 1 per cent through-the-year to March 2012, maintaining the solid pace observed over the past few years. Despite this growth, dwelling building has largely gone sideways since 2004. As a result, we estimate that an existing shortage of around 40,000 dwellings has developed, which is 30 per cent higher than

the current level of commencements in New South Wales. Consistent with our view that the dwelling shortage is sizeable, rental vacancy rates are low, and rental inflation in the state is high and rising. Furthermore, we expect the dwelling shortage to intensify, with the state's population forecast to increase by just below 1.2 per cent in each of the four years to June 2016 and the current level of commencements to remain around 10,000 below underlying demand for dwellings.

We forecast this dwelling shortage, combined with recent State Government changes that provides incentives for first home buyers to purchase newly-built homes, and the below-average level of housing interest rates, to underpin a steady, but not spectacular, recovery in dwelling building in New South Wales. This recovery will be critical to the state's economic performance, given continued forecast declines in public investment, lower mining-related investment, and the impact of the high Australian dollar on the manufacturing and tourism industries.

Provided that the recovery in dwelling building takes hold, it will increase demand for the industries that support the dwelling building industry, including real estate agents, professional and business services, some parts of the manufacturing industry, and retail trade. We forecast a steady recovery in these industries to increase demand for office space and other commercial buildings, prompting a recovery in non-dwelling building in the state in 2013/14.

As a result, business investment is expected to strengthen over the next three years, as the improved outlook for dwelling construction and further increases in coal and minerals investment precipitate a broader pick-up in overall business investment. Offsetting this, public investment is forecast to fall over the next year and remain low in the subsequent year, before posting a gradual recovery.

With the Australian dollar expected to remain around parity with the US dollar over the next three years, the negative impacts on the state's tradeables sectors will continue to weigh on the overall prospects for GSP. This includes the rural sector, which will suffer from falling revenues when current high world prices (ie in US dollar terms) for a number of agricultural commodities fall back as global supply increases in response to high prices and current drought conditions in the United States pass. However, the prolonged period of the high Australian dollar is likely to lead to some further decline in the manufacturing industry, lower levels of manufacturing investment and potentially long-term damage to the state's tourism and education services industries.

Overall, we are forecasting growth in SFD of 3.2 per cent in 2012/13 and 4.8 per cent in 2013/14. The forecast cycle in GSP growth is less marked, but still notable, with growth of 2.6 per cent and 3.9 per cent forecast for the next two years respectively. This should underpin a gradual recovery in employment growth, to 0.8 per cent in 2012/13 and 3 per cent 2013/14, which should be sufficient to keep the unemployment rate around the national average of just above 5 per cent. When combined with ongoing population growth, this means that household expenditure will also be an important driver of economic growth in the state over the next two years.

Nevertheless, there is a real risk that the recovery will falter. Because we believe that the Reserve Bank thinks that dwelling building will be an important driver of the much-needed recovery in domestic activity, we expect the Reserve Bank to be quick to lower interest rates further this year if the near-term indicators suggest the recovery is not being sustained. This in turn will further encourage the recovery in dwelling building and the wider state economy, albeit later than we are forecasting.

New South Wales is particularly sensitive to interest rate movements due to higher levels of mortgage debt. The solid economic growth forecast for the Australian economy for 2012/13 and 2013/14 will see the Reserve Bank increase interest rates to curb inflation and avoid the economy overheating. This will lead to a weakening in output and employment growth in 2015/16. But the weakening in the economy is likely to be relatively brief. A subsequent easing in interest rates, a lower Australian dollar and strengthening in residential, public and business investment are projected to lead to buoyant economic conditions over the second half of this decade.

Overall, we expect the New South Wales economy to build momentum into solid, but constrained, growth over the next five years.

Table 3.2: NSW and Victoria – Key Economic Indicators, Financial Years

	Annual Percentage Change										
						Forecasts					Average
Year Ended June	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2017-22
NSW											
Total Construction Activity[(a)]	3.5	6.8	5.2	5.9	1.9	0.9	8.5	8.9	1.1	-1.9	1.0
State Final Demand	5.3	-0.1	3.1	3.1	2.2	3.0	4.4	4.6	1.8	2.7	2.6
Gross State Product (GSP)	**2.9**	**1.0**	**2.0**	**2.6**	**2.4**	**2.8**	**3.7**	**4.0**	**2.8**	**3.4**	**2.8**
Employment Growth	2.9	0.6	1.1	3.4	0.4	0.8	3.2	2.8	0.7	1.3	1.5
VIC											
Total Construction Activity[(a)]	4.5	7.3	8.3	6.5	1.6	-4.9	-9.7	-0.8	-0.6	2.9	4.2
State Final Demand	4.8	0.8	3.8	3.2	2.1	1.0	2.3	3.2	1.9	3.1	3.0
Gross State Product (GSP)	**3.5**	**1.1**	**1.9**	**2.7**	**2.3**	**1.5**	**2.0**	**3.0**	**2.5**	**3.4**	**3.2**
Employment Growth	3.3	0.9	2.8	3.6	0.3	-0.4	1.3	1.9	1.2	1.4	1.8
AUST											
Total Construction Activity[(a)]	6.5	8.9	3.2	5.8	15.2	7.5	-1.0	1.5	-2.6	-5.2	0.5
Australian Domestic Demand	5.8	1.4	2.0	3.6	5.3	3.3	3.1	4.0	1.4	2.3	3.0
Gross Domestic Product (GDP)	**3.8**	**1.6**	**2.1**	**2.4**	**3.5**	**2.9**	**3.1**	**4.0**	**2.9**	**3.3**	**3.3**
Employment Growth	3.0	1.7	1.1	2.5	1.1	1.1	2.3	2.8	1.1	1.2	1.6

(a) Total Construction work done (constant prices), equals sum of new dwellings, building, alterations and additions activity over $10 000, non-residential building and engineering construction by private and public sectors.

3.3 The Victorian Economy

The Victorian economy recovered solidly from the GFC-induced downturn in 2008/09 and generally outperformed most other state economies over 2009/10 and 2010/11. However, the state economy lost momentum over 2011/12, and is now slowing sharply as building activity declines, retail spending weakens and as the sustained high Australian dollar impacts on the key Victorian manufacturing, tourism and education sectors.

The key factor underpinning Victoria's strong performance over the past three years was the overall strength of its construction sector. New dwelling building activity picked up quickly between 2008/09 and 2010/11 after interest rates tumbled and the first home owner grants scheme boosted demand. In addition, stronger population growth and the ready availability of reasonably priced residential land facilitated a much faster upswing compared to other states which had a greater undersupply of dwellings, but more expensive (and less available) land.

Public investment ramped up significantly over 2008/09 to 2010/11, partly because the Victorian government was able to get the Federal stimulus spending underway quickly and partly because the state government was already proceeding with its own major health, rail, harbour and sewerage projects. However, this is now starting to unwind as major projects are completed or near completion, and public investment declined by 9.2 per cent in 2011/12.

Private sector engineering construction also made a healthy contribution, thanks to substantial electricity, pipelines, oil and gas activity, and work on the $1.6 billion Wonthaggi desalination

plant. Strong growth in dwellings continued in 2011, although private engineering construction and public investment peaked while plant and equipment investment declined. Partially offsetting these positives was a cumulative 41 per cent decline in private non-residential building over the three years to 2010/11, before increasing 17.7 per cent increase in 2011/12.

The strength of the construction sector (which spilled over into other sectors) fuelled strong growth in employment, household incomes and spending. Employment growth averaged 2.8 per cent in 2009/10 and accelerated to 3.6 per cent for 2010/11, compared to 1.4 per cent and 2.9 per cent for Australia, but slowed sharply to only 0.3 per cent in 2011/12 (0.7 per cent for Australia). The slowdown in employment was mirrored by weaker retail sales growth of only 1.3 per cent in 2011/12.

Overall, state final demand (SFD), which is the sum of consumption and investment spending by the household, business and government sectors, slowed to 2.1 per cent in 2011/12, following 3.2 per cent in 2010/11 and 3.8 per cent in 2009/10. Australian domestic demand over the same periods recorded growth of 5.3 per cent, 3.3 per cent and 2.3 per cent respectively. Gross state product (GSP) increased 2.5 per cent in 2010/11 (compared to Australian GDP growth of 1.9 per cent), but Victorian GSP is estimated to be have eased to 2.3 per cent for 2011/12. One bright spot over the past year has been the 7.5 per cent growth in merchandise exports.

3.3.1 Outlook for the Victorian Economy

Victoria is set to underperform against the national average over the short to medium term. Several factors will contribute to this outcome.

A downturn in construction over the next two to three years will drag down overall state growth. Engineering construction will fall in 2012/13, as work is progressively completed on the desalination plant, major sewerage infrastructure and the current round of pipelines, oil and gas investments. Public sector building will continue to decline, with the end of stimulus spending causing steep declines in schools construction and, later, health and other social and institutional buildings, which will more than offset a recovery in commercial and industrial building.

Dwelling building is also forecast to decline over 2012/13 to 2015/16 with the current oversupply of dwellings triggering a sharp downturn in 2012/13. Despite healthy growth in the underlying demand for dwellings helping to reverse the oversupply to a deficiency by 2013/14, rising interest rates over 2013/14 and into 2014/15 is expected to prevent a recovery taking hold.

The ‘finance and insurance’ and ‘professional scientific and technical services’ industries are also likely to slow over the next year or so. We think some of this may reflect back-office operations, which had been moved to Victoria because it was the most cost-effective location in Australia, now moving offshore.

The A$ is expected to remain around current levels or higher. This means the competitive pressures on the tradeables sectors will continue, with the state’s manufacturing, education and tourism sectors negatively affected. Already, manufacturing industry output has contracted more than the Australian average.

Growth in employment therefore is expected to be muted over the next two years. Growth in SFD and GSP is also forecast to slow further over 2012/13, mainly due initially to the decline in overall construction, while weak employment and local consumer confidence will keep retail spending relatively weak.

Victoria's indirect exposure to the major mining and investment boom will partially offset the negative factors listed above. In particular, Victoria is expected to benefit indirectly from strengthening Australian domestic demand and private investment. Interstate domestic demand is a key driver of the state economy because of the importance of the wholesale trade, distribution and transport sectors, in part facilitated by the Port of Melbourne being the largest container port by volume. Product from these imported cargoes and from Victoria's manufacturing and mining sectors (gas mainly) are distributed locally and interstate, with Victoria's finance, insurance and business services sectors also providing services interstate.

Looking further ahead, we expect the state's positive structural factors (availability of reasonably priced residential land, competitively priced office market and strong finance and business services sectors) to continue to underpin relatively strong population growth, healthy demand for housing, infrastructure and household services which, in turn, will support further business investment and employment. Indeed by 2014/15 we expect private non-residential building, plant and equipment spending and private and public infrastructure construction activity to be increasing. However, the expected domestic demand downturn in 2015/16 will impact on Victoria and stall the recovery in private investment.

Growth is expected to rebound from the domestic downturn in 2015/16, with the expected fall in interest rates to be the initial catalyst. Overall, however, the Victorian economy is forecast to record only modest growth over the next six years to 2017/18, with SFD averaging 3.1 per cent and GSP averaging 2.7 per cent per annum. This is, however, a marked underperformance when compared with Australian domestic demand at 3.6 per cent and GDP growth at 3.5 per cent.

CHAPTER FOUR

Forecasts of Labour Demand, Workforce Gap and Capability Shortfall for Australia

4. FORECASTS OF LABOUR DEMAND, WORKFORCE GAP AND CAPABILITY SHORTFALL FOR AUSTRALIA

4.1 Estimate of surveying and geospatial workforce

Table 4.1 presents BIS Shrapnel's estimate of the size of the skilled surveying and surveying-related workforce in Australia in 2011/12. As discussed in Section 2.1, the aggregate figures for surveyors, spatial scientists, and surveying and spatial science technicians were sourced from 2011 ABS Census data. The size of the specialist surveying occupations is based on the results of BIS Shrapnel industry research. Similarly, the population of planners, engineers, environmental scientists employed at consulting surveying firms is based on the industry survey.

Table 4.1: Estimate of the Size of Surveying and Geospatial Workforce by specialist occupation by state, as at 2011/12

Specialist Occupation	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	Total
Surveyors									
Cadastral	1,301	592	673	190	295	126	77	76	3,330
Construction	305	372	459	82	329	9	1	13	1,570
Engineering	489	393	362	107	307	16	1	18	1,692
Mining	235	97	404	64	524	15	1	0	1,340
Others	77	134	106	18	91	11	0	10	446
Total Surveyors	**2,405**	**1,588**	**2,005**	**462**	**1,545**	**177**	**80**	**116**	**8,378**
o/w Registered/Licensed Surveyors	*1,067*	*521*	*579*	*171*	*258*	*111*	*77*	*68*	*2,852*
Total Spatial Scientists	**841**	**707**	**783**	**217**	**683**	**117**	**57**	**191**	**3,596**
Technicians									
Surveying Technicians	366	185	263	78	151	33	13	26	1,116
Spatial Technicians	92	46	66	20	38	8	3	7	279
Total Technicians	**458**	**231**	**329**	**98**	**189**	**41**	**16**	**33**	**1,395**
Total Skilled Surveying and Geospatial Workforce	**3,704**	**2,526**	**3,117**	**777**	**2,417**	**335**	**153**	**340**	**13,369**
Other Professionals (a)									
Planners	120	77	80	20	56	8	3	6	370
Engineers	155	125	126	31	88	11	5	9	550
Environmental Scientists	35	28	34	8	24	3	2	3	137
Other (include Architects)	30	60	28	7	18	2	1	2	148
Total Other Professionals	**340**	**290**	**268**	**66**	**186**	**24**	**11**	**20**	**1,205**
Total	**4,044**	**2,816**	**3,385**	**843**	**2,603**	**359**	**164**	**360**	**14,574**

o/w: of which Source: BIS Shrapnel, ABS, CSN

(a) These are other professionals employed at consulting surveying firms

Surveyors comprise 63 per cent of the skilled surveying and geospatial workforce with spatial scientists and surveying and spatial science technicians making up 27 and 10 per cent respectively. We estimate that cadastral surveyors account for nearly 40 per cent of all surveyors at the Australia level. This is followed by engineering surveyors (20 per cent), construction surveyors (19 per cent), mining surveyors (16 per cent) and other surveyors (5 per cent). In addition, we estimate that there are two non-licensed surveyors practicing for every licensed surveyor at the national level.

4.2 Outlook for key determinants of skilled labour demand

4.2.1 Private house commencements: key determinant of demand for cadastral surveyors

In recent months we have seen stronger residential building approvals figures coming through, and we are now certain that the housing cycle bottomed in the middle of 2012. We believe there will be a reasonable recovery in dwelling construction in 2013 and beyond, but not a 'boom' of pre-GFC magnitude. Our expectation is that the upturn will be in New South Wales,

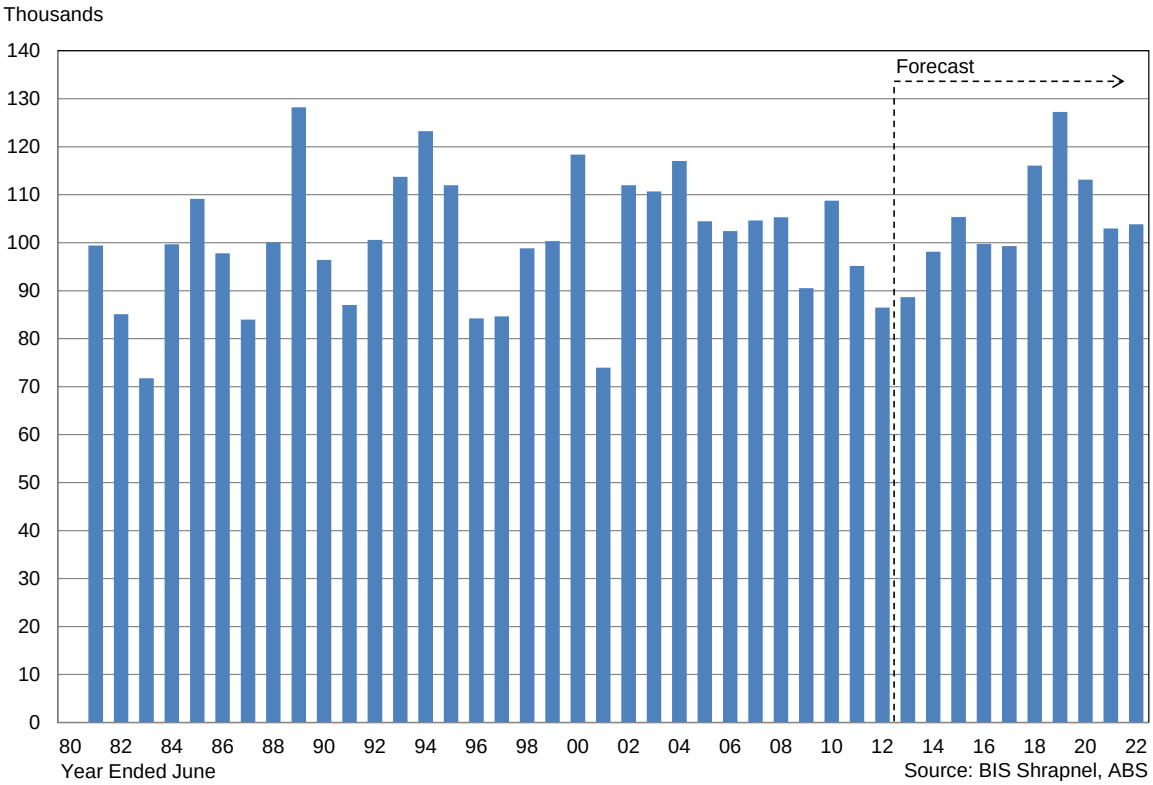
Queensland, Western Australia and Northern Territory with Victoria, Tasmania and ACT heading into decline.

The key is that, Australia wide, the residential market is under-building and undersupplied. This has resulted in an estimated housing stock deficiency of about 53,000 dwellings as at June 2012. Recovery at present is being impeded due to excessive caution by households. Nonetheless, with the recent reductions in the cash rate and with housing interest rates at its lowest level since March 2010, the chronic deficiency of stock, combined with tight rental vacancies and rising rents will drive a solid recovery in dwelling construction.

For 2012/13 our forecast is for 88,650 private detached house commencements at the national level. If fulfilled, it will result in a 2.5 per cent growth compared with the previous year. Subsequently, we see private detached house starts growing by 11 per cent and 7 per cent in 2013/14 and 2014/15 respectively (see chart 4.1). Private detached house commencements are likely to fall by 5 per cent in 2015/16 (to 99,750) as the Reserve Bank raises interest rates in response to an overheating economy in 2014/15.

We still see solid pent up demand unfolding in Sydney, Brisbane and Perth. We predict a rise in new housing starts in New South Wales on account of the huge undersupply of housing in that state (especially Sydney). In Western Australia, and Queensland, we expect to see momentum building in the wake of the mining boom which is seeing population grow. Also, incomes are rising faster than in the south eastern states. For similar reasons, we also expect Northern Territory to perform well.

Chart 4.1: Number of Dwellings Commenced Private Houses – Australia



The forecast outlook envisions a recovery but not a return to a housing ‘bubble’ or building ‘bonanza’, reflecting a more muted climate of effective demand for dwelling construction. Lower interest rates will do their work of lifting the market in the next two years. Australia’s vulnerable economy – as the mining boom winds down – will however keep income growth from surging

and maintain a cautious mood which is likely to prevail for much of the forecast period. Toward the middle of the decade, interest rates are forecast to rise and this will cause a standard cyclical correction to residential building.

Cautious consumer intentions and investor sentiment — due to lower expected gains in future house prices, more restricted credit availability, household debt ratios, bank mortgage premiums, and reduced appetite for risk — will act to limit the rebound in home building compared with the pre-GFC pattern. We expect rising unemployment in several south eastern states, more disturbing news out of Europe, and unimpressive gains in share market values will continue to hamper confidence.

Government actions such as rate of land release, and incentives/penalties offered by governments such as tax settings or stamp duty exemptions, will be a factor in the residential outcome. We are confident that new measures from the governments of New South Wales, Queensland, and Western Australia will make a positive difference in those states by boosting house construction. Federal political uncertainty under a hung parliament, however will continue to add uncertainty in 2013.

The major positive for the outlook is reduced interest rates. We have seen sizable cuts in the cash rate by the Reserve Bank in the past 12 months, Although banks have not passed on the full effect of Reserve Bank interest rate cuts, and while it is still too early to see the flow through effects of all the rate reductions announced in 2012, evidence to date indicates that the market is beginning to respond, albeit slowly.

Taking all these considerations together, we see three years of growth, and then a downturn of 5 per cent in 2015/16 based on the Reserve Bank tightening interest rates. Longer term, we expect private detached house starts stabilise at just over 110,000 per annum.

4.2.2 Private multi-residential construction and non-dwelling building: key determinant for construction surveyors

Private multi-residential construction

Analysis by BIS Shrapnel into emerging trends in the residential market, supported by recent Census data indicates that other dwellings (both medium and high density) will increasingly account for a larger proportion of dwelling demand.

Medium density refers to townhouses, villas, duplexes and low rise apartment blocks three storeys or less. Development of these comes through both in infill and greenfield sites. Higher land costs have resulted in a shift away from houses to more affordable other dwellings in greenfield areas. An outcome of this is that medium density building is become increasing focused on the city fringe.

High density development refers to apartments and flats four storeys and above and is typically done through infill development in the inner and middle ring of major population centres. Higher land costs have resulted in a shift away from medium density to higher density building in infill sites, especially around well services transport hubs.

This shift reflects several key trends:

- housing affordability - strong growth in property prices has seen the cost of buying a new home deteriorate considerably over the past decade. This is pushing people to build smaller and more affordable dwellings, namely other dwellings

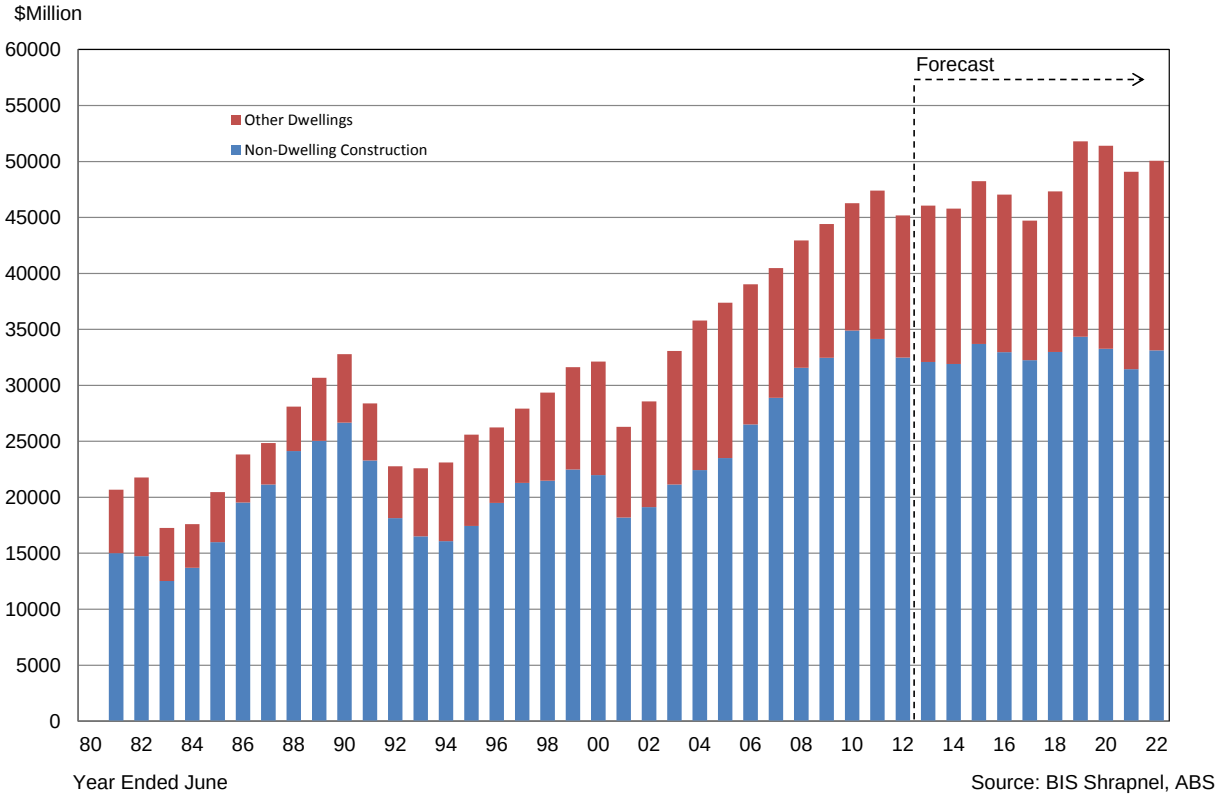
- preferences - demand for inner and middle ring living is rising as a lack of amenities and travel costs make the city fringe greenfield sites less desirable, specifically in Australia's largest cities
- household structure - the number of lone person and couple only households is growing and such households tend to be concentrated more in other dwellings
- demographics - an ageing population is driving downsizer demand, as empty nesters downsize to more appropriately sized and easy to maintain dwellings

All of these trends are forecast to continue, supporting a continued shift to other dwelling construction over the long term.

The GFC saw private other dwellings' share of total private dwelling commencements fall in most states. Access to finance became much more difficult with significant pre-commitment requirements becoming commonplace. The share has since lifted in most markets despite debt conditions remaining tough for developers. New South Wales, Victoria, Queensland and Western Australia have all experienced a notable lift over the past few years.

The above mentioned trends are all important is explaining this lift. They have been further aided by investor interest prompted by Australia's strong economy outlook, robust rental growth and state government investment incentives in some states.

Chart 4.2: Other residential buildings and non-dwelling building– Australia
Value of Work Done, 2009/10 Prices



Of the five major states the greatest skew towards other dwellings is in New South Wales, averaging 46 per cent of total private dwelling starts over the past decade. Queensland has the next greatest skew (31 per cent) followed by Victoria (27 per cent). Coming off a significant inner city apartment boom in Melbourne, Victoria's share is currently well above the states longer term average.

Overall, we forecast private multi-residential construction in Australia will average $13.8 billion (in constant 2009/10 prices) over the next five years. Longer term (ie over 2016/17 to 2021/22), we expect medium and high density construction to average $16.9 billion per annum (again in constant 2009/10 prices, see chart 4.2).

Non-dwelling building

Activity in the non-dwelling construction sector is expected to be weak in the short term as several sub-categories move in opposite directions. Publicly funded construction work is expected to subtract from growth as stimulus spending continues to be withdrawn, while privately funded work has passed through the trough in activity and is poised for an upswing.

In the public sector, the segments that received the largest boost from government stimulus will begin to fall sharply as Federal and State Governments seek to rein in spending and focus on tackling government budget deficits. As a result, we expect public non-dwelling building investment to fall by a third by 2014/15 as the stimulus projects on schools and hospitals are completed.

Private non-dwelling construction — which is dominated by commercial and industrial building (ie offices, hotels, shops, factories, warehouses, transport terminals) — collapsed during the GFC period. An increase in the cost of debt and equity finance as well as a lack of funding saw the real value of commencements halved, sector by sector. In work done terms, non-dwelling building has fallen by 27 per cent in the three years following the global financial crisis.

Private non-dwelling construction has passed the trough of the cycle and begun the long road to recovery. Demand is expected to recover as the economy picks up momentum through the course of this year and over the next three to five years. Meanwhile, excessive caution by banks and investors suppressed development following the GFC. Recovering demand and constrained supply will result in a tightening of leasing markets leading to a long period of firming rents across the sub-sectors of commercial and industrial construction. This, in turn, will underwrite financial feasibilities and the next round of investment in commercial and industrial building. We expect Retail building to be the first cab off the rank, followed by Industrial and Commercial investment. The upswing will build momentum into a boom, peaking in the second half of this decade.

Private social and institutional building (the other main segment of private non-dwelling building) is also expected to benefit from a number of smaller private hospital developments alongside continued investment in aged care facilities over the next five years. Overall, private non-dwelling building is expected to grow strongly in 2012/13 and 2013/14.

4.2.3 Utilities and transport engineering construction: key driver of demand for engineering surveyors

Following a surge in activity during the second half of the 2000s, **electricity** work done has stabilised around the $10-11 billion mark per annum between 2008/09-2010/11. This reflects a pause in new generation work, following substantial additions to capacity in the 2000s, against a backdrop of generally increasing transmission and distribution work. We do not expect this situation to last much longer, however, with work to advance on several new power station projects from 2011/12 onwards. This, combined with further increases in transmission work, particularly, (to both increase the efficiency of the network and ensure energy supply to new regional developments), is forecast to see electricity-related works rise progressively to over $16 billion per annum by 2015/16.

Given the impact of the carbon tax nearly all the new generation projects will be focused on wind or gas, although the interaction of Federal carbon tax and the State-based renewable energy schemes tend to disadvantage gas as a supply source. Rising energy demand will require the development of new generation capacity in Queensland first, with Victoria, South Australia and Tasmania not far behind, according to the Australian Energy Market Operator's *Statement of Opportunities* report. By contrast, new baseload capacity will not be required in New South Wales until after mid-decade at the earliest (although this means that construction work will need to begin before mid-decade). We have also factored in several new power stations for Western Australia given mine-specific requirements for energy, as well as prospective renewable and gas projects

Water and sewerage works have continued to rise as large new investments joined existing programs of work. However, BIS Shrapnel expects that following a peak of $9.1 billion in water and sewerage activity in 2010/11, work done will ease from here as the completion of major drought-busting measures (e.g. Wonthaggi and Adelaide desalination plants, Cotter Dam etc) subtract from overall activity. With that said, there are still several large projects to get underway in this space over the next few years — including new dams, desalination plants, treatment upgrades and major pipeline systems for mining and non-mining uses — which will combine with rising asset investment programs to keep overall activity high in historical terms. BIS Shrapnel is forecasting water and sewerage activity to ease back to between $6 and $7 billion in work done per annum between 2012/13 to 2015/16. While lower than the period from 2006/7-2010/11, this still far exceeds the average level of activity experienced during the 1990s and first half of the 2000s.

Telecommunications activity has more or less stabilised at the $3.8 billion per annum mark since 2008/09. While there was a small gain overall in 2010/11, this came through a $220 million increase in publicly funded work, while privately funded activity fell.

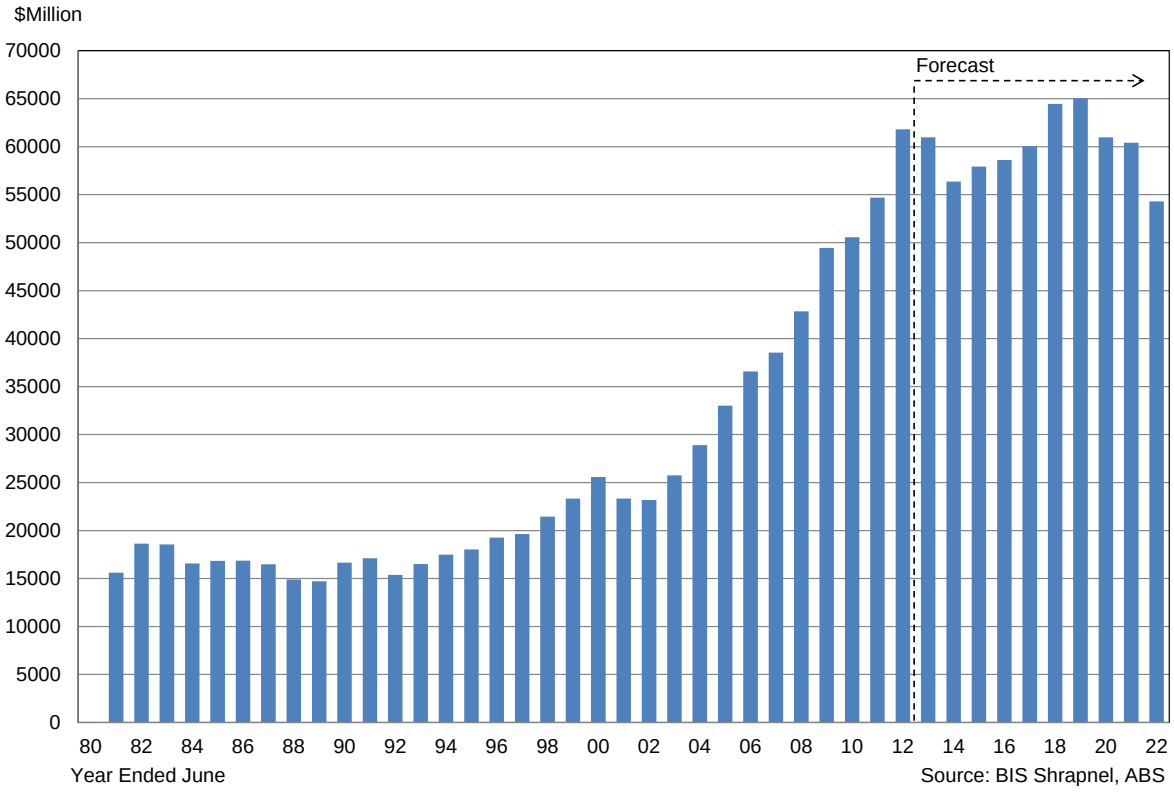
This level of expenditure may be considered low by historical standards – indeed, the last time construction in this segment was so low was back in 1995 – but the 2010/11 figure included upgrades to most mobile networks, including the introduction of new 4G services by Telstra. In our view, the looming construction of the massive NBN project has effectively "crowded out" private investment in similar high speed networks, with private companies not willing to lay new cable in areas that will soon be serviced by NBN fibre.

Overall, telecommunications activity is forecast to pick up strongly from here as NBN fibre is rolled out. The decision by NBN Co to cancel a tender process in early 2011 has delayed the roll-out somewhat, although most construction contracts have since been settled. We believe that construction activity ramped up in the December quarter 2011, and should increase strongly over the next 2 years. Based on an analysis of the construction contracts, we now assume that construction makes up approximately $16 billion of the estimated $35.9 billion total capital cost of the NBN. Spread over 8-9 years, this means that NBN construction activity is likely to ramp up to over $2 billion per annum by 2013/14, pushing overall telecoms work to between $6 billion to $7 billion through the middle of the decade.

Roads activity rose 10 per cent to $15.8 billion in 2010/11, led mainly by new publicly funded projects, but also a pick-up in privately funded work (mostly new subdivisions and access roads). Roads activity peaked in 2011/12 and was driven by reconstruction efforts in Queensland, as well as the ramp up in projects such as the Hunter Expressway and M2 expansion. However the completion of other large projects (including Airport Link and Peninsula Link) and a lack of similarly sized projects to take their place is expected to see roads activity

decline in subsequent years, bottoming out at around $12.5 billion in 2014/15, before another pick-up from 2015/16. This will have a related impact on bridges work, which we also expect to weaken significantly over the next 3-4 years.

Chart 4.3: Utilities and Transport Engineering Construction – Australia
Value of Work Done, 2009/10 Prices



By contrast, **railways** construction rose nearly 40 per cent in 2011/12, following similarly large percentage increases in 2009/10 and 2010/11. The key driver here is private, mining-related railway works, which are expected to double to $4 billion in construction work per annum over the 2011/12-2013/14 period. By contrast, publicly funded rail work is expected to ease gradually after peaking at $4.4 billion in 2011/12. However, as with roads, we are forecasting a substantial pick-up in publicly funded rail work closer to the middle of the decade, led by projects such as the North West Rail Link in Sydney. By state, the largest increases over the next three years will be in Western Australia and Queensland (driven mainly by iron ore and coal-related projects), although Victorian and South Australian activity will also be sustained at high levels.

Harbours construction is booming now, and is forecast to remain very strong right through the next 5 year period. After averaging around $1.5 billion per annum in work between 2005 and 2010, activity surged to $2.8 billion in 2010/11, before escalating to $4.5 billion through 2011/12. Activity is forecast to remain between $4.3 billion and $5.5 billion per annum over each of the next five years. The overwhelming bulk of new work is based in Western Australia, tied to the expanding iron ore ports of Cape Lambert, Dampier and Port Hedland. (We have not assumed Oakajee proceeding until mid-decade.) There is also a substantial volume of investment taking place in Queensland, led by Wiggins Island and Abbott Point now, but later to include new facilities to help export coal from new mines in the Surat and Galilee Basins (Dudgeon Point, Balaclava Bay, further Abbot Point expansions) as well as LNG jetties. Overall, we are forecasting Queensland harbours work to triple to $1.5 billion by 2014/15.

Pipelines activity (which excludes water and sewerage pipes) boomed in 2010/11 to over $1.5 billion, driven mainly by new LNG projects which require massive investment in upstream gas field development and gas transportation. As the LNG boom unfolds, along with other oil and gas projects around the country and new electricity gas-fired plants, pipeline construction is expected to surge further. Overall, BIS Shrapnel is forecasting activity in this segment to double to $3.3-$3.8 billion per annum between 2012/13 and 2014/15, with the largest increases in activity coming from Queensland and Western Australia initially, but also the Northern Territory. However, the near simultaneous completion of pipeline developments (which in many cases will be built to cater for future expansion of LNG facilities), will see a substantial slump in activity late in the forecast period.

Our outlook for overall utilities and transport engineering construction is presented in chart 5.3.

4.2.4 Mining and heavy industry construction: determinant for mining surveyors

Mining and heavy industry construction has been the largest segment of the engineering construction market since 2005/06 (in which year, activity in this segment nearly doubled) and is a benchmark for the rolling minerals and energy resources boom. At $52.6 billion in 2011/12, this segment is now three times the size of the former 'largest category' (roads) and is the principal driver of activity in the engineering construction market.

Mining and heavy industry construction activity grew 70.7 per cent in 2011/12 (see chart 4.4), driven mainly by new oil and gas, and iron ore, projects, along with a solid increase in coal-related works. This follows growth of just 4.1 per cent in 2009/10, when many new projects were delayed with the onset of GFC in 2008/09.

Notwithstanding the slowdown in global growth to less than 4 per cent over calendar 2012 and 2013 — and growth in China to ease back towards 8 per cent — we believe growth in industrial production and demand will nevertheless be sustained at a rate to support further investments in bulk commodities, copper, gold and, eventually, other base metals. While we expect that some projects will be delayed, overall mining and heavy industry activity will continue to rise steeply from here, driven by several massive LNG projects spanning Queensland, Western Australia and the Northern Territory, as well as further expansions to existing coal, iron ore, copper and gold resources.

Further strong growth is expected in 2012/13 and 2013/14 as work cranks up on the current round of major projects, and as the boom extends back into base metals. However, the simultaneous completion of the current round of projects through the middle of the decade opens up the risk of a significant decline in work between 2015/16 and 2020/21. Even so, BIS Shrapnel expects that further legs to the rolling boom will keep activity in this segment at around $46 billion per annum on average through the decade to 2025/26

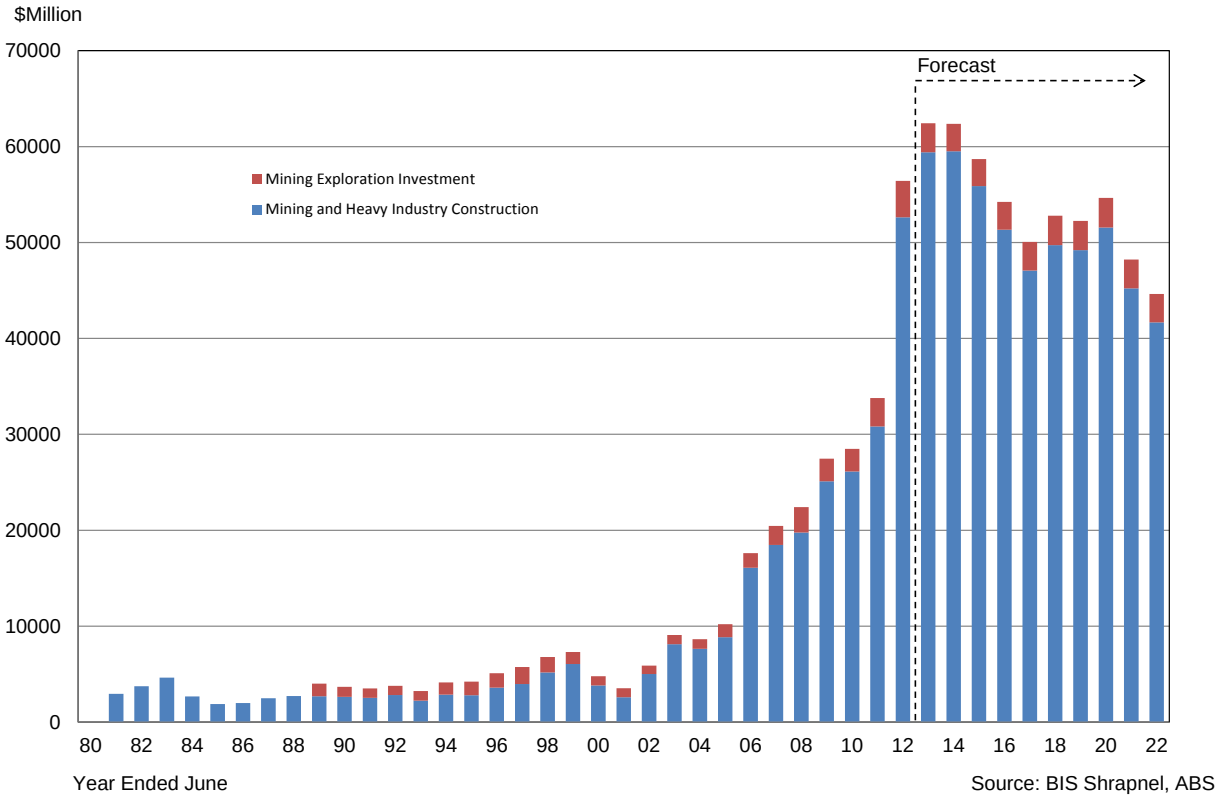
Mining exploration investment

Exploration activity in Australia was relatively stable between 1988/89 and 2003/04, oscillating around $2 billion per annum (in constant prices), with the exception of a few years in the late 1990's. Oil and gas and gold exploration were the primary contributors during this time, but the discovery of vast iron ore deposits (in Western Australia) and coal (in Queensland) has changed the industry significantly.

In line with significant price growth, both coal and iron ore have experienced rapid increases in exploration activity in recent years. Coal increased from $105 million in 2003/04 to $800 million in 2011/12, while iron ore rose from $82 million to $1.1 billion over the same period. However, oil and gas remains the largest sector, valued at $3.1 billion in 2011/12. Total exploration

expenditure has therefore increased from $2.2 billion in 2003/04, to a record $6.9 billion in 2011/12. This rapid acceleration in activity has paved the way for corresponding growth in mineral investment and production in recent years

Chart 4.4: Mining an Heavy Industry Construction Work Done and Mining Exploration Investment – Australia, constant 2009/10 Prices



Looking ahead, we believe that recent levels of exploration activity are unlikely to continue amid softer commodity prices. As a result, we are forecasting mild declines in total exploration over the coming two years, before picking up once more as mineral prices continue to strengthen. Annual exploration activity is therefore expected to average $6.4 billion per annum over the five years to 2016/17, up slightly from $6.3 billion per annum in the five years to 2011/12.

4.2.5 Total construction: determinant for technicians labour demand, spatial scientists, and other professionals at consulting surveying firms

The last decade saw strength in all the major categories of construction, but cycles were not synchronised. First came the private sector, initially with a boom in residential construction followed by strong generalised business investment in particular minerals investment. Later (around mid-decade), came the escalation of public sector investment which was initiated by the emergence of infrastructure bottlenecks across Australia. It was the strong growth in investment through this period which underwrote the strength of the Australian economy in the period leading up to the global financial crisis (GFC).

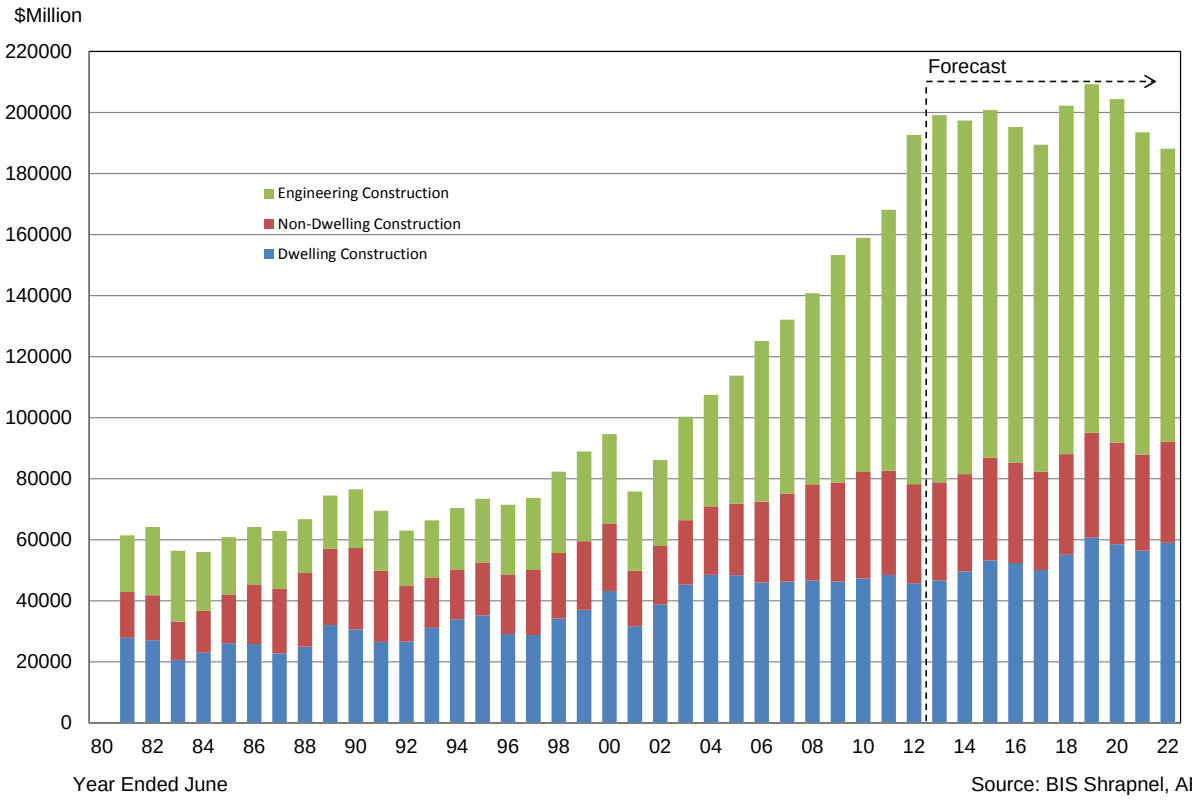
The GFC, however, triggered a collapse in confidence (hitting business spending) and a severe credit squeeze which affected the availability and cost of debt and equity finance. The stalling of finance saw the real value of commencements in private non-dwelling construction halved, sector by sector. Nonetheless, Australia did not experience the precipitous downturn in total construction that was widely anticipated.

Work on mining projects underway before the GFC hit sustained robust growth in mining investment. In addition, swift implementation of the government stimulus saw public sector investment rising strongly from already record levels to offset weaker private sector investment through 2009/10. As Federal stimulus projects reached completion in 2010/11, private investment came through once again to take up the baton as the key driver of investment growth in 2011/12.

Commodity prices — supported by China's insatiable demand for steel making raw materials (ie iron-ore and coking coal) as well as industrialising Asia's continued strong demand for energy commodities — quickly rebounded to historically high levels, This has underwritten another cycle of mining-related activity over the next five years. Initially, most of the increase will come from the oil and gas segment, with several large LNG projects now ramping up in Western Australia and Queensland. But there will also be large investments in mine (including major projects in coal, gas, iron ore, gold, copper and alumina), port and rail construction over the next five years to relieve supply bottlenecks and boost coal and iron-ore exports to meet robust global demand.

Nonetheless, the prospect of skilled labour shortages, tightening capacity and a re-acceleration in construction costs will conspire to keep overall growth in work done constrained through the next 5 years. These factors, combined with an easing in privately funded construction in the second half of our forecast horizon (as a number of multi-billion dollar projects move towards completion) will see work done ease marginally from record levels in 2014/15 before falling slightly in 2015/16.

Chart 4.5: Total Construction by Category – Australia
Value of Work Done, 2009/10 Prices



Source: BIS Shrapnel, ABS

Meanwhile, private non-dwelling construction has passed the trough of the cycle and begun the long road to recovery. But it will be slow. Demand is expected to recover as the economy picks up momentum through the course of this year and over the next three to five years. Recovering demand and constrained supply will result in a tightening of leasing markets leading to a long period of firming rents across the sub-sectors of commercial and industrial construction. This, in turn, will underwrite financial feasibilities and the next round of investment in commercial and industrial building.

We expect residential markets to improve over the next two years as the economic recovery broadens and as confidence picks up. The key is that, Australia wide, the residential market is under-building and undersupplied.

An extended period of low dwelling investment and continued population growth means that there is now a nationwide dwelling shortage approaching 86,000 dwellings (as at June 2013) — close to the current annual levels of dwelling building — with around two-thirds of that shortage being in New South Wales. This pent-up excess demand, combined with the recent lowering in housing interest rates, means that we are forecasting residential investment to increase from 2012/13. However, the recovery in dwelling investment will not be sufficient to reduce the dwelling shortage before interest rate increases stifle the recovery around the middle of the decade. In other words, the increase in building activity will not have been enough to ease the existing stock deficiencies in key markets. Hence as interest rates begin to ease again in late 2016 and over 2017, we will see residential building activity pick up again over 2017/18.

The upshot is that resources investment is strong now and will continue to record solid growth. But other private construction will recover gradually and will build momentum three to four years from now. In contrast, public construction will fall as Federal and State Governments seek to rein in spending and focus on tackling budget deficits. Total construction growth is expected to average 0.1 per cent per annum over the five years 2016/17, before rebounding to 2.1 per cent per annum in the second half of this decade.

4.3 Forecasts of skilled labour demand

Our outlook for the key determinants of labour demand generally translates into increasing demand for skilled labour over the next three years before falling construction activity over 2015/16 and 2016/17 sees demand for skilled labour easing over this period. However, acceleration in activity over the subsequent two years is expected to see strong growth in skilled labour demand (see charts 4.6, 4.7 and table 4.2).

As shown in table 4.2 (which is based on a productivity growth of 1.5 per cent per annum) and chart 4.8, from an estimate of 14,574 professionals in 2011/12, total skilled labour demand is expected to rise to 15,143 persons in 2014/15 before falling to 14,077 in 2016/17 as construction activity weakens. Total skilled labour demand is then projected to rise and peak at 15,885 persons in 2018/19.

Under weaker productivity growth assumptions, the demand for labour is correspondingly higher. For example, with a zero productivity growth assumption, the peak becomes 17,448 persons in 2018/19. However, under a 2 per cent per annum productivity growth, the peak drops to 15,147 persons.

We would stress that demand for surveying skills is likely to precede demand forecast in this model as our forecasts are based on actual construction work done.

Chart 4.6: Forecasts for Demand for Cadastral Surveyors and Total Surveyors – Australia

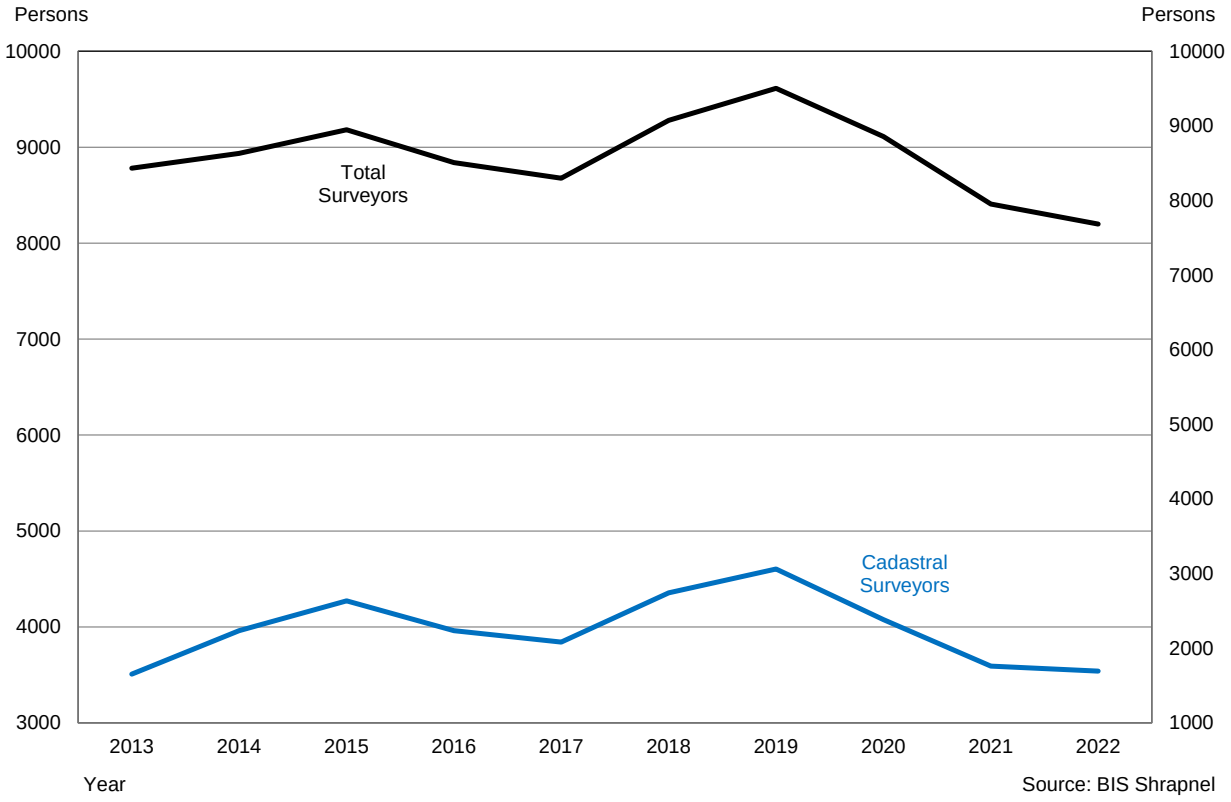


Chart 4.7: Forecasts for Demand for Surveyors by area of Specialisation– Australia

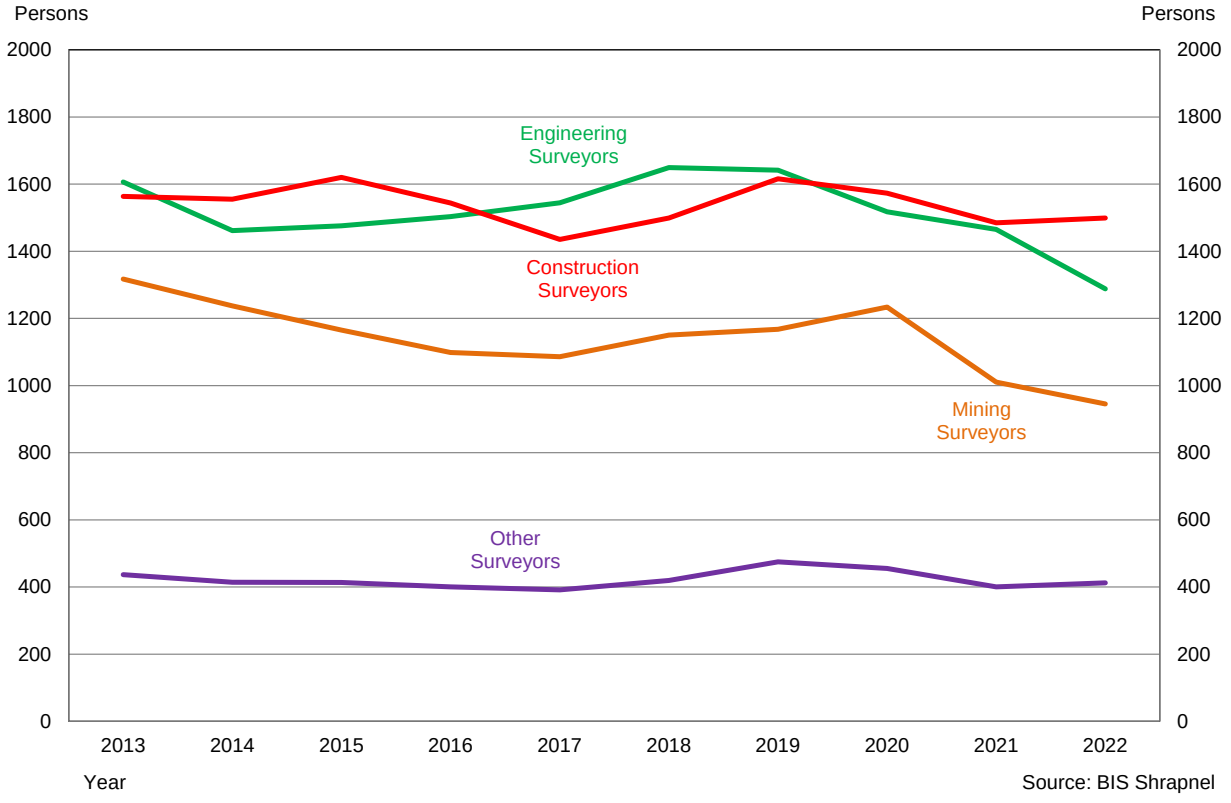


Chart 4.8: Total Skilled Labour Demand under Different Productivity Assumptions – Australia

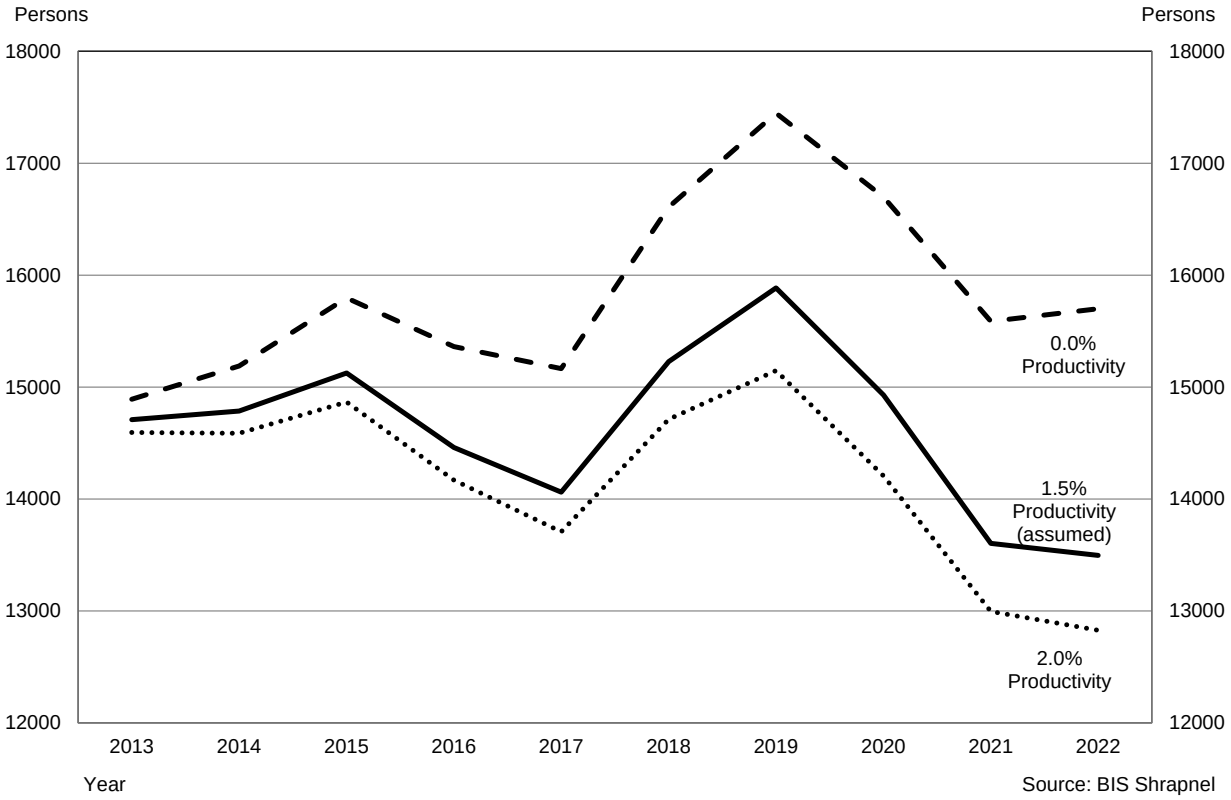


Table 4.2: Forecasts for Skilled Labour Demand and capability shortfalls for Surveyors and Surveying Related Professionals: Australia

(Baseline Scenario of 1.5% labour productivity growth, forecasts as at June)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Labour Demand by Specialist Occupation	Estimate	Forecasts									
Cadastral	3,330	3,509	3,962	4,272	3,961	3,843	4,356	4,605	4,077	3,591	3,540
Construction	1,570	1,563	1,555	1,620	1,544	1,435	1,499	1,612	1,569	1,481	1,495
Engineering	1,692	1,606	1,461	1,476	1,503	1,544	1,649	1,641	1,518	1,465	1,288
Mining	1,340	1,318	1,238	1,165	1,099	1,086	1,150	1,168	1,234	1,010	935
Other Surveyors	446	438	416	415	402	393	421	475	455	400	412
All Surveyors	**8,378**	**8,434**	**8,632**	**8,948**	**8,509**	**8,301**	**9,076**	**9,501**	**8,852**	**7,948**	**7,670**
Registered/Licensed Surveyors	*2,852*	*3,017*	*3,407*	*3,674*	*3,406*	*3,305*	*3,747*	*3,960*	*3,506*	*3,089*	*3,045*
Total Spatial Scientists	3,596	3,637	3,548	3,565	3,438	3,316	3,501	3,670	3,521	3,234	3,326
Total Technicians	1,395	1,446	1,443	1,440	1,372	1,335	1,472	1,490	1,375	1,297	1,332
Total 'Other' Professionals	1,205	1,207	1,181	1,191	1,156	1,125	1,196	1,225	1,173	1,110	1,141
Total Skilled Labour Demand	**14,574**	**14,723**	**14,804**	**15,143**	**14,474**	**14,077**	**15,245**	**15,885**	**14,922**	**13,589**	**13,470**
Existing Workforce (a)											
Cadastral Surveyors	3,330	3,213	3,098	2,983	2,867	2,752	2,641	2,530	2,419	2,308	2,197
Construction Surveyors	1,570	1,560	1,549	1,537	1,525	1,514	1,497	1,480	1,462	1,445	1,428
Engineering Surveyors	1,692	1,660	1,629	1,597	1,565	1,533	1,497	1,461	1,424	1,388	1,351
Mining Surveyors	1,340	1,315	1,290	1,265	1,240	1,215	1,185	1,156	1,127	1,097	1,068
Other' Surveyors	446	440	434	429	423	417	409	400	392	383	375
All Surveyors	8,378	8,189	8,000	7,811	7,621	7,430	7,228	7,026	6,824	6,622	6,419
Registered/Licensed Surveyors	*2,852*	*2,716*	*2,580*	*2,444*	*2,307*	*2,171*	*2,059*	*1,947*	*1,834*	*1,722*	*1,610*
Spatial Scientists	3,596	3,527	3,457	3,387	3,316	3,245	3,153	3,061	2,969	2,877	2,784
All technicians	1,395	1,375	1,351	1,327	1,302	1,278	1,249	1,219	1,190	1,161	1,131
'Other' Professionals	1,205	1,183	1,162	1,141	1,120	1,098	1,072	1,045	1,018	991	964
Total skilled labour	14,574	14,274	13,971	13,666	13,360	13,052	12,702	12,352	12,001	11,650	11,299
Workforce Gap											
Cadastral Surveyors	-	296	864	1,289	1,093	1,091	1,716	2,075	1,658	1,283	1,343
Construction Surveyors	-	3	6	83	19	(78)	2	132	107	36	68
Engineering Surveyors	-	(54)	(167)	(121)	(62)	11	152	181	93	78	(63)
Mining Surveyors	-	2	(53)	(100)	(141)	(129)	(35)	12	107	(87)	(133)
Other' Surveyors	-	(2)	(19)	(14)	(21)	(24)	12	75	63	16	37
All Surveyors	-	245	632	1,137	888	871	1,847	2,474	2,028	1,326	1,251
Registered/Licensed Surveyors	-	*301*	*828*	*1,231*	*1,099*	*1,134*	*1,688*	*2,013*	*1,671*	*1,366*	*1,434*
Spatial Scientists	-	110	91	177	122	71	348	608	552	358	542
All technicians	-	71	92	113	69	57	224	271	185	136	201
'Other' Professionals	-	24	19	50	36	27	124	180	155	118	177
Total skilled labour	-	450	833	1,478	1,115	1,025	2,543	3,533	2,921	1,939	2,171
New Supply of Surveyors	-	114	239	366	504	650	802	963	1,131	1,308	1,494
New Supply of Technicians	-	60	123	188	254	322	392	454	514	554	584
Surveyors Capability Shortfall (c)	-	**131**	**393**	**772**	**383**	**221**	**1,045**	**1,512**	**897**	**18**	**- 243**
Technicians Capability Shortfall (c)	-	**11**	**(31)**	**(75)**	**(185)**	**(265)**	**(168)**	**(183)**	**(329)**	**(418)**	**(383)**

(a) Existing workforce is generated by adjusting the size of the current skilled workforce for natural attrition rates such as retirements and death. Source: BIS Shrapnel, ABS

(b) Workforce gap is calculated as labour demand less existing workforce.

(c) Capability shortfall is derived by subtracting new supply from workforce gap. A positive number implies a shortage of labour

Numbers in brackets imply an excess supply as new supply exceeds the forecast workforce gap.

4.4 Workforce attrition and the workforce gap

The total skilled surveying and geospatial workforce *requirement* to meet future construction activity is inevitably higher than the labour demand generated by the model given attrition of the existing workforce 'base', primarily through retirement and death (but also through people leaving the workforce for other reasons).

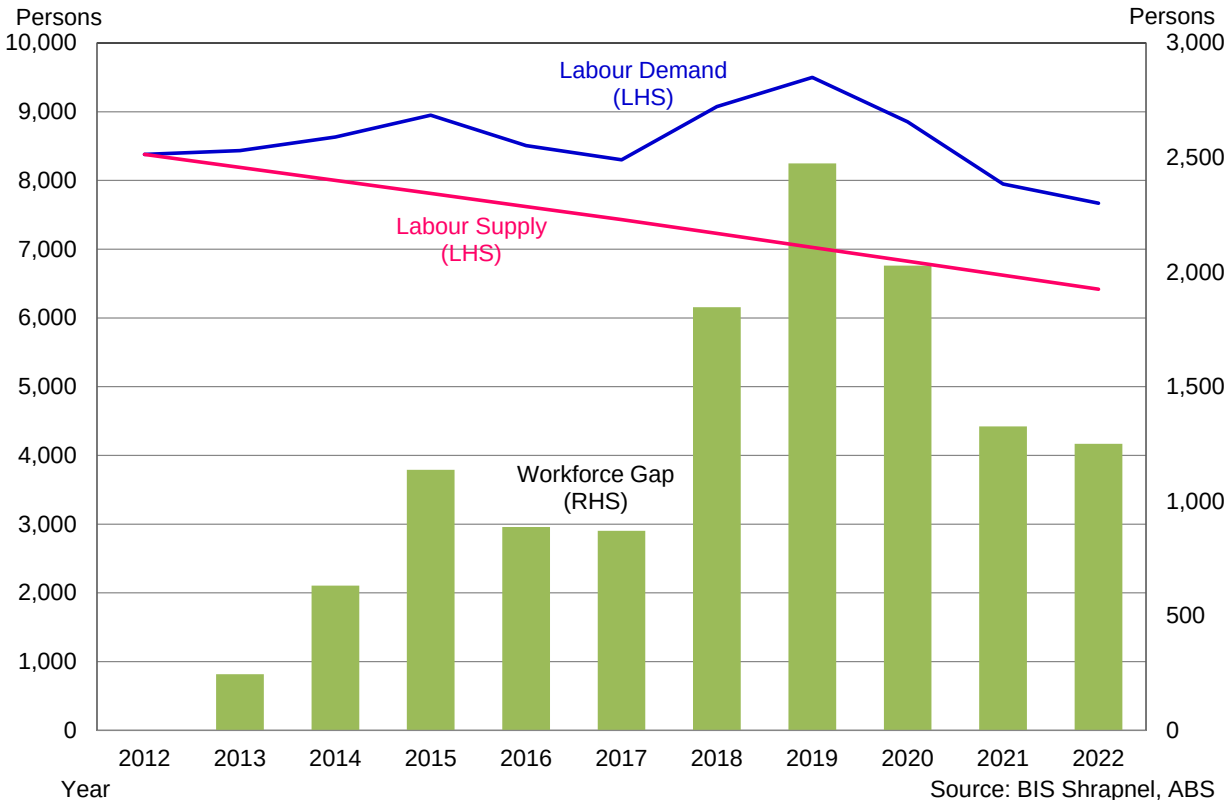
Given the estimated age profile of the current total skilled labour demand workforce — and the assumed likelihood of retirement and death in each age group — we estimate that the current workforce will shrink by around 22 per cent over the next ten years from demographic factors alone. The difference between the (declining) existing workforce and total labour demand is the workforce gap. The workforce gap will need to be met by additional supply if forecast levels of end use sector activity are to be achieved. Possible sources of labour supply include:

- New graduates, and/or
- Net migration from overseas

It should be noted again that while the existing skilled surveying workforce is expected to decline in personnel terms, the measure of skills and experience lost is likely to be far greater given that the retirees will be concentrated in relatively "high skill/experience" occupations. This report does not attempt to quantify this, potentially greater, loss but acknowledges that it is a key issue facing the surveying and geospatial industry and the broader construction industry.

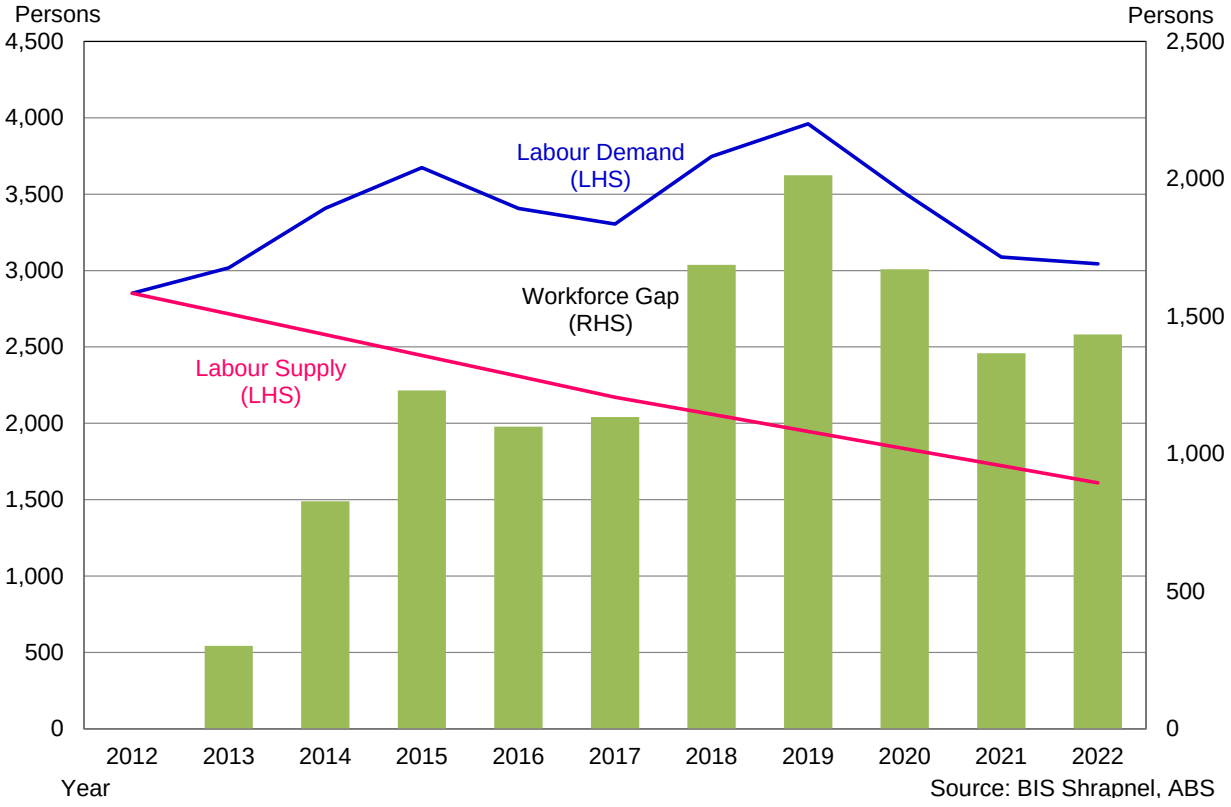
Given the forecast shape of labour demand, and the attrition of the existing workforce, the size of the total surveying and geospatial skilled workforce gap is expected to increase to 1,478 persons by 2014/15 before falling to around 1,000 persons by 2016/17. However, an expected rebound in activity over the subsequent three years will drive demand for skilled labour higher. With ongoing attrition of the existing workforce around this time, increased demand for skilled labour will lead to a higher workforce gap. We expect the workforce to peak at 3,533 persons in 2018/19 with surveyors accounting for 70 per cent of this deficit. This means that an additional 2,474 surveyors, 608 spatial scientists, 271 technicians and 180 'other' professionals will be required to meet forecast levels of construction activity and to cover for the replacement of existing employees. The labour demand, labour supply and workforce gap for surveying and geospatial workforce as well as 'other' professionals is presented in table 4.2. Charts 4.9 to 4.14 also shows the labour demand, labour supply and workforce gap for a select group of specialist occupations.

Chart 4.9: Australia
Total Surveyors (1.5% Productivity Growth)



Source: BIS Shrapnel, ABS

Chart 4.10: Australia
Registered Surveyors (1.5% Productivity Growth)



Source: BIS Shrapnel, ABS

Chart 4.11: Australia
Spatial Scientists (1.5% Productivity Growth)

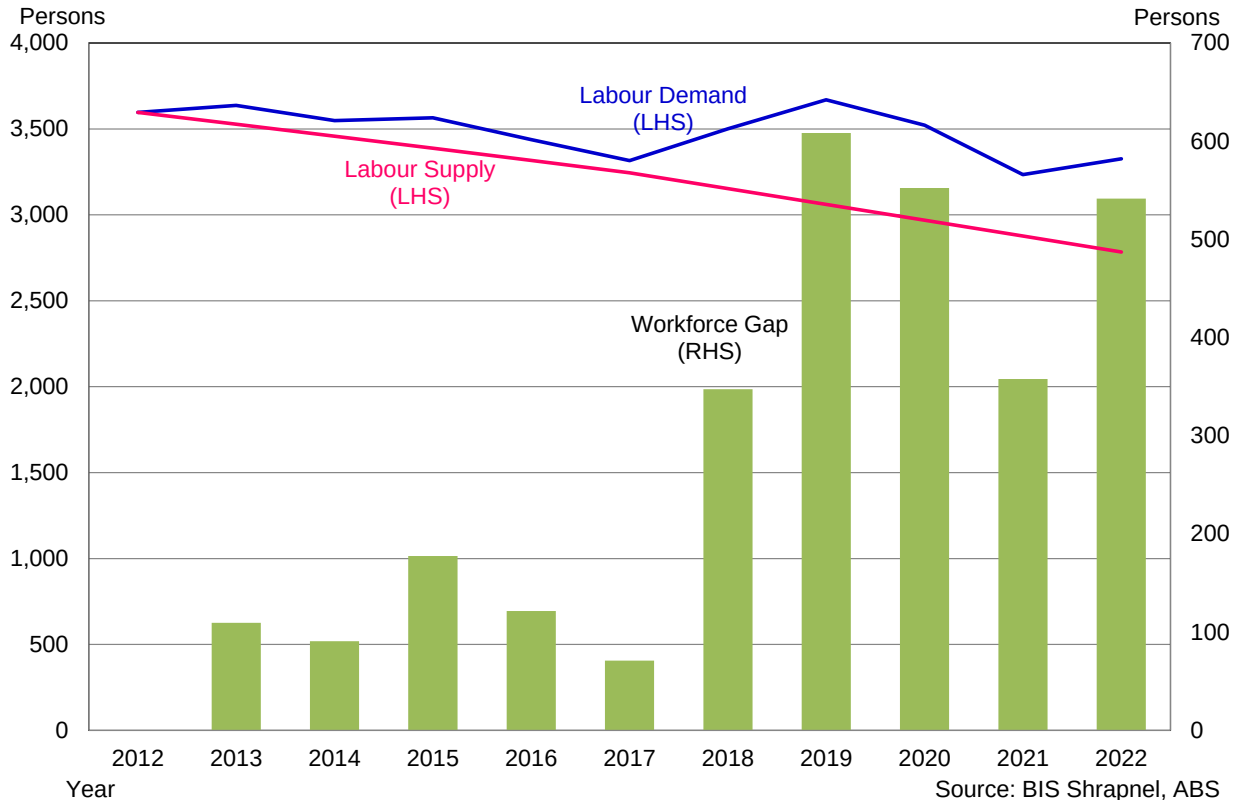


Chart 4.12: Australia
Technicians (1.5% Productivity Growth)

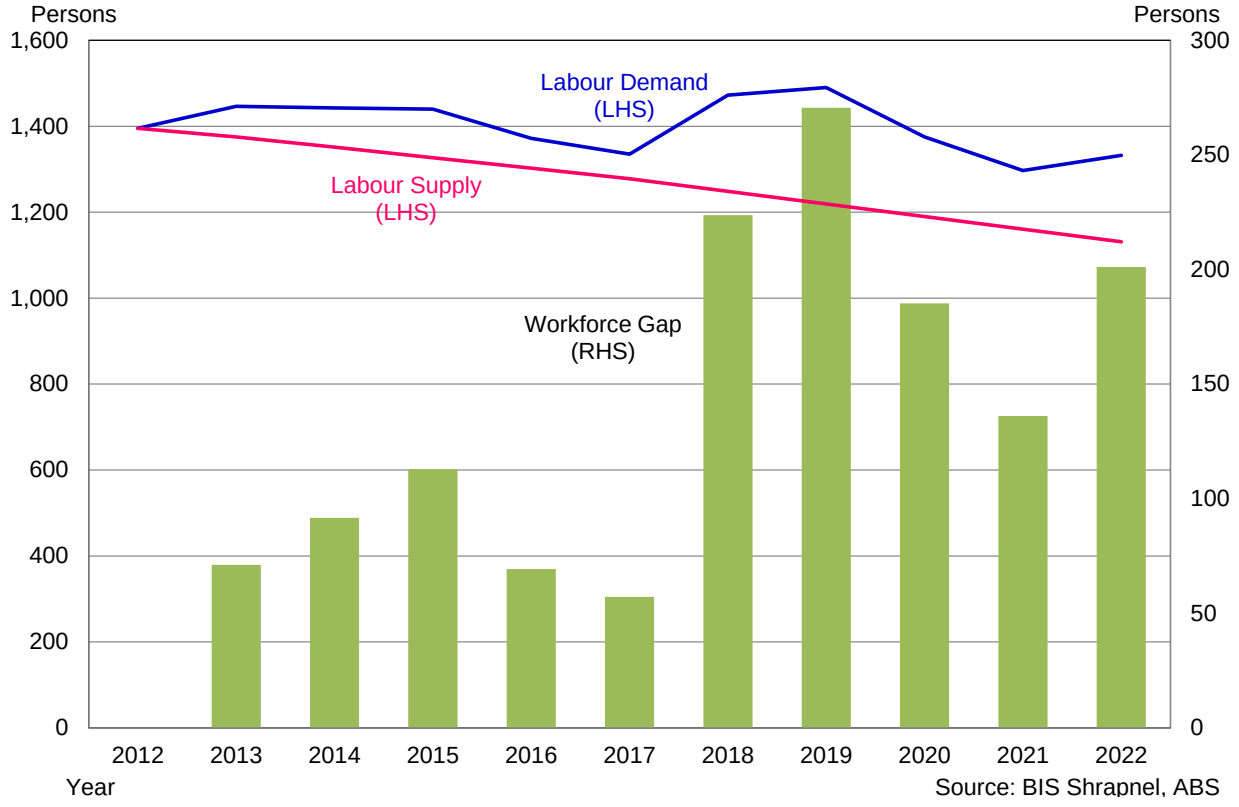
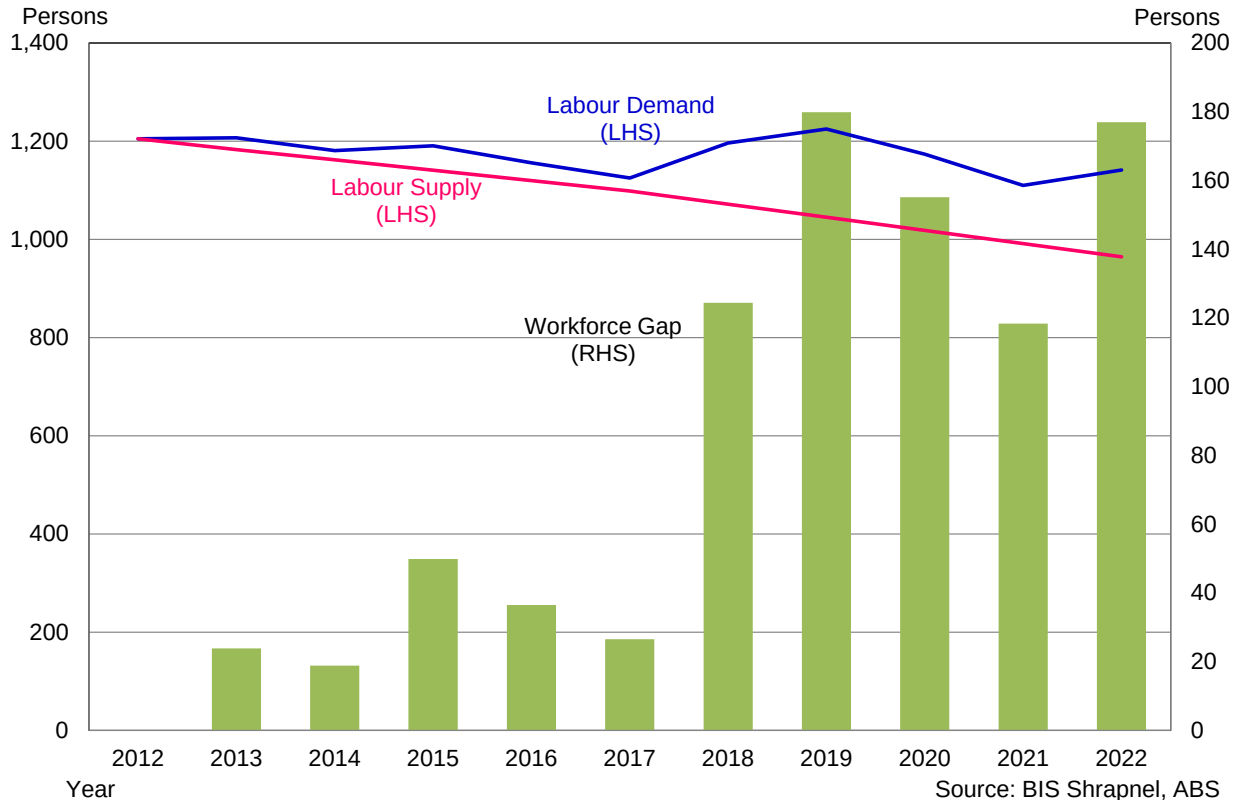
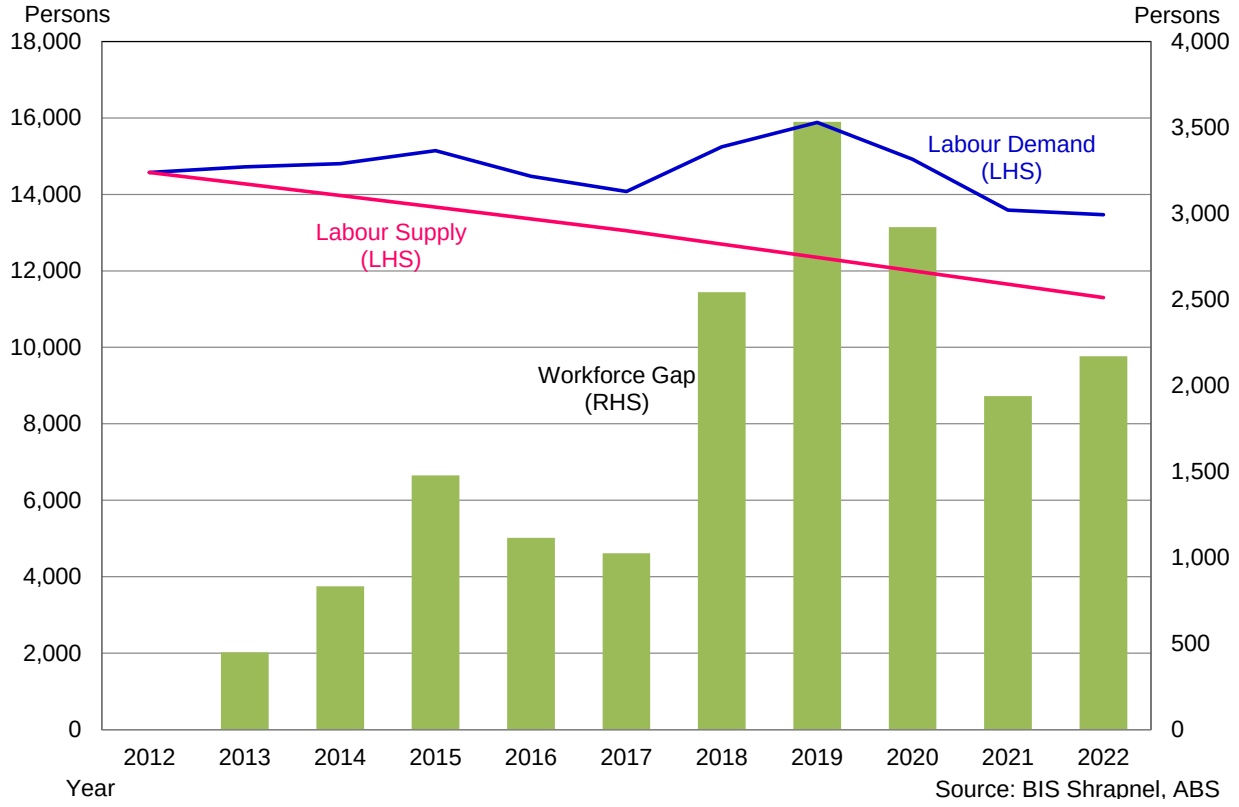


Chart 4.13: Australia
'Other' Professionals (1.5% Productivity Growth)



Source: BIS Shrapnel, ABS

Chart 4.14: Australia
Total Skilled Labour (1.5% Productivity Growth)



Source: BIS Shrapnel, ABS

4.5 Graduate supply and the capability shortfall

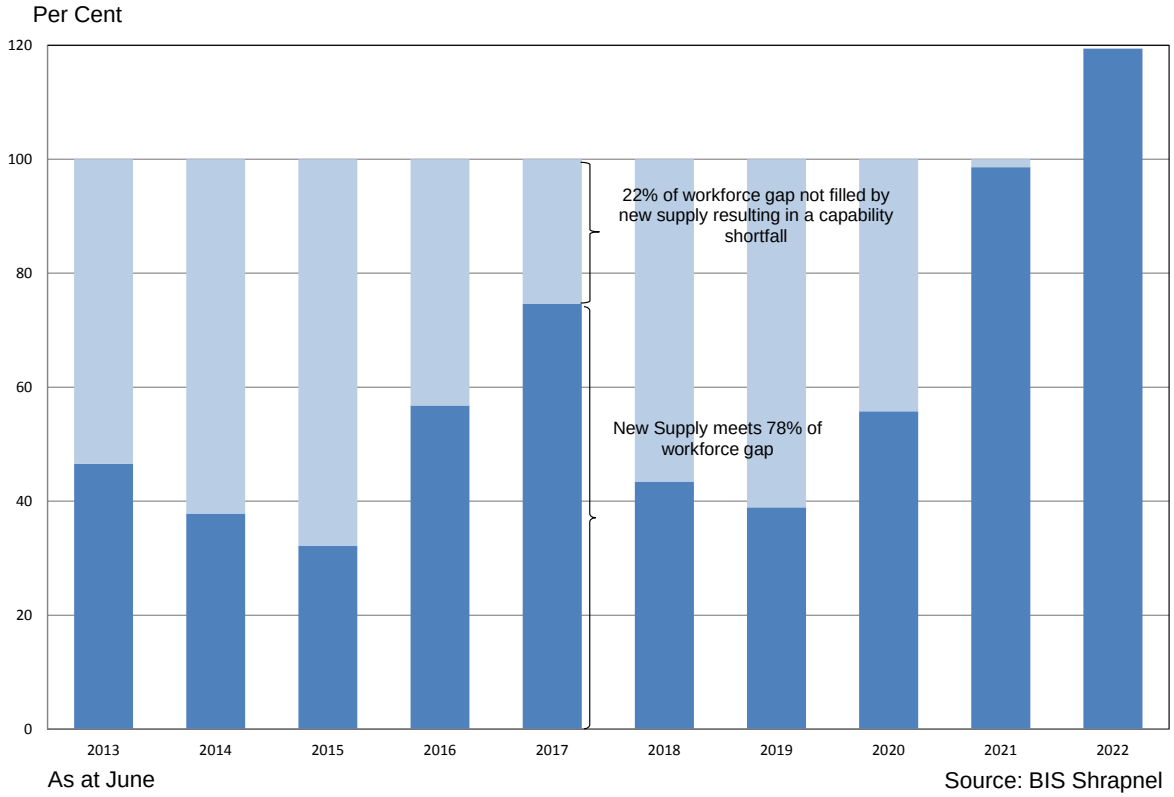
The total surveying and geospatial profession's workforce gap will need to be met by additional supply if forecast levels of construction activity are to be achieved. Possible sources of labour supply include:

- New graduates
- Net migration from overseas, and/or
- Other labour supply boosting measures (eg increasing productivity or reducing the rate of workforce attrition)

All of these supply sources are important in meeting future surveying and surveying-related workforce requirements. In this report, however, we have attempted to quantify only the supply of new graduates to the surveying and geospatial industry. Any positive difference between the total sector workforce gap and the supply of new graduates represents the capability shortfall in the surveying and geospatial workforce.

As discussed in Section 2.4, in quantifying new graduate supply we have chosen to use data relating to Australian domestic undergraduate enrolments and completions in the fields of surveying as well as Diploma and Advanced Diploma completions in vocational training that lead to surveying and geospatial associate professional qualifications

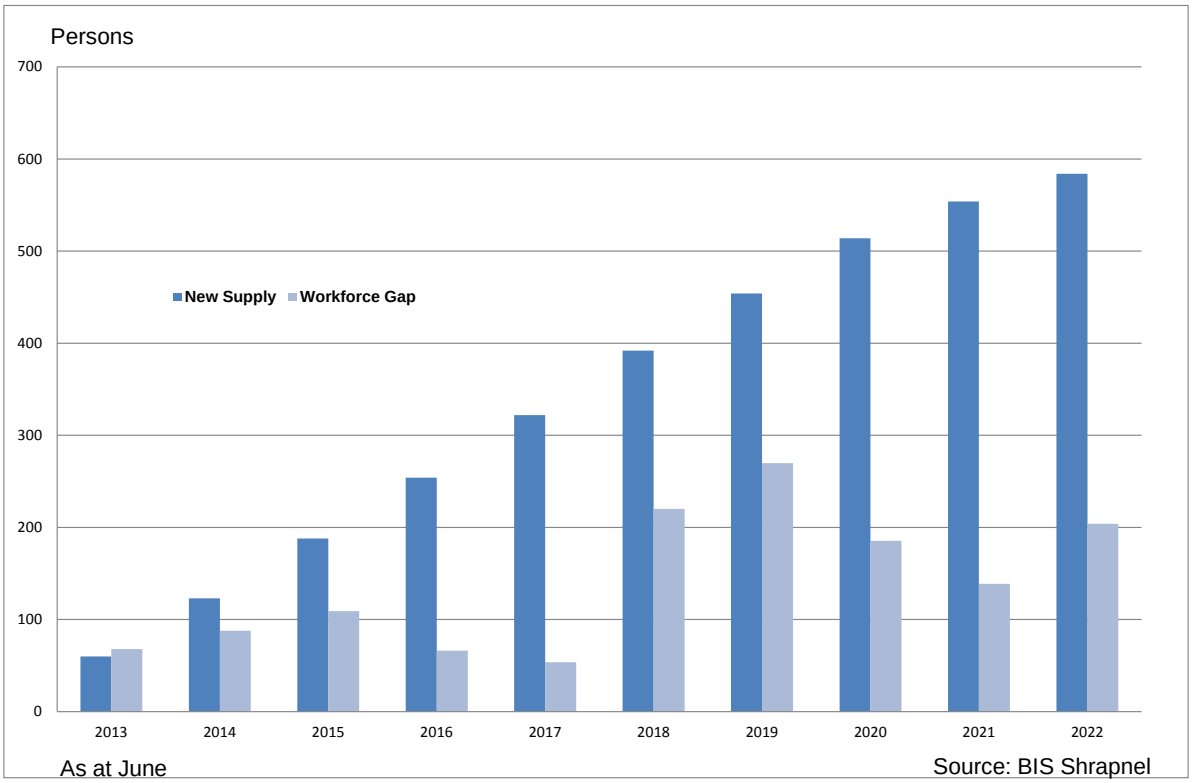
Chart 4.15: Australia
Total Surveyors Workforce Gap, Graduate Supply and Net Capability Position
(1.5% Productivity Growth)



As at June

Source: BIS Shrapnel

Chart 4.16: Australia
Total Technicians Workforce Gap, New Supply and Net Capability Position
(1.5% Productivity Growth)



Based on current enrolments, completion rates and historical trends, we forecast there will be an average of just under 150 undergraduate completions in surveying across Australia over the next ten years. In addition, we forecast new supply of 60 technicians per annum over the current decade.

The difference between the stream of graduate supply and the workforce gap is the capability shortfall, which is illustrated in Charts 4.15 and 4.16 (incorporating the base labour force productivity growth assumption of 1.5 per cent). The first chart projects the percentage of workforce gap that is met by new graduate supply. The proportion of the workforce gap not covered by new graduate supply represents the capability shortfall.

Given our projections of the workforce gap and graduate supply, we estimate that Australia's 'net capability position' for surveyors will be in deficit situation for the next nine years (see chart 4.15). We expect the net capability position to turn into a surplus situation only in 2021/22. The reasons for the persistence of a capability shortfall over the nine years to 2020/21 are:

- Generally forecast strong phase of construction activity
- Accelerating workforce attrition through ageing, and
- Flat growth in graduate supply.

Naturally, a larger capability shortfall will occur under lower (ie les than 1.5 per cent) labour productivity growth assumptions. For technicians, we estimate a situation of capability surplus over the forecast period (see chat 4.16).

4.6 Interpretation of results

The capability model described here suggests that based on forecast levels of construction activity and taking into account labour lost through workforce attrition, future skilled surveying labour supply will not be enough to meet forecast skilled labour demand in the surveying and geospatial sector. As a consequence, in theory, a capability shortfall will arise.

In practice, of course, there will be no observable capability shortfall. Either construction activity, and hence labour demand, will fall back to meet the constrained level of labour supply, or measures will be put in place that will boost labour supply to meet currently expected future construction activity.

Nonetheless, the quantification of the capability shortfall provides an important insight. First and foremost, it provides a simple measure of how much more labour is required whether through migration or other supply boosting measures to meet forecast demand requirements.

The key result of the analysis is that Australia faces a shortage of skilled surveying and geospatial labour to meet projected demands from the construction industry over the coming decade. The shortage is expected to become particularly acute in the middle of this decade driven by rising levels of construction activity, accelerating attrition of the existing skilled workforce through ageing, and only flat growth in graduate supply.

The capability shortfall reaches a peak in 2018/19. To some, this may suggest that the issue of skills shortages is one which can be deferred until this period. In our view, this would be a mistaken interpretation of the model results for several reasons. Primarily, given the time taken to develop new surveying hires (particularly new graduates) to a point of high capability — typically measured to be 4-6 years — the model suggests that hiring should be taken now to meet the future capability requirement. This issue becomes more severe when it is also considered that the demand for surveying skills tends to precede that of construction work done.

CHAPTER FIVE

Forecasts of Labour Demand and Workforce Gap for New South Wales

5. FORECASTS OF LABOUR DEMAND AND WORKFORCE GAP FOR NEW SOUTH WALES

5.1 Estimate of the surveying and geospatial workforce

Table 5.1 presents, by state, BIS Shrapnel's estimate of the size of the skilled surveying and surveying-related workforce in 2011/12. As discussed in Section 2.1, the aggregate figures for surveyors, spatial scientists, and surveying and spatial science technicians were sourced from 2011 ABS Census data. The size of the specialist surveying occupations is based on the results of BIS Shrapnel industry research. Similarly, the population of planners, engineers, environmental scientists employed at consulting surveying firms is based on the industry survey.

Table 5.1: Estimate of the Size of Surveying and Geospatial Workforce by specialist occupation by state, as at 2011/12

Specialist Occupation	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	Total
Surveyors									
Cadastral	1,301	592	673	190	295	126	77	76	3,330
Construction	305	372	459	82	329	9	1	13	1,570
Engineering	489	393	362	107	307	16	1	18	1,692
Mining	235	97	404	64	524	15	1	0	1,340
Others	77	134	106	18	91	11	0	10	446
Total Surveyors	**2,405**	**1,588**	**2,005**	**462**	**1,545**	**177**	**80**	**116**	**8,378**
o/w Registered/Licensed Surveyors	*1,067*	*521*	*579*	*171*	*258*	*111*	*77*	*68*	*2,852*
Total Spatial Scientists	**841**	**707**	**783**	**217**	**683**	**117**	**57**	**191**	**3,596**
Technicians									
Surveying Technicians	366	185	263	78	151	33	13	26	1,116
Spatial Technicians	92	46	66	20	38	8	3	7	279
Total Technicians	**458**	**231**	**329**	**98**	**189**	**41**	**16**	**33**	**1,395**
Total Skilled Surveying and Geospatial Workforce	**3,704**	**2,526**	**3,117**	**777**	**2,417**	**335**	**153**	**340**	**13,369**
Other Professionals (a)									
Planners	120	77	80	20	56	8	3	6	370
Engineers	155	125	126	31	88	11	5	9	550
Environmental Scientists	35	28	34	8	24	3	2	3	137
Other (include Architects)	30	60	28	7	18	2	1	2	148
Total Other Professionals	**340**	**290**	**268**	**66**	**186**	**24**	**11**	**20**	**1,205**
Total	**4,044**	**2,816**	**3,385**	**843**	**2,603**	**359**	**164**	**360**	**14,574**

o/w: of which Source: BIS Shrapnel, ABS, CSN

(a) These are other professionals employed at consulting surveying firms

Surveyors comprise 65 per cent of the skilled surveying and geospatial workforce with spatial scientists and surveying and spatial science technicians making up 23 and 12 per cent respectively. We estimate that cadastral surveyors account for nearly 54 per cent of all surveyors in New South Wales. This is followed by engineering surveyors (20 per cent), construction surveyors (13 per cent), mining surveyors (10 per cent) and other surveyors (3 per cent). In addition, we estimate that there are about 1.3 non-licensed surveyors practicing for every licensed surveyor in New South Wales.

5.2 Outlook for key determinants of skilled labour demand

5.2.1 Private house commencements

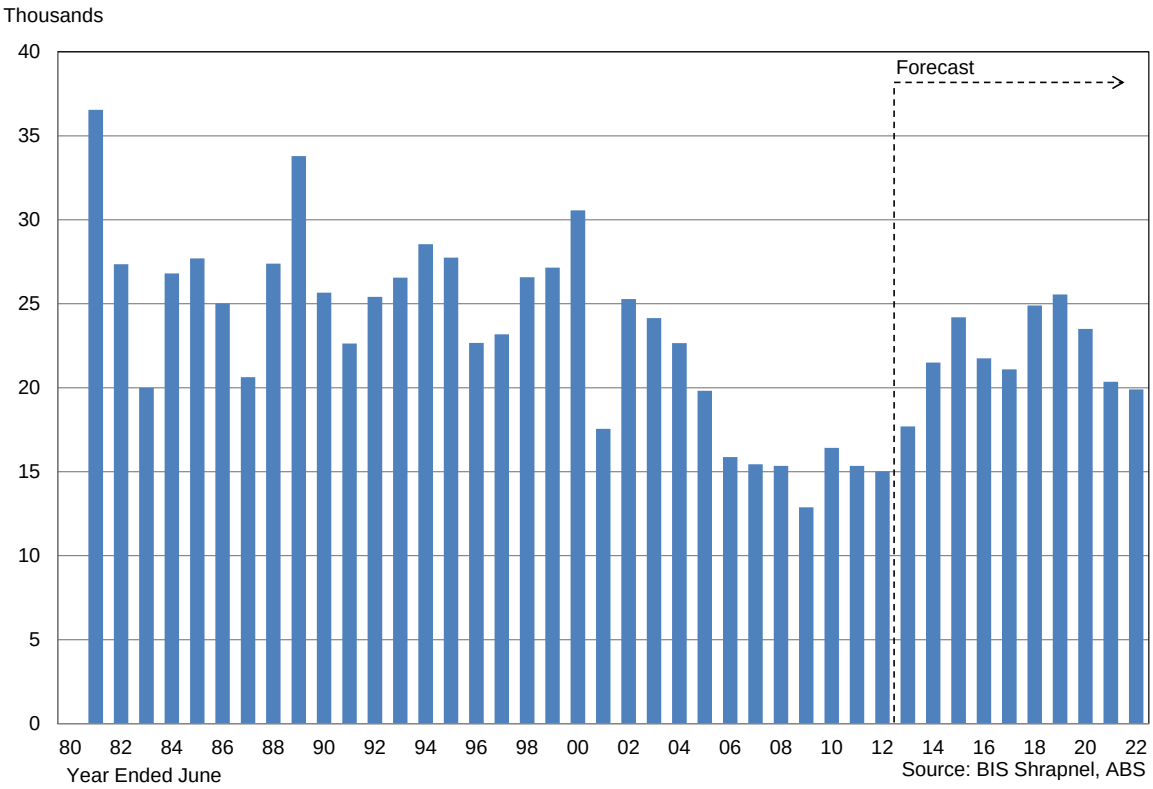
Since the mid-2000s dwelling construction in New South Wales has been relatively subdued, and consequently a significant stock deficiency has emerged. This deficiency has created significant pressure in residential markets across New South Wales, driving price and rental growth and making Sydney the least affordable capital city in Australia. Coupled with a few other factors, this affordability constraint has helped limit the entry of first home buyers.

However during 2012 the key factors have begun to align more favourably:

- housing affordability, a perennial issue in the Sydney market, has improved following several interest rate cuts.
- the NSW Government's announcement of a new housing stimulus package in its May 2012 budget targeting stamp duty and other concessions toward new building, as opposed to existing dwellings, is a step in the right direction.
- the NSW Government has also signalled a new focus on opening up greenfields land for development, a strategy that saw building volumes in Victoria shoot up after the GFC.

As housing demand recovers, so too will confidence amongst purchasers and consumers more generally. This will flow through to increased turnover in the property market and with the significant stock deficiency across New South Wales will promote moderate growth in house prices. As momentum builds, demand from the investor and upgrader/downsizer segments of the market will also improve.

Chart 5.1: Number of Dwellings Commenced Private Houses – NSW



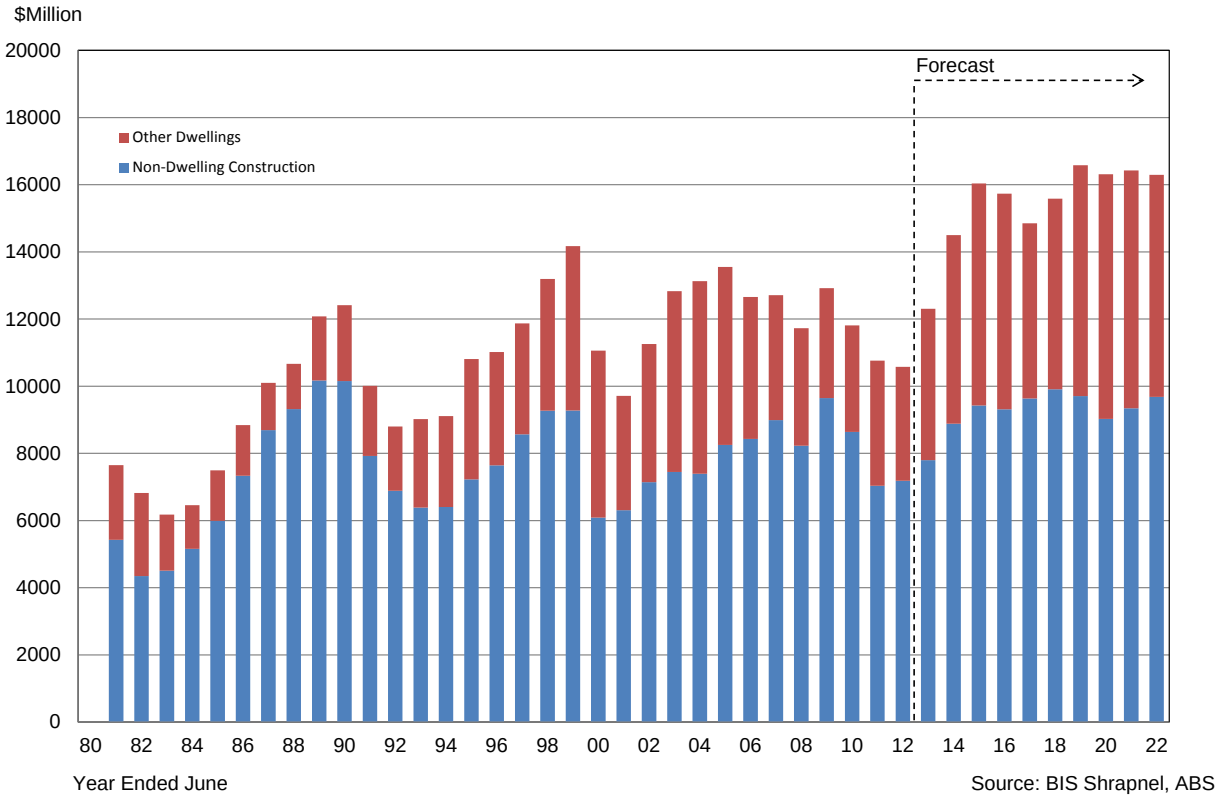
Momentum is expected to build across New South Wales before dwelling commencements peak at approximately 49,400 dwellings in 2014/15 (see chart 5.1). Private house commencements are expected to account for 50 per cent of total dwelling commencements. With interest rates beginning to reach more restrictive levels in response to emerging inflationary pressures over 2014/15, housing affordability will deteriorate once more and demand will moderate. As a result, building activity will once again fall back over 2015/16 (-10%) and 2016/17 (-3%). However, the increase in building activity over the next three years will not have been enough to ease the existing stock deficiencies. Hence, as interest rates begin to ease again in late 2016 and over 2017, we will see private residential commencements pick up again over 2017/18 and 2018/19.

5.2.2 Private multi-residential construction and non-dwelling building construction

Private multi-residential construction

New South Wales is by far the largest market for high density dwellings, accounting for 39 per cent of total private high density dwellings commenced over the past decade. Geography, affordability and infrastructure issues push much more people into higher density households in Sydney than in all other major cities. There has been a solid rise in the share of high density in New South Wales over the past few years. Our forecasts of private multi-residential of 'other' dwellings construction is provided in chart 5.2.

Chart 5.2: Other residential buildings and non-dwelling building– NSW
Value of Work Done, 2009/10 Prices



Non-dwelling building construction

Non-residential building in New South Wales has oscillated around a relatively flat trend since the late 1980's. An uplift in 1997/98 and 1998/99 was related to a handful of large commencements related to the Sydney Olympics in 2000. An upturn in commercial building supported a lift in activity over the two years to 2007/08 (+40%). The GFC then saw non-residential building collapse in 2008/09 (-28%).

Although commercial & industrial building remained weak, non-residential starts lifted strongly in 2009/10, thanks primarily to a surge in education building related to BER (Building the Education Revolution) stimulus. With BER funding beginning to dissipate in 2010/11, the value of starts contracted 39 per cent to $6.29 billion. In 2011/12, non-residential building lifted 8 per cent to $6.8 billion (in constant 2009/10 prices).

Coming off a historically low base, NSW is forecast to show solid improvement from 2012/13. Continued growth is forecast over the following three years to 2015/16, rising a cumulative 37 per cent to $8.79 billion, with the rate of growth expected to gradually slow over this period. A

continued upturn in commercial & industrial building, especially for offices, will underpin this result. With a number of major hospital projects driving a strong lift in health, and the expected commencement of the new $550 million Sydney Exhibition and Convention Centre driving entertainment & recreational building, social & institutional building is forecast to see a solid lift in 2013/14 before holding relatively flat over the following years. Overall, the pipeline of major projects for NSW over the coming years is quite healthy.

Average annual commencements over the 2018–2022 period are forecast to average $9 billion (see chart 5.2).

5.2.3 Utilities and transport engineering construction

We expect to see strong growth in telecommunications engineering construction, due to early works on the National Broadband Network. Analysis undertaken by BIS Shrapnel suggests approximately $7.4 billion (of which $5.2 billion will be engineering construction) will be invested in New South Wales as part of this initiative over the next decade, which will play a major role in a sustained upward trend in the sector. The first major contract covering New South Wales (as well as Queensland and the ACT) has been awarded to Silcar, worth up to $1.1 billion over the next two years, with a potential two-year extension. We therefore expect the first NBN-related activity to commence in the current financial year, before steadily ramping up over the coming five years.

The other major public sector — electricity — is set to fall slightly in 2012/13, in line with what we believe to be weak allocations within the five-year determination framework by the Australian Energy Regulator (AER) for Transgrid and the distributors in NSW. Another negative will come from any improvements or upgrades to new generation capacity by the state-owned generators in this time being done by the private sector (as per the recent partial privatisation).

This will mean the rehabilitation of the Munmorah Power Station will be a private project and will contribute to a significant strengthening in privately funded electricity construction to 2015/16. However, a greater contribution will come from the next phase of wind farm projects, as well as the Wellington and Dalton gas-fired power stations. The uncertainty surrounding the Carbon Tax has diminished and this should provide additional incentives to provide clean power. Additionally, we believe that a major investment in base-load power will be required by about 2013/14 to minimise/eliminate the possibility of power shortages by 2017/18. Continued population growth, continued demand growth per head of population and a greater mining industry will all contribute to greater demands being placed on electricity supply, and cause it to be the primary driver of private activity growth over the coming five years.

Roads sector grew by 11 per cent over 2011/12 underpinned by Pacific Highway and Hume Highway improvements, as well as work on the Hunter Expressway ramping up. The railway sector will also remain around very high levels (albeit falling slightly), with work on the South West Rail Link carrying through this period, although falls will arrive in following years as this project approaches completion.

From 2012/13 onwards, roads is set to fall back, due mostly to the winding down of work on the Pacific and Hume Highways from the NBP, with the next major projects (either Federal or State) not expected to come through until the following five year period. Railways is expected to experience several sharp falls in activity through to 2013/14 as the South West Rail Link moves toward completion, although the sector will remain at historically high levels thanks to projects such as the Northern Sydney Freight Corridor. However, rail activity will rebound strongly through to 2015/16 upon commencement of the North West Rail Link.

We expect to see private roads activity experience a strong five year period with both toll roads and subdivisions contributing albeit with differing cycles. Subdivisions activity is forecast to grow a cumulative 73 per cent over the next two years to a record $1.3 billion, as a much-needed recovery in dwelling construction begins to arrive. However, this level of activity will be only temporary, with construction falling back below $1 billion through to 2016/17 in line with an easing of the dwelling construction cycle.

Private toll roads activity is expected to remain around $200 to $400 million over the next four years, as work goes ahead on the M2 expansion in Sydney. Although this is a relatively small project compared to previous private toll roads, activity is set to surge ahead around 2016/17 with the commencement of the recently announced WestConnex project.

From 2015/16, BIS Shrapnel expects continued population growth and sprawl and stress on existing infrastructure, in addition to improved public sector finances and a new desire from the private sector to be involved in the construction and ownership of major infrastructure once again, to drive the next upswing in activity in New South Wales.

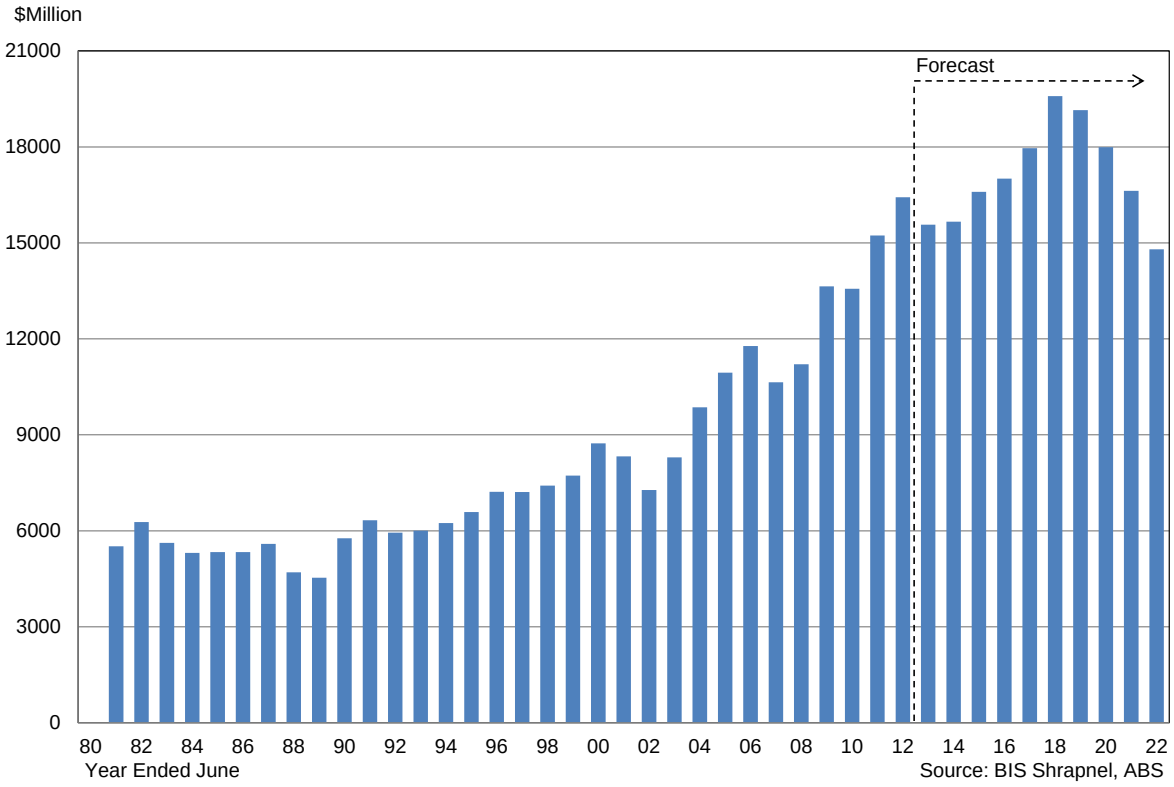
The main contributors here initially will be railways, electricity and roads. The $6+ billion North West Rail Link will drive rail activity, while the next five-year phase of Federal Transport funding (possibly called NBP 2) will mean another infusion of funding for major freight rail works. Possibilities here include the next stage of works on the Hunter Valley line, the North Coast line and the Northern Sydney Freight Corridor, as well as the completion of the Maldon to Dombarton line (to open up capacity for the rail transport of coal to Port Kembla).

Total road construction is set for tremendous growth in the following five years to 2021/22, as the mammoth WestConnex project ramps up. Annual average activity is forecast to reach $5.5 billion, which is much higher than any previous year on record. As well as the WestConnex project, we expect to see the F3 to M2 link, estimated to cost $4 billion, enter the construction phase by the beginning of next decade. These two projects will see Toll road construction reach record levels, such that the private sector more than offsets the expected mild declines in public expenditure.

However, public road construction is expected to recover toward the end of the forecast period. The completion of WestConnex will free up funding for other necessary projects, particularly in the Highways and Arterials sector, while the current financial tightness of local councils is likely to have passed, resulting in much needed growth in the Local roads sector. Private sector construction is expected to fall slightly, albeit remaining around historically high levels, with activity around this time likely to include an F6 Extension.

Electricity activity will be the next major contributor from 2015/16 and beyond. Much of this will be from work ramping up on the expansion of base-load power at Bayswater B, further investment in wind farms as the move towards ‘greener’ power continues and the next upswing in expenditure in distribution and transmission infrastructure. There will also be contributions from the other utilities sectors (ie water and sewerage) as they move into their next upswing in activity, and these may even be accelerated by a return to drought conditions. Our outlook for the sum of utilities of transport engineering construction is presented in chart 5.3.

Chart 5.3: Utilities and Transport Engineering Construction – NSW
Value of Work Done, 2009/10 Prices



5.2.4 Mining and heavy industry construction

Mining and Heavy industry construction has experienced tremendous growth over the past five years, more than trebling to $3.2 billion in 2010/11. Most of this growth has arrived in the coal sector, driven by record thermal coal prices. This sector is expected to continue to dominate activity in New South Wales as coal remains an important component of energy generation, despite the imposition of the new carbon tax. This will translate into continued strength in total mining and heavy industry activity (except for a minor blip in 2012/13) which will reach a peak of $4.7 billion by 2014/15.

With thermal coal prices around record levels, and expected to remain elevated, investment in coal projects is likely to remain strong in New South Wales. Activity leapt to a record of $2.2 billion in 2010/11 with further growth expected over the next four years, reaching a peak of $4 billion in 2014/15. Key projects here will include Ravensworth North and Mt Pleasant in the Hunter Valley, and the Maules Creek and Caroona projects in the Gunnedah Basin. Activity is also boosted by investment in expanding loading facilities at the Newcastle Coal Infrastructure Group (NCIG) coal terminal and Port Waratah. Note that the ABS appears to classify coal loading facilities as coal and coal handling construction, rather than harbours construction.

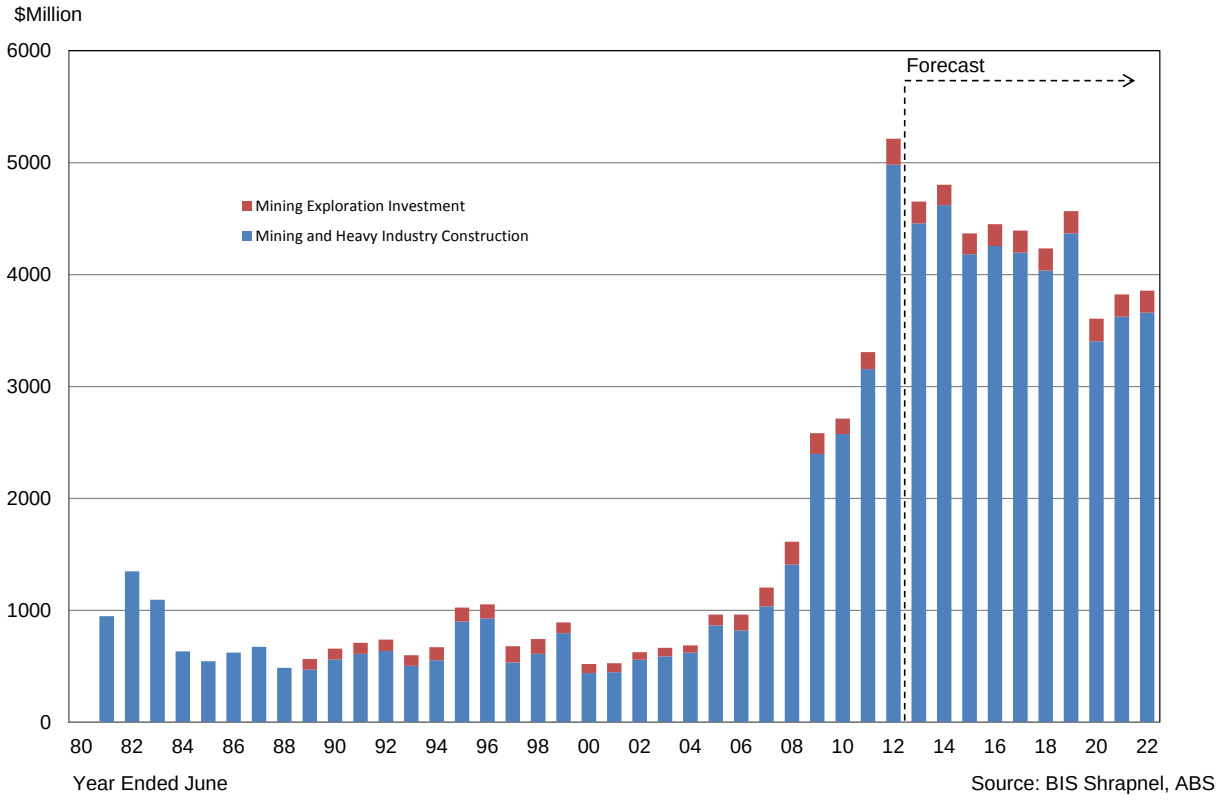
Other minerals activity is expected to continue its recent strength, reaching a record peak of $485 million in 2011/12. Ongoing work on the $1.9 billion Cadia East (gold and copper) project will continue to be the main driver of activity in the short term, and will soon be supported by the somewhat smaller Copper Hill project. However, activity will not be sustained at the currently high levels and will nearly halve over the two years to 2013/14, although remaining strong by historical standards. The healthy levels of exploration in recent years will also see a number of smaller mineral sands, nickel and base metals projects get underway towards the middle of the decade.

Although forecast to grow slightly to $395 million in 2011/12, other heavy industry is expected to decline rapidly over the following four years as significant projects reach completion. The largest of these include the $400 million pulp mill in Botany, and a $600 million expansion to the Kooragang Island ammonia nitrate facility. The recent peak of $578 million in 2008/09 will take some time to be reached again, with activity by 2015/16 only just remaining over $100 million.

Oil and gas activity more than trebled to $168 million 2010/11, and is generally expected to trend upward through to a peak of $261 million in 2014/15. The primary driver of activity will be a small scale gas storage facility in Newcastle, resulting in average annual activity over the five years to 2015/16 being nearly double that of the previous corresponding period, at $204 million. However, oil and gas is still expected to be one of the smallest sectors over the next five years, although this could change substantially if Coal Seam Gas (CSG) projects are approved.

In the decade to 2025/26, average levels of activity are expected to rise modestly with coal once again the leading driver. The longer term outlook for coal remains positive despite the nearing presence of the carbon tax, and uncertainty over the commercial viability of clean coal technologies. We believe that, ultimately, the rapid growth of electricity consumption across developing nations will provide considerable incentive in expanding domestic coal mining capabilities. A strong outlook for thermal coal prices, combined with capacity upgrades to the Gunnedah Basin rail network will accommodate increased mining investment in the region. The oil and gas sector will also grow steadily, and contains considerable upside potential with the development of coal seam methane gas. Overall, annual average activity will fall slightly over the five years to 2020/21 to $3.9 billion, but will recover to an average of $4.5 billion in the following period to 2025/26.

Chart 5.4: Mining and Heavy Industry Construction Work Done and Mining Exploration Investment – NSW, constant 2009/10 Prices



5.2.5 Total construction

New South Wales has experienced prolonged weakness in residential building. Even on the back of government stimulus measures in 2010/11 residential building work done only peaked at around $8.6 billion, compared to over $13 billion in Victoria. With the impact of stimulus waning and limited confidence despite falling interest rates, residential work done fell 5 per cent in 2011/12.

There exists a sizeable stock deficiency in New South Wales (particularly in Sydney) that will place significant pressure on the existing supply of dwellings. As confidence improves and the economy strengthens we expect this deficiency to help drive a strong increase in residential building work done across New South Wales, rising 71 per cent over the three years to 2014/15. Other dwellings will play a particularly significant role in this recovery as higher density development becomes more popular in the inner Sydney market. As interest rates become more restrictive and affordability deteriorates, work done will then fall back over the two years to 2016/17, but remain at historically strong levels.

The total value of non-residential work done in New South Wales has oscillated around a relatively flat trend since the late 1980s (constant 2009/10 prices).

Although commercial & industrial building remained weak post GFC, non-residential work done lifted strongly in 2009/10 (+17%), thanks primarily to a surge in education building related to BER stimulus. With BER funding beginning to dissipate and a lack of new private projects commencing, the value of work done fell back sharply over 2010/11 (-10%) and 2011/12 (-17%).

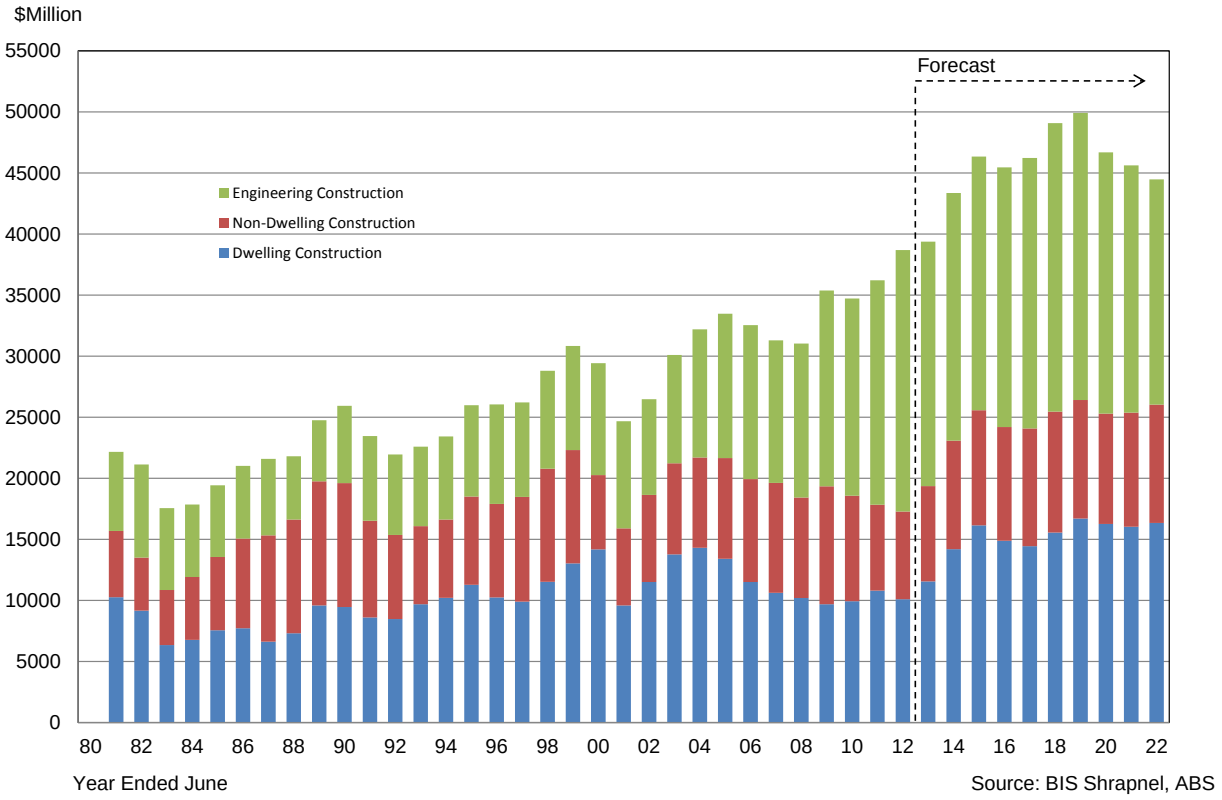
Off the current low base, sustained growth in non-dwelling building is forecast over the four years to 2015/16, rising a cumulative 32%. Improving economic conditions and emerging undersupplies in some sectors will prompt an upturn in commercial & industrial building, especially for offices and accommodation. Recent momentum on the massive Barangaroo project is particularly encouraging.

With a number of major hospital projects driving a strong lift in health (six projects over $60m in 2013/14 alone), and the expected commencement of the new Sydney Exhibition and Convention Centre driving entertainment & recreational building, social & institutional building is also forecast to see solid growth over the coming years. This is in contrast to many other states.

While resources states have generally taken the limelight through the 2000s, it should be noted that engineering construction activity in New South Wales rose tremendously over the latter half of the 2000s through both resources activity (mainly coal-related) but also through a boom in public investment in water (the Kurnell desalination plant), railways (Cityrail / freight line upgrades / Hunter Valley coal chain), electricity (transmission / distribution upgrades), harbours (Port Botany expansion) and roads projects (eg Pacific Hwy / Hume Hwy/ Hunter Expressway).

Unfortunately, while resources investment will continue to ramp up in the coalfields (and goldfields), we expect public investment to pull back slightly from here. This will see total engineering construction activity hover around the $18.5-19.5 billion between now and 2013/14. However, the next round of public investment projects (including roads, railways, electricity and telecommunications) coupled with new resources projects (Newcastle ports / Hunter coal) is likely to see another strong upswing in work from the middle of the decade (see chart 5.5).

Chart 5.5: Total Construction by Category – NSW
Value of Work Done, 2009/10 Prices



5.3 Forecasts of skilled labour demand

Our outlook for the key determinants of labour demand generally translates into increasing demand for skilled labour over the next three years before falling construction activity over 2015/16 and 2016/17 sees demand for skilled labour easing over this period. However, acceleration in activity over the subsequent two years is expected to see strong growth in skilled labour demand (see charts 5.6 and 5.7 and table 5.2).

As shown in table 5.2 (which is based on a productivity growth of 1.5 per cent per annum), from an estimate of 4,044 professionals in 2011/12, total skilled labour demand is expected to rise to 5,067 persons in 2014/15 before falling to 4,653 in 2016/17 as construction activity weakens. Total skilled labour demand is then projected to rise and peak at 5,224 persons in 2018/19.

Chart 5.6: Forecasts for Demand for Cadastral Surveyors and Total Surveyors – NSW

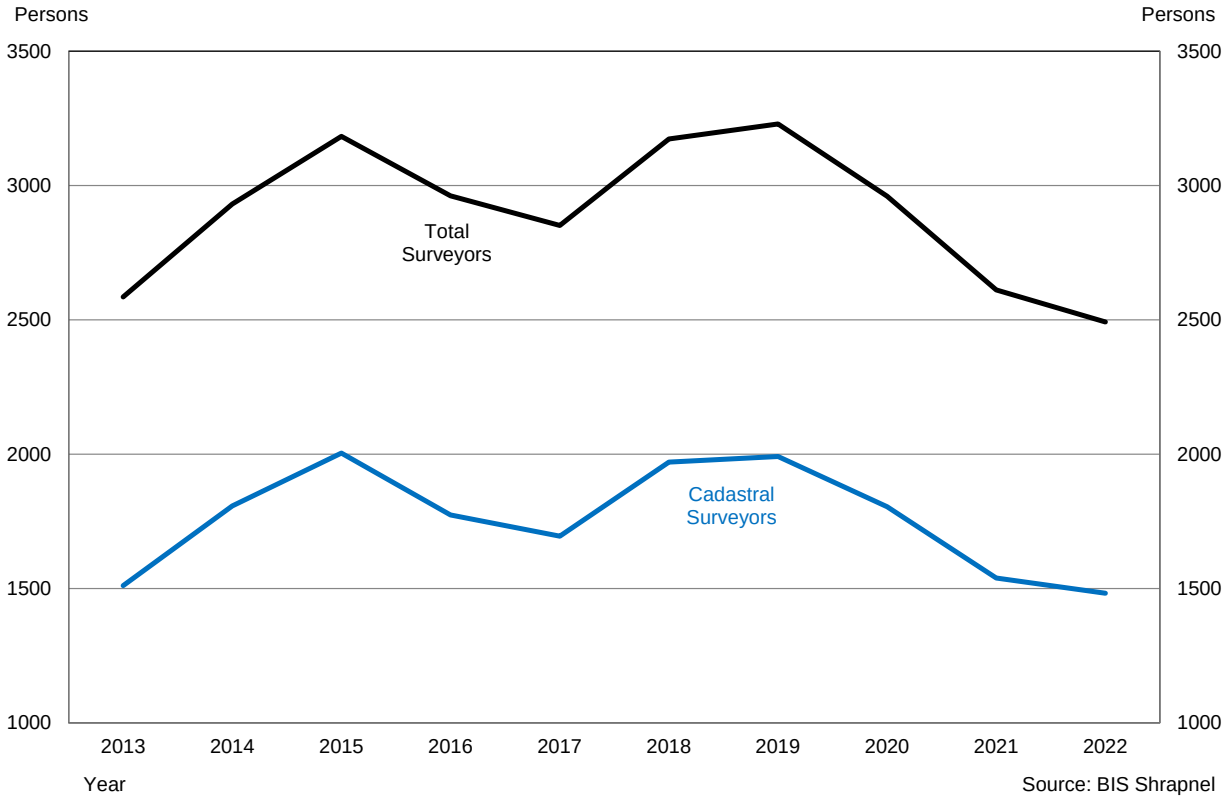
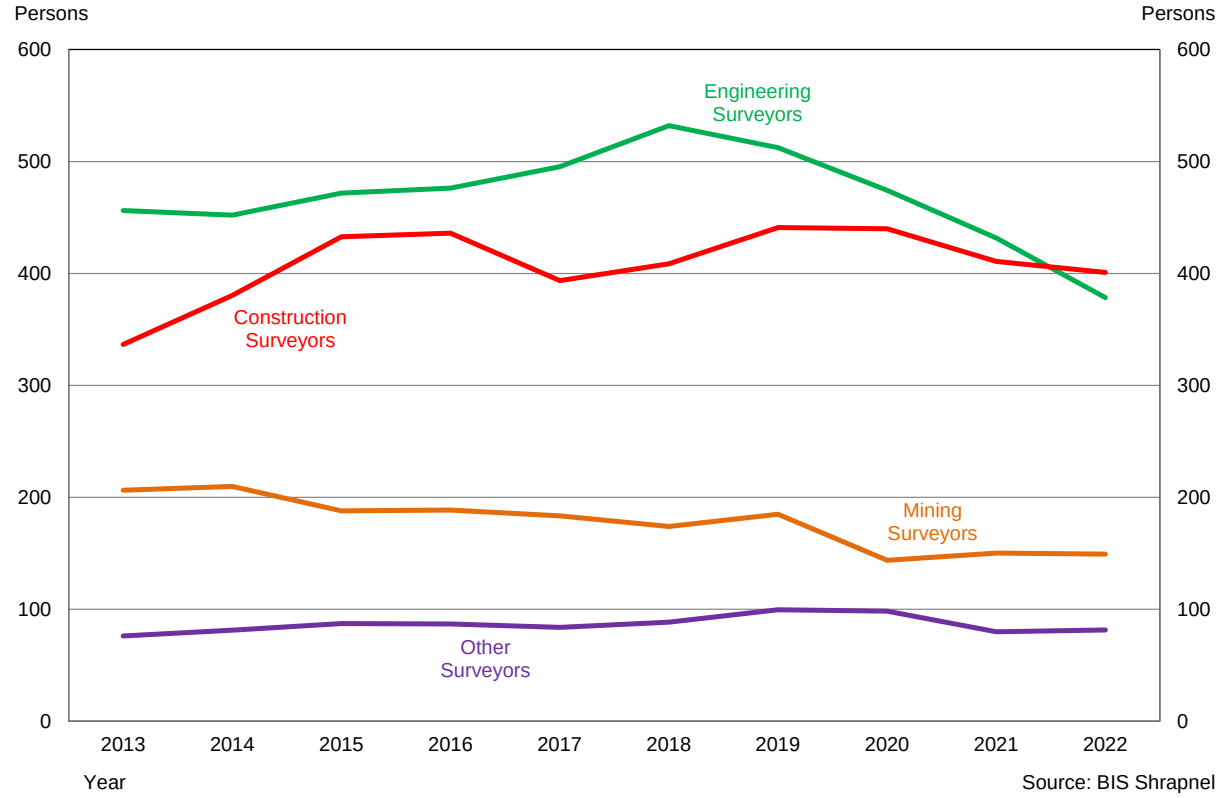


Chart 5.7: Forecasts for Demand for Surveyors by area of Specialisation– NSW



5.4 Workforce attrition and workforce gap

The total skilled surveying and geospatial workforce *requirement* to meet future construction activity is inevitably higher than the labour demand generated by the model given attrition of the existing workforce 'base', primarily through retirement and death (but also through people leaving the workforce for other reasons).

Given the estimated age profile of the current total skilled labour demand workforce — and the assumed likelihood of retirement and death in each age group — we estimate that the current workforce will shrink by around 23 per cent over the next ten years from demographic factors alone. The difference between the (declining) existing workforce and total labour demand is the workforce gap. The workforce gap will need to be met by additional supply if forecast levels of end use sector activity are to be achieved. Possible sources of labour supply include:

- New graduates, and/or
- Net migration from overseas

It should be noted again that while the existing skilled surveying workforce is expected to decline in personnel terms, the measure of skills and experience lost is likely to be far greater given that the retirees will be concentrated in relatively "high skill/experience" occupations. This report makes no attempt to quantify this, potentially greater loss, but acknowledges that it is a key issue facing the surveying and geospatial industry and the broader construction industry.

Given the forecast shape of labour demand, and the attrition of the existing workforce, the size of the total surveying and geospatial skilled workforce gap is expected to increase to 1,297 persons by 2014/15 before falling to around 1,000 persons by 2016/17. However, an expected rebound in activity over the subsequent three years will drive demand for skilled labour higher. With ongoing attrition of the existing workforce around this time, increased demand for skilled labour will lead to a higher workforce gap. We expect the workforce to peak at 1,822 persons in 2018/19 with surveyors accounting for 69 per cent of this deficit. This means that an additional 1,255 surveyors, 312 spatial scientists, 154 technicians and 101 'other' professionals will be required to meet forecast levels of construction activity and to cover for the replacement of existing employees. The labour demand, labour supply and workforce gap for surveying and geospatial workforce is presented in table 5.2. The labour demand, labour supply and workforce gap for a select group of specialist occupations are presented in charts 5.8 to 5.13.

Table 5.2: Forecasts for Labour Demand Surveyors and Surveying Related Professionals and Workforce Gap for – New South Wales

(Baseline Scenario based on 1.5% labour productivity growth, forecasts as at June)

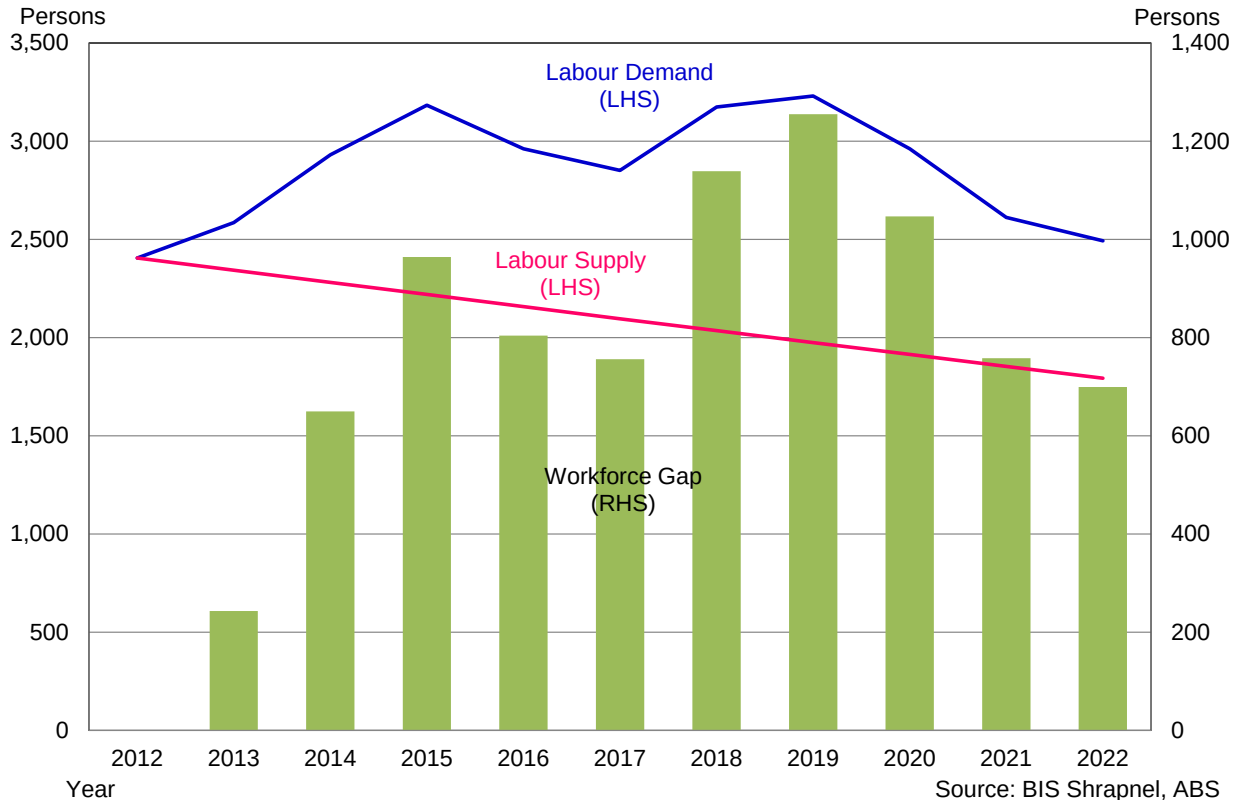
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Labour Demand by Specialist Occupation	Estimate	Forecasts									
Cadastral	1,301	1,511	1,808	2,004	1,774	1,695	1,971	1,992	1,804	1,539	1,483
Construction	305	336	380	433	436	394	409	441	440	411	401
Engineering	489	456	452	472	476	495	532	512	474	432	379
Mining	235	206	210	188	189	183	174	185	144	150	148
Other Surveyors	77	76	82	87	87	84	89	100	99	80	81
All Surveyors	**2,405**	**2,586**	**2,931**	**3,184**	**2,962**	**2,852**	**3,174**	**3,230**	**2,961**	**2,612**	**2,492**
Registered/Licensed Surveyors	*1,067*	*1,239*	*1,482*	*1,643*	*1,455*	*1,390*	*1,616*	*1,633*	*1,480*	*1,262*	*1,216*
Total Spatial Scientists	841	838	896	961	956	924	974	1,037	969	877	893
Total Technicians	458	471	508	533	521	503	551	557	500	478	486
Total 'Other' Professionals	340	339	363	389	387	374	394	399	372	355	362
Total Skilled Labour Demand	**4,044**	**4,235**	**4,698**	**5,067**	**4,826**	**4,653**	**5,093**	**5,224**	**4,802**	**4,321**	**4,233**
Existing Workforce (a)											
Cadastral Surveyors	1,301	1,255	1,210	1,165	1,120	1,075	1,031	988	945	901	858
Construction Surveyors	305	303	300	298	296	294	291	289	287	284	282
Engineering Surveyors	489	479	470	461	452	443	433	424	415	405	396
Mining Surveyors	235	230	226	222	217	213	208	204	199	195	190
Other' Surveyors	77	76	75	74	73	72	71	70	69	68	67
All Surveyors	2,405	2,343	2,281	2,220	2,158	2,095	2,035	1,975	1,914	1,854	1,793
Registered/Licensed Surveyors	*1,067*	*1,016*	*965*	*914*	*863*	*812*	*770*	*728*	*686*	*644*	*602*
Spatial Scientists	841	825	809	792	776	759	742	725	708	691	674
All technicians	458	452	444	436	428	420	411	403	395	387	378
'Other' Professionals	340	334	328	322	316	310	304	298	292	286	280
Total skilled labour	4,044	3,953	3,862	3,770	3,677	3,584	3,493	3,401	3,309	3,217	3,125
Workforce Gap											
Cadastral Surveyors	-	256	598	839	654	621	939	1,004	860	638	624
Construction Surveyors	-	34	80	135	140	100	117	152	153	126	119
Engineering Surveyors	-	(23)	(18)	10	24	53	99	88	59	26	(17)
Mining Surveyors	-	(24)	(16)	(34)	(29)	(29)	(34)	(19)	(55)	(45)	(42)
Other' Surveyors	-	1	7	14	14	12	18	30	30	12	15
All Surveyors	-	243	650	964	804	756	1,139	1,255	1,047	758	699
Registered/Licensed Surveyors	-	*223*	*517*	*729*	*592*	*578*	*846*	*905*	*793*	*618*	*613*
Spatial Scientists	-	13	88	169	181	165	232	312	260	186	220
All technicians	-	20	65	98	93	84	139	154	105	91	108
'Other' Professionals	-	5	35	67	71	64	90	101	80	69	82
Total skilled labour	-	281	837	1,297	1,149	1,069	1,601	1,822	1,492	1,104	1,108

(a) Existing workforce is generated by adjusting the size of the current skilled workforce for natural attrition rates such as retirements and death. Source: BIS Shrapnel, ABS

(b) Workforce gap is calculated as labour demand less existing workforce. A positive number implies a shortage of labour

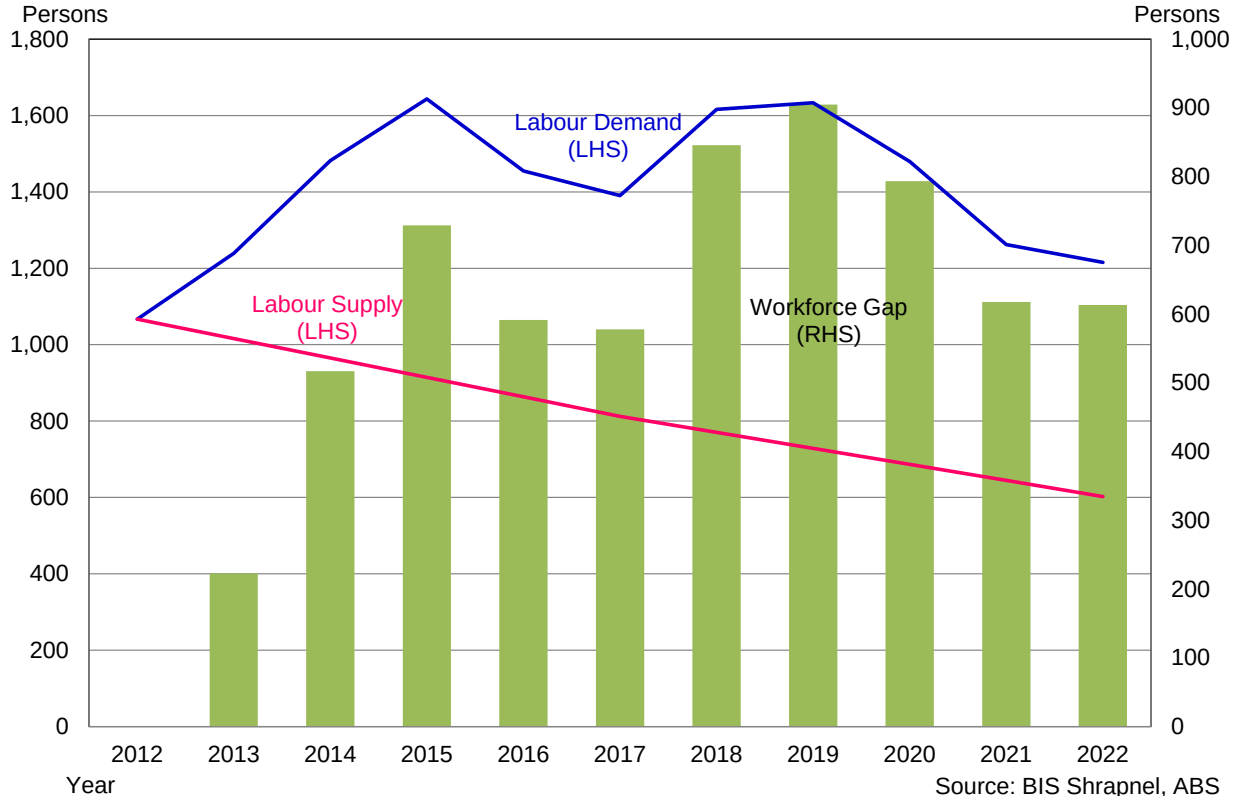
Numbers in brackets imply an excess supply as new supply exceeds the forecast workforce gap.

Chart 5.8: New South Wales
Total Surveyors (1.5% Productivity Growth)



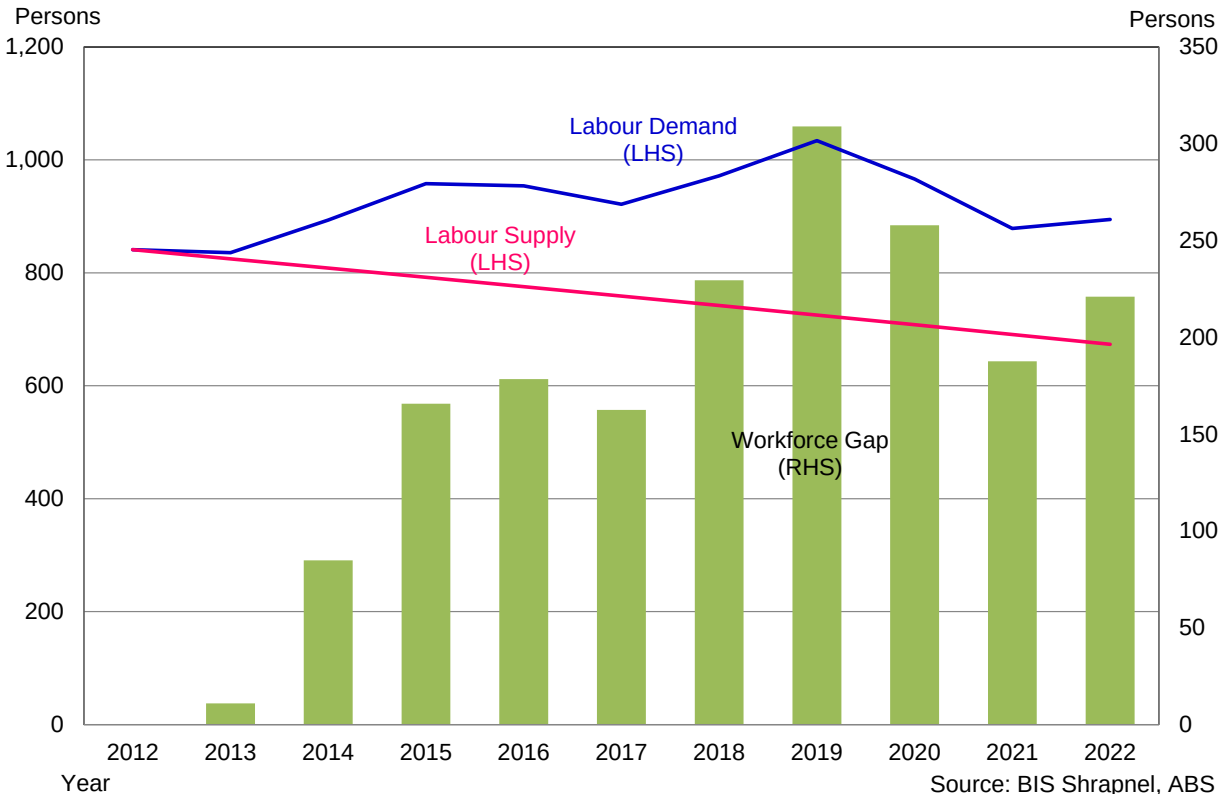
Source: BIS Shrapnel, ABS

Chart 5.9: New South Wales
Registered Surveyors (1.5% Productivity Growth)



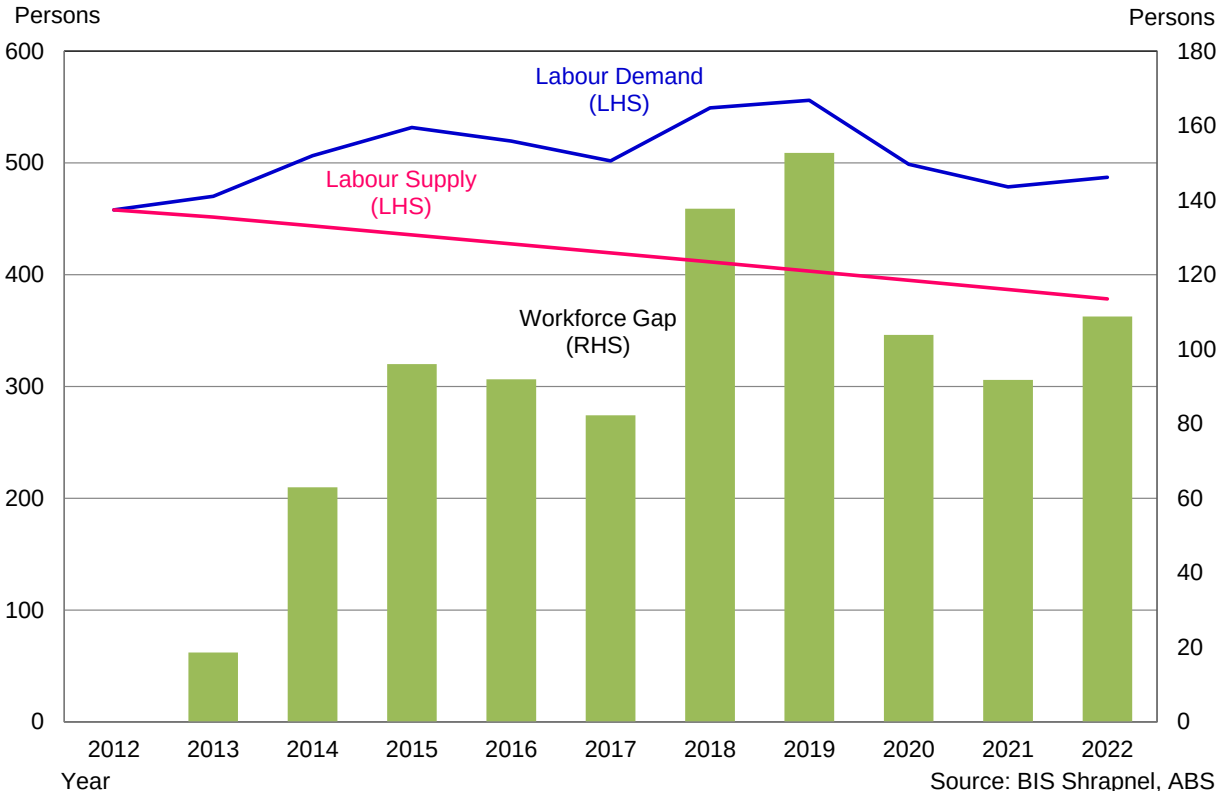
Source: BIS Shrapnel, ABS

Chart 5.10: New South Wales
Spatial Scientists (1.5% Productivity Growth)



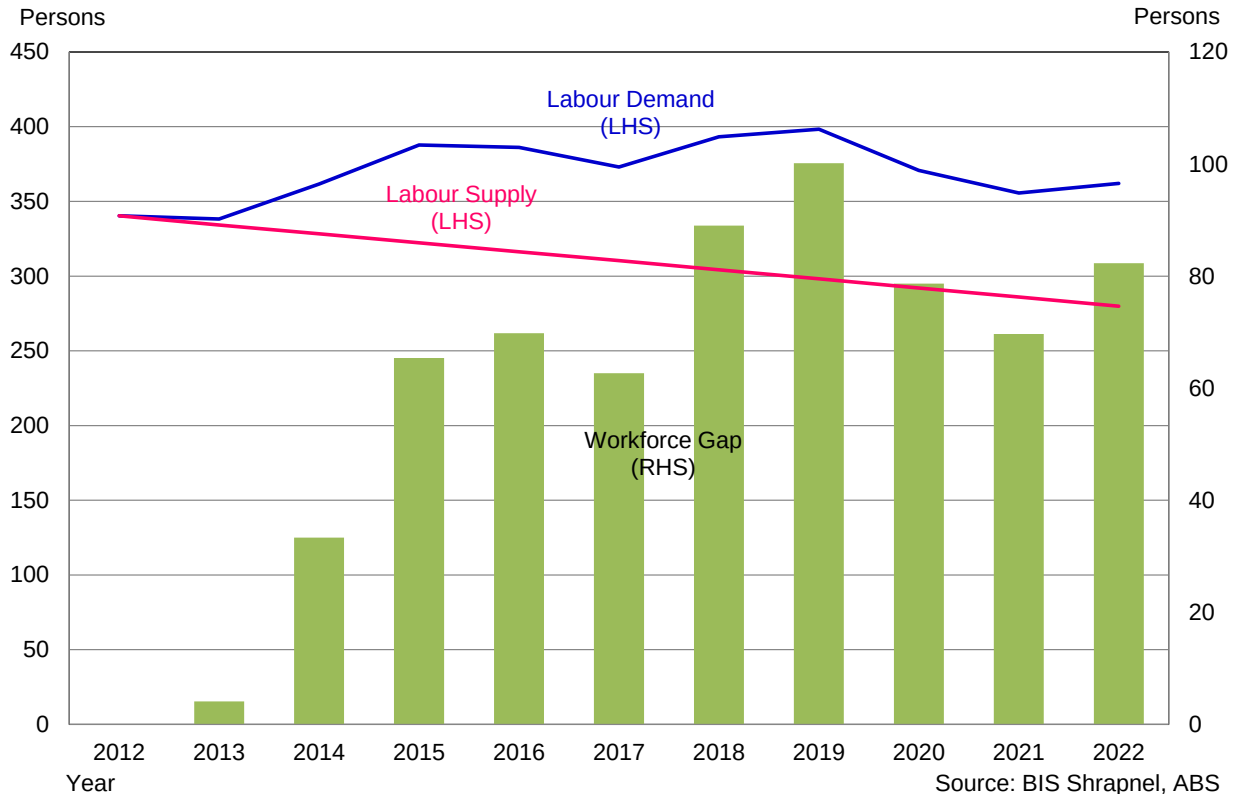
Source: BIS Shrapnel, ABS

Chart 5.11: New South Wales
Technicians (1.5% Productivity Growth)



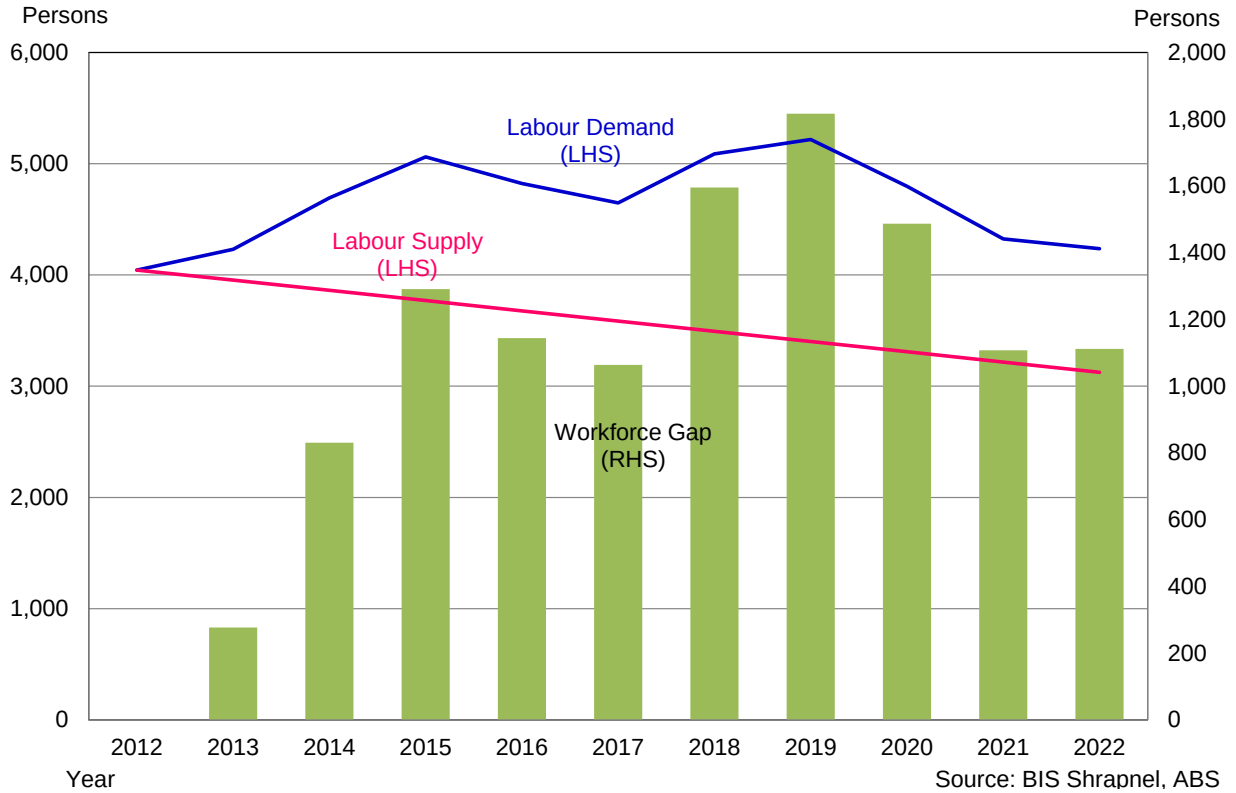
Source: BIS Shrapnel, ABS

Chart 5.12: New South Wales
'Other' Professionals (1.5% Productivity Growth)



Source: BIS Shrapnel, ABS

Chart 5.13: New South Wales
Total Skilled Labour (1.5% Productivity Growth)



Source: BIS Shrapnel, ABS

CHAPTER SIX

Forecasts of Labour Demand and Workforce Gap for Victoria

6. FORECASTS OF LABOUR DEMAND AND WORKFORCE GAP FOR VICTORIA

6.1 Estimate of the surveying and geospatial workforce

Table 6.1 presents, by state, BIS Shrapnel's estimate of the size of the skilled surveying and surveying-related workforce in 2011/12. As discussed in Section 2.1, the aggregate figures for surveyors, spatial scientists, and surveying and spatial science technicians were sourced from 2011 ABS Census data. The size of the specialist surveying occupations is based on the results of BIS Shrapnel industry research. Similarly, the population of planners, engineers, environmental scientists employed at consulting surveying firms is based on the industry survey.

Table 6.1: Estimate of the Size of Surveying and Geospatial Workforce by specialist occupation by state, as at 2011/12

Specialist Occupation	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	Total
Surveyors									
Cadastral	1,301	592	673	190	295	126	77	76	3,330
Construction	305	372	459	82	329	9	1	13	1,570
Engineering	489	393	362	107	307	16	1	18	1,692
Mining	235	97	404	64	524	15	1	0	1,340
Others	77	134	106	18	91	11	0	10	446
Total Surveyors	**2,405**	**1,588**	**2,005**	**462**	**1,545**	**177**	**80**	**116**	**8,378**
o/w Registered/Licensed Surveyors	*1,067*	*521*	*579*	*171*	*258*	*111*	*77*	*68*	*2,852*
Total Spatial Scientists	**841**	**707**	**783**	**217**	**683**	**117**	**57**	**191**	**3,596**
Technicians									
Surveying Technicians	366	185	263	78	151	33	13	26	1,116
Spatial Technicians	92	46	66	20	38	8	3	7	279
Total Technicians	**458**	**231**	**329**	**98**	**189**	**41**	**16**	**33**	**1,395**
Total Skilled Surveying and Geospatial Workforce	**3,704**	**2,526**	**3,117**	**777**	**2,417**	**335**	**153**	**340**	**13,369**
Other Professionals (a)									
Planners	120	77	80	20	56	8	3	6	370
Engineers	155	125	126	31	88	11	5	9	550
Environmental Scientists	35	28	34	8	24	3	2	3	137
Other (include Architects)	30	60	28	7	18	2	1	2	148
Total Other Professionals	**340**	**290**	**268**	**66**	**186**	**24**	**11**	**20**	**1,205**
Total	**4,044**	**2,816**	**3,385**	**843**	**2,603**	**359**	**164**	**360**	**14,574**

o/w: of which Source: BIS Shrapnel, ABS, CSN

(a) These are other professionals employed at consulting surveying firms

Surveyors comprise 63 per cent of the skilled surveying and geospatial workforce with spatial scientists and surveying and spatial science technicians making up 28 and 9 per cent respectively. We estimate that cadastral surveyors account for nearly 37 per cent of all surveyors in Victoria. This is followed by engineering surveyors (25 per cent), construction surveyors (23 per cent), mining surveyors (6 per cent) and other surveyors (8 per cent). In addition, we estimate that there are two non-licensed surveyors practicing for every licensed surveyor in Victoria.

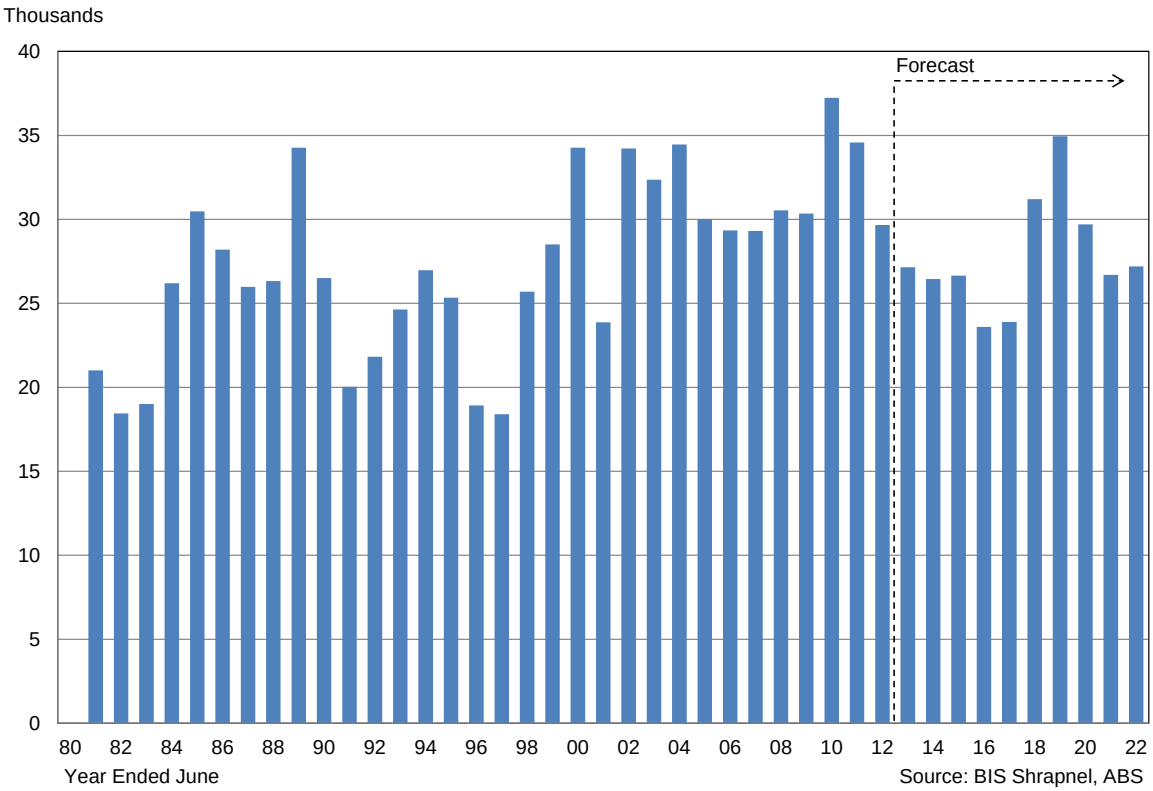
6.2 Outlook for key determinants of skilled labour demand

6.2.1 New private housing commencements

Private house commencements reached a peak of 37,238 dwellings in 2009/10 but have since fallen off considerably. BIS Shrapnel forecasts that private house commencements will fall a cumulative 43 per cent from peak to trough of just 23,600 dwellings in 2015/16.

Initially this decline reflects easing pressure on the Victoria dwelling stock. The surge in dwelling construction over recent years has eaten into the state's dwelling stock deficiency and will continue to do so until June 2014. Also, as the Victorian economy will be outperformed by the other major states over the coming years, migration inflows into the state are forecast to ease, and as a result underlying demand is forecast to ease off modestly. It isn't until 2016/17 that growth will re-emerge (see chart 6.1).

Chart 6.1: Number of Dwellings Commenced Private Houses – Victoria



6.2.2 Private multi-residential construction and non-dwelling building construction

Private multi-residential construction

There has been a very strong rise in the share of high density in Victoria over the past five years, reflecting a surge in Melbourne inner city tower apartment construction. Off a very high base, the share of high density is forecast to drop back sharply from 2012/13.

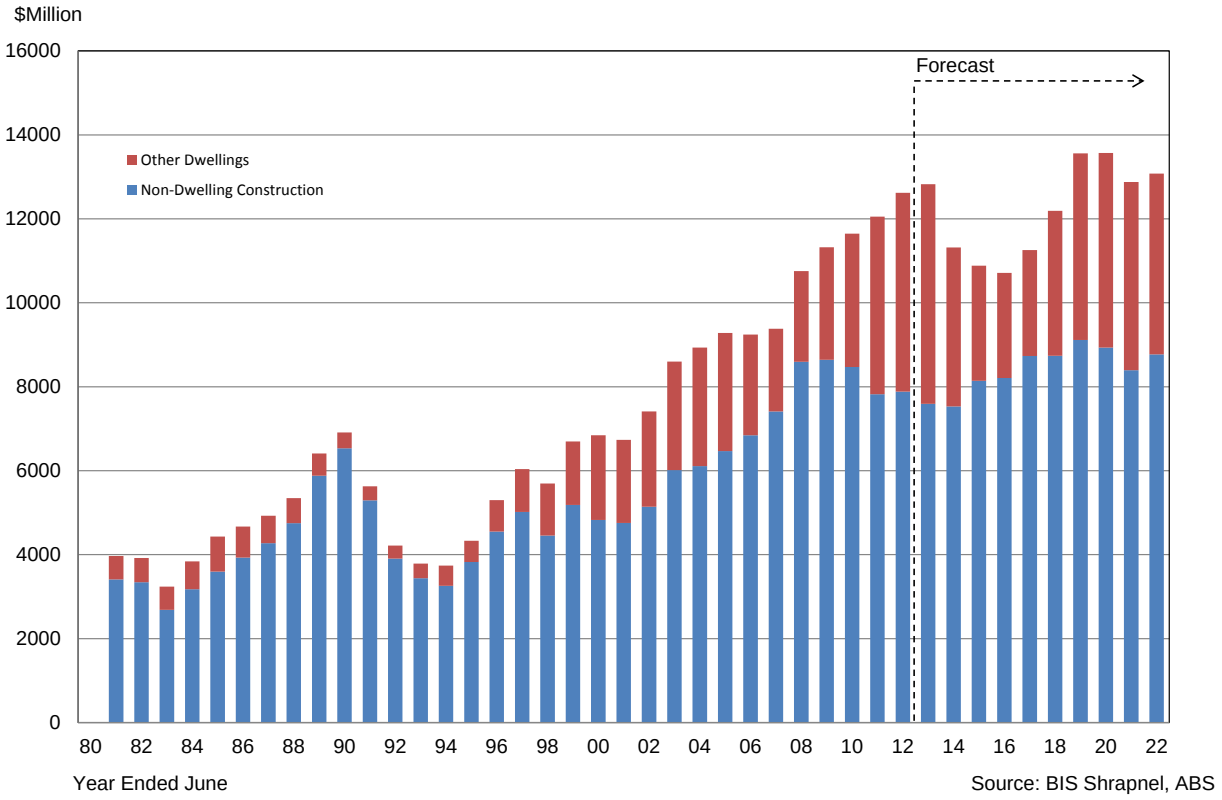
Non-dwelling building construction

Victorian non-residential building work done showed a strong upwards trend from the mid 1990s, close to doubling from 2000/01 to 2007/08. During this period, Victoria's economy improved significantly. The rate of population growth for the state also lifted markedly. Activity — supported by stimulus related spending — held at a high level over 2008/09 and 2009/10.

Total non-residential starts subsequently weakened over 2010/11 followed by modest improvement in 2011/12. Social & institutional building declined over these years reflecting weaker public sector activity with the BER Scheme winding up. The decline would have been greater if not for work on a number of major university and health projects. Commercial & industrial building posted a robust result in 2011/12 off the back of a number of major new projects commencing in retail and offices.

With social & institutional building continuing to weaken given the tightening of public funding, and commercial & industrial building holding flat in a subdued economic climate for the state, we forecast that total non-residential work done will weaken modestly over 2012/13 (-5%) and 2013/14 (-1%). With a significant slowdown in the state's housing market coming, little exposure to the mining sector and greater exposure to the manufacturing industry, overall economic prospects in Victoria relative to the other states are less favourable. Nonetheless, it is forecast that Victoria will see non-residential activity begin to turnaround in 2014/15, as economic conditions lift and undersupplies of prime space become more evident in a number of sectors. Driven predominately by commercial & industrial building, moderate growth in total non-residential building starts is forecast over 2014/15 to 2016/17. Social & institutional building is forecast to show some improvement later in this period as the control on public spending gradually eases.

Chart 6.2: Other residential buildings and non-dwelling building– Victoria
Value of Work Done, 2009/10 Prices



Source: BIS Shrapnel, ABS

6.2.3 Utilities and transport engineering construction

We forecast that energy related engineering construction will grow strongly through the next decade. Overall, we expect the energy generation sector to be among the strongest contributors to engineering construction activity in Victoria, second only to roads work. The growing list of wind and other renewable energy projects, including hydro and geothermal, is driving activity forward over the forecast. Although many of the projects will meet resistance from the public and other interested parties, the sheer volume of projects, along with the track record Victoria has with wind energy, is shaping our forecast.

Driving energy projects in Victoria is total expected demand. The Federal energy regulator has revised industry and energy forecasts, projecting demand growth will rise between 30-70% higher than expected to 2030. This is due to population growth and per capita income growth.

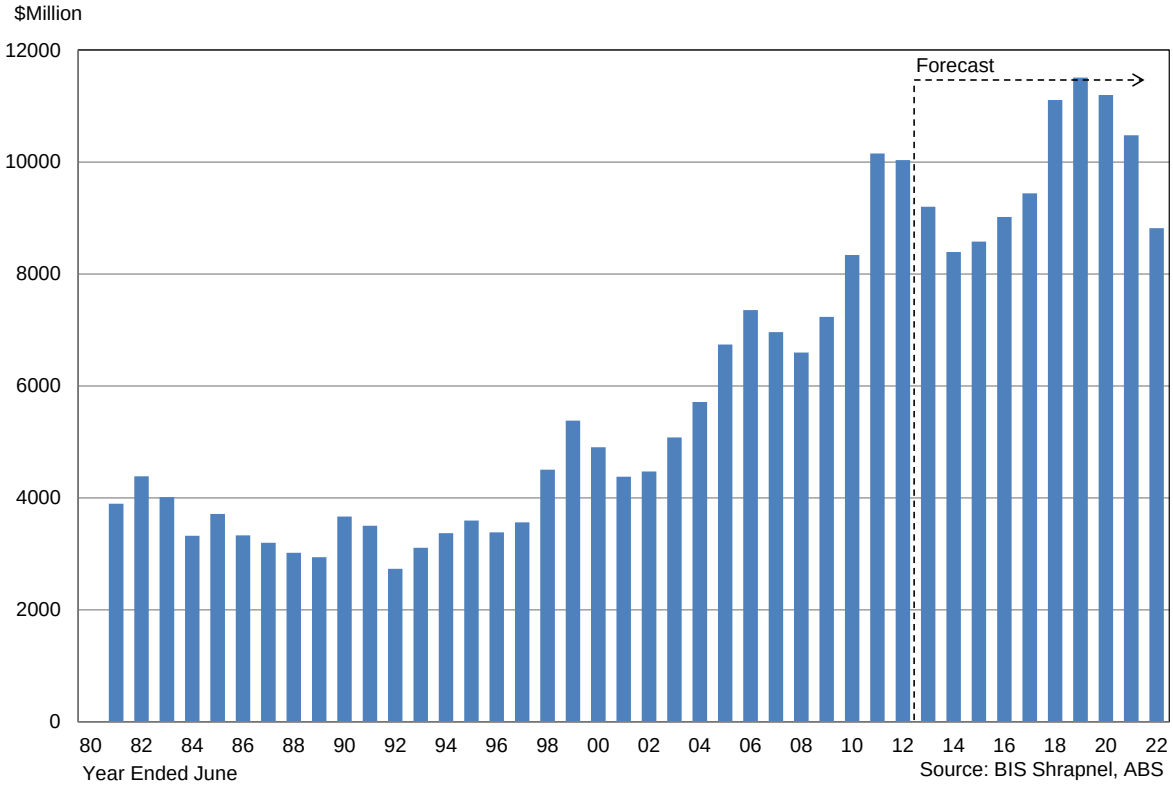
Other drivers of growth are ageing equipment and moves to replace what are known to be dirty brown coal operations with more environmentally friendly generators. This will see a gradual shift to gas-fired plants over the next one to two decades as existing brown coal plants are decommissioned. But it won't happen straight away.

The water engineering construction sector will go through a long-term decline as the Wonthaggi desalination project moves to completion. The "Food Bowl modernisation" Stages 1 and 2 will underpin remaining activity in our forecasts. Pipelines projects are also scheduled to be completed in the short to medium term. A minor driver of residual activity is upgrades of older water and sewerage infrastructure and cycles in housing activity. Urban population growth will drive stable and moderate growth in the long term

The Victorian rollout of the NBN is expected to be worth approximately $4 billion, over eight years, with ramping up from late 2011. This represents strong growth in Telecommunications specifically but also sustains total activity in Victoria in the short to medium term. Peak levels of activity are expected at around $500-$550 million per annum for the NBN, mid decade and $2 billion per annum for the entire industry.

Rail activity will move higher over the next two years. This is due to a series of projects underway (such as the Regional Rail Link project) and the South Morang extension. The new Baillieu Government announced many new rail projects, some of which have undefined timeframes or are less likely to be built due to funding pressures. In the medium term, the newly promised Rowville Extension and Doncaster lines will underpin longer-term growth, whilst stimulus work to the main northern (Sydney) line has yet to be commenced. This, and the North East revitalisation, will drive strong growth this year and a surge after 2012.

Chart 6.3: Utilities and Transport Engineering Construction – Victoria
Value of Work Done, 2009/10 Prices



Roads activity will remain robust in 2012/13 (at $2.3 billion of work done) before steadily receding back until 2016. Activity in the short term will be driven by a few key projects, including the states' largest project right now, Peninsula Link. With an initial cost estimate of $750 million, the project has mushroomed to over $1.3 billion in its effort to maintain a completion date of early 2013 despite the weather conditions. However, the next five years will on average be weaker than the previous five as roads activity sharply declines beginning in 2012/13 as projects wind down and before the next round of NBP projects kick in around the middle of the decade.

6.2.4 Mining and heavy industry construction

The oil and gas and coal sectors continue to dominate mining and heavy industry construction in Victoria. The record levels of mining and heavy industry construction over the past five years have been largely contained within these two sectors sector. Activity during this period has oscillated around the $1 billion mark (constant prices), falling to $848 million in 2010/11.

We expect mining and heavy industry construction to peak in 2011/12 at just below $1.5 billion (in constant prices) before declining over the next few years to a low of $503 million (constant prices). Driving this decline in activity will be major project completions in the oil and gas sector, and weaker levels of construction related to coal.

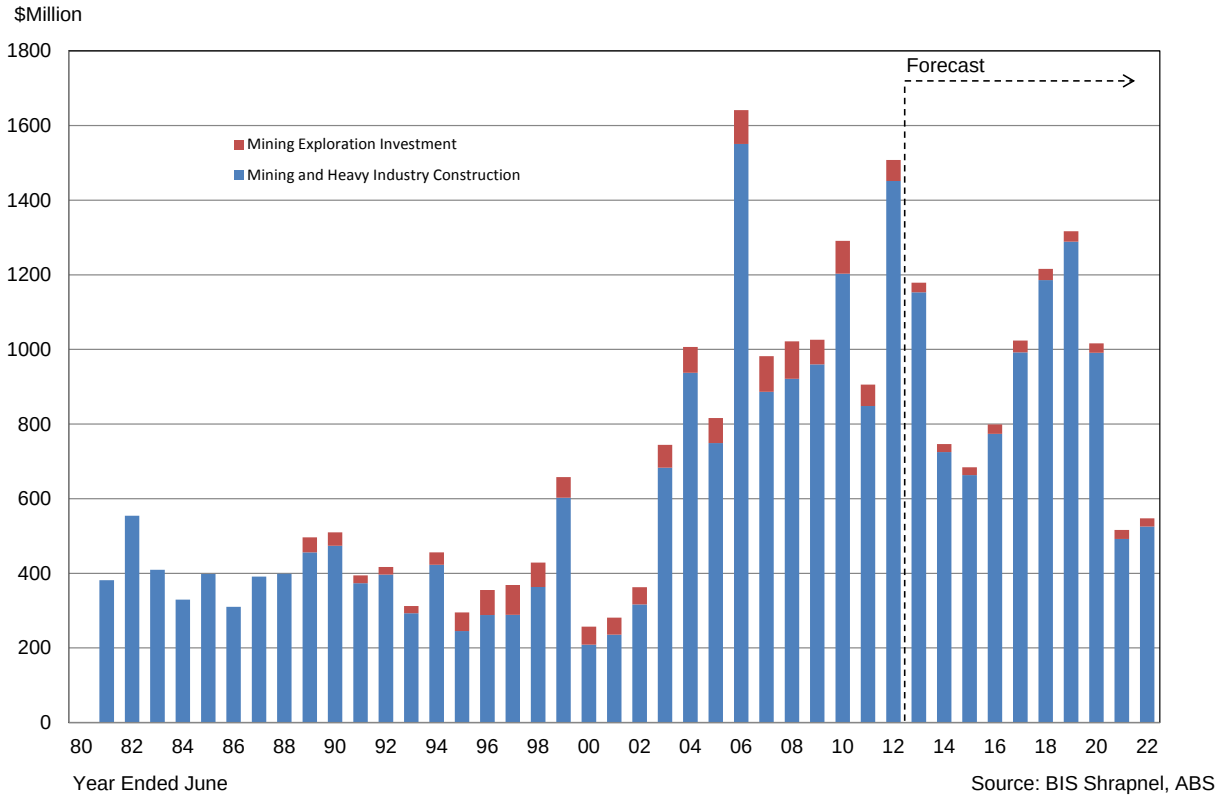
Construction activity is expected to remain fairly strong over the longer term. During the decade to 2025/26, activity will be led by further oil and gas developments in the Gippsland and Otway Basins. There will also be considerable volumes of work in the coal sector, relating to new design requirements (clean coal and sequestration of carbon sources) and clean diesel initiatives.

Oil and gas has been the key driver of mining and heavy industry construction in Victoria in recent years, and this should continue to be the case for the next five years at least. However, the outlook for activity in this sector is been due to existing projects underway, rather than the anticipation of new projects. The development of the Turrum and Kipper fields will generate strong levels of activity out to 2012/13 before dropping off in 2013/14 as construction nears completion on the Turrum project and the first stage of the Kipper development is wrapped up. The second stage of the Kipper field development, scheduled to commence in 2015/16, will ramp activity up again.

Brown coal investment is expected to decline during the forecast horizon with the implementation of the carbon price. Activity is expected to weaken but not stop as strong electricity demand and public funding for 'low emissions' coal technology will help maintain brown coal as important piece of the energy mix for the state. Although unlikely, construction activity in the coal sector could be bolstered in the medium-term by the recent announcement by the Victorian Government of plans to export brown coal for the first time. A tender process is being set up for businesses to mine and process coal from the Latrobe Valley. The implementation of the carbon tax will have a significant influence on this proposal however, as brown coal is such a relatively high emitter of carbon dioxide.

Construction activity in the other minerals sector has been weak in recent years due to levels of investment in exploration. The outlook period is expected to be weak apart from the $282 million Donald Sands project, which is expected to commence construction in 2012/13. This project will generate increased levels of activity in this sector during 2012/13 to 2014/15, otherwise construction activity is expected to be minimal. Investment in gold may pick up in the medium-term as well, due to sustained high gold prices.

Chart 6.4: Mining and Heavy Industry Construction Work Done and Mining Exploration Investment – Victoria, constant 2009/10 Prices



The $6 billion Monash Energy Project has the potential to drive activity considerably higher; however, this project is still in the concept phase and relies on the development of Carbon Capture and Storage infrastructure. It is therefore not expected to commence before the end of this decade. If the technology turns out to be successful, the plant would convert coal into clean diesel, ensuring higher levels of activity through to 2025/26.

6.2.5 Total construction

In Victoria residential building work done has vastly outperformed the rest of the nation over the past few years, peaking at over $13 billion in 2010/11. Activity saw a marginal decline in 2011/12 (-1%), with continued work on some sizeable high density apartment projects (+12%) preventing the total from falling further.

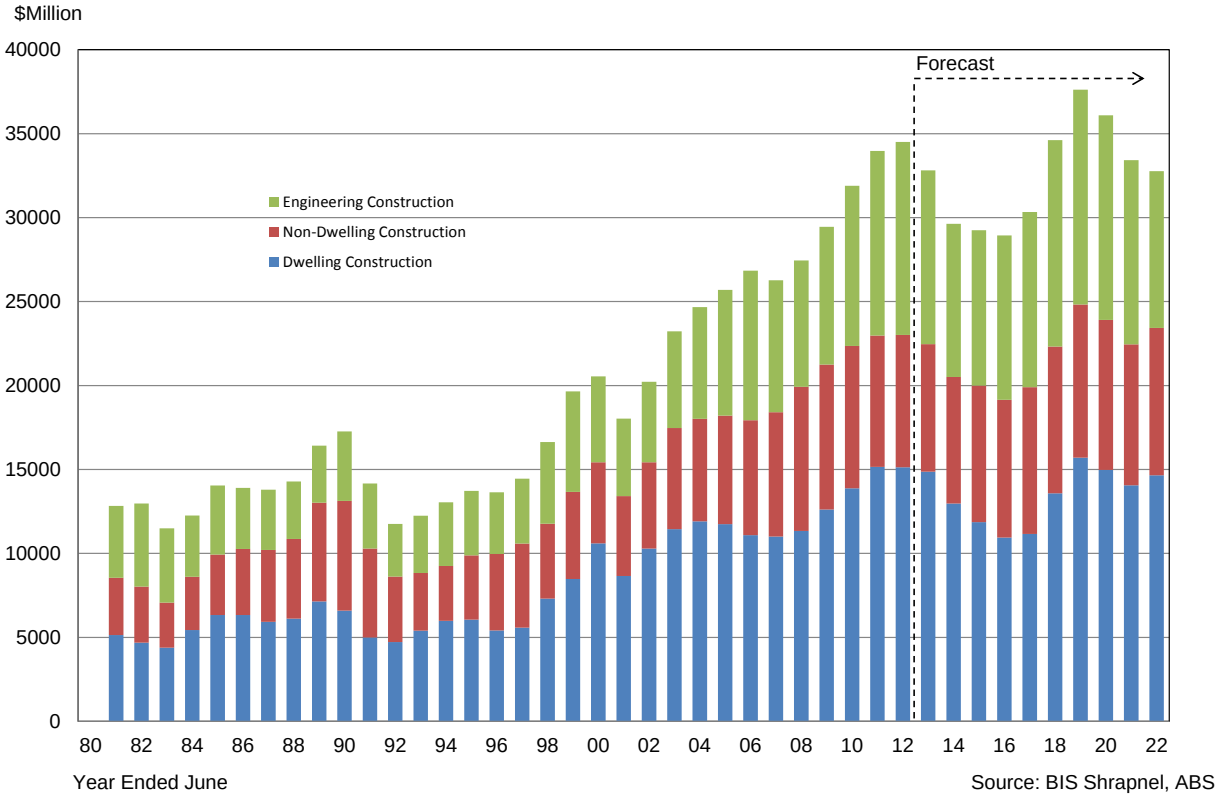
After a period of such strong activity we feel that segments of the Victorian market have moved into an oversupply of dwellings. In contrast to the national result, this will see new residential building work done in Victoria steadily fall out to 2016/17, with the other dwellings segment experiencing the sharpest falls. Growth in Victoria is not expected to return until 2017/18.

BIS Shrapnel forecasts that total non-residential work done will weaken modestly over 2012/13 and 2013/14 before turning around in 2014/15 as economic conditions lift and undersupplies of prime space become more evident in a number of commercial and industrial building sectors. Social & institutional building is forecast to show some improvement later in this period, as the control on public spending gradually eases.

In stark contrast to most states and territories, civil construction activity in Victoria is forecast to *decline* in aggregate over the 2011/12 to 2013/14 period. While, this is mainly driven by the completion of the Wonthaggi desalination plant, it also reflects a trend towards lower activity in

roads and bridges (upon completion of Peninsula Link), sewerage (Eastern Treatment upgrade completion) and, after 2011/12, and mining and heavy industry (mainly the completion of offshore oil and gas works). However, some sectors will move ahead during this period, including railways (Regional Rail Link), harbours (Port of Melbourne expansions) and telecommunications (NBN). As in New South Wales, we expect a broader upswing in Victoria closer to the middle of the decade, as attention once again turns to urban development projects around Melbourne, the ramping of work on stages of the Regional Rail Link, and another strong phase of electricity investment.

Chart 6.5: Total Construction by Category – Victoria
Value of Work Done, 2009/10 Prices



6.3 Forecasts of skilled labour demand

Our outlook for the key determinants of labour demand generally translates into decreasing demand for skilled labour over the next four years. However, acceleration in activity over the subsequent three years is expected to see strong growth in skilled labour demand (see charts 6.6 and 6.7 and table 6.2).

As shown in table 6.2 (which is based on a productivity growth of 1.5 per cent per annum), from an estimate of 2,816 professionals in 2011/12, total skilled labour demand is expected to fall to 2,208 persons in 2015/16 before increasing and peaking at 2,819 in 2018/19 as construction activity strengthens. Total skilled labour demand is then projected to fall to 2,362 persons by 2021/22.

Chart 6.6: Forecasts for Demand for Cadastral Surveyors and Total Surveyors – Victoria

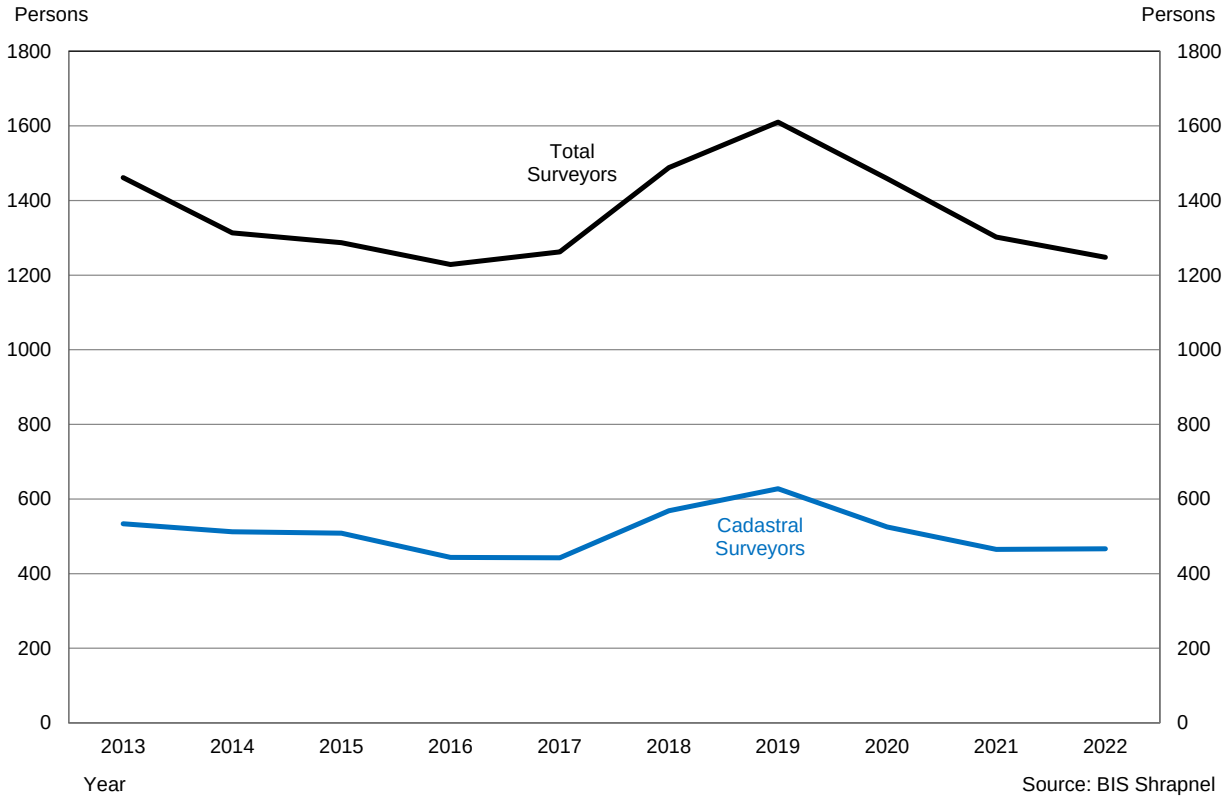
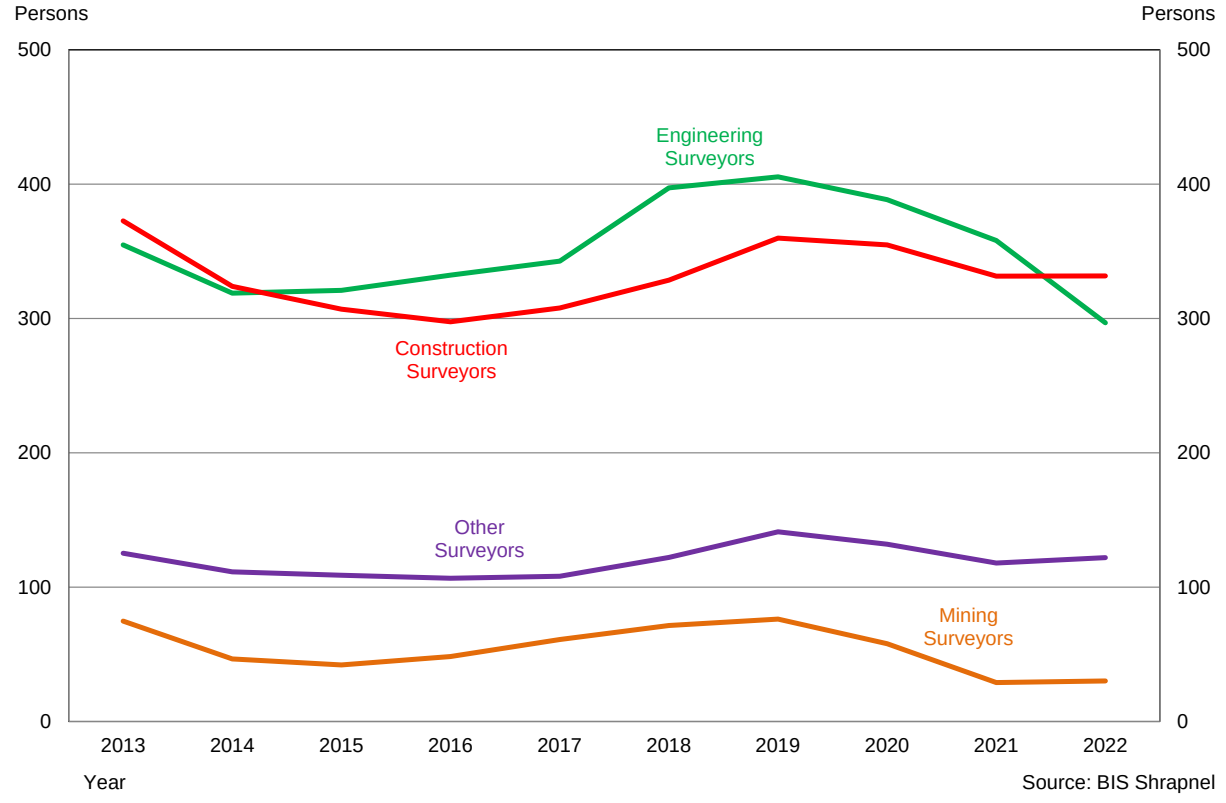


Chart 6.7: Forecasts for Demand for Surveyors by area of Specialisation– Victoria



6.4 Workforce attrition and workforce gap

The total skilled workforce requirement to meet future construction activity is inevitably higher than the labour demand generated by the model given attrition of the existing workforce 'base', primarily through retirement and death (but also through people leaving the workforce for other reasons).

Given the estimated age profile of the Victorian roads workforce — and the assumed likelihood of retirement and death in each age group — we estimate that the current workforce will shrink by around 22 per cent over the next ten years which is similar to the national rate of attrition. The difference between the (declining) existing workforce and total labour demand is the workforce gap.

For Victoria, our expectation is for total skilled labour workforce gap to remain negative (ie in a surplus position) over the first half of the forecast period. The gap is expected to turn positive over the second half of the decade and as mentioned will be driven by:

- Ongoing (and accelerating) attrition of the existing workforce, and
- Generally rising labour demand as construction activity re-accelerates strongly.

By 2018/19, the total surveying skilled labour workforce gap in Victoria is expected to peak at around 427 persons. The presence of positive workforce gap in the second half of the forecast period suggests that skilled labour will need to be drawn into Victoria from other states and/or new supply if forecast levels of end use construction sector activity are to be achieved.

The labour demand, labour supply and workforce gap for surveying and geospatial workforce is presented in table 6.2. The labour demand, labour supply and workforce gap for a select group of specialist occupations are presented in charts 6.8 to 6.13.

Table 6.2: Forecasts for Labour Demand Surveyors and Surveying Related Professionals and Workforce Gap for – Victoria

(Baseline Scenario based on 1.5% labour productivity growth, forecasts as at June)

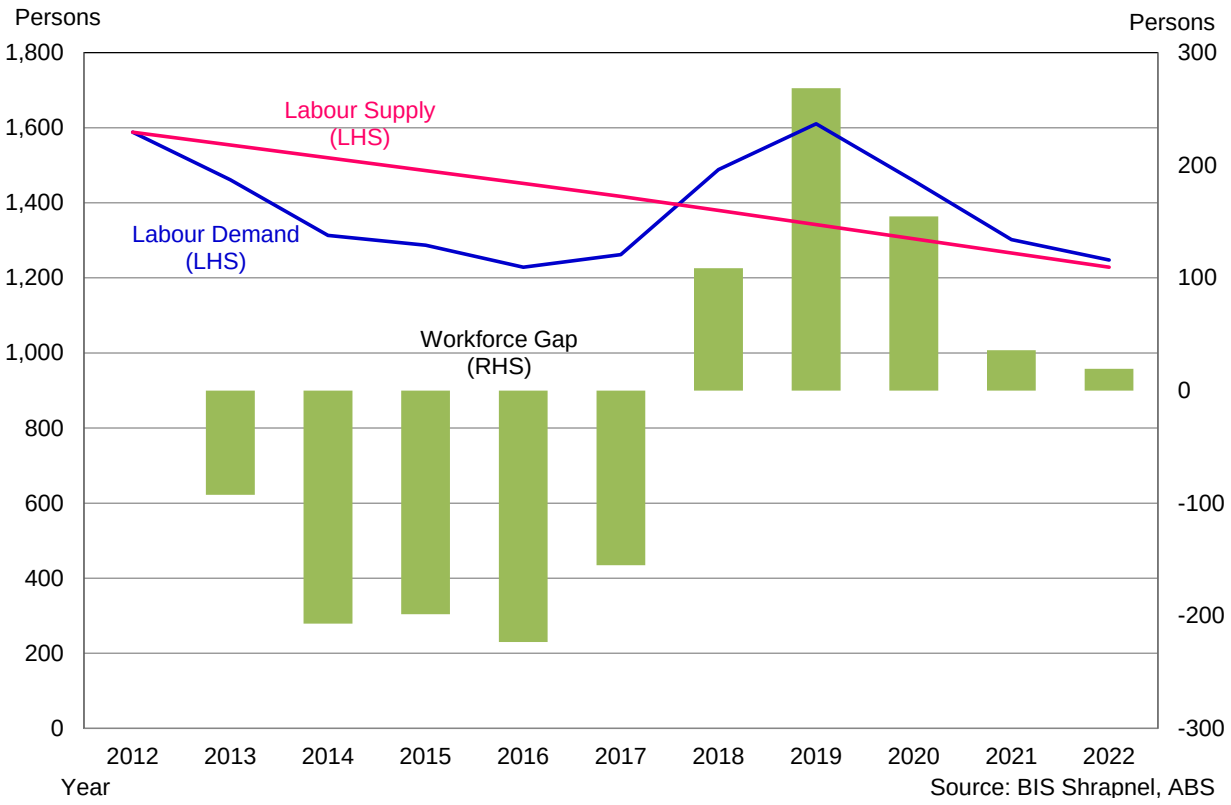
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Labour Demand by Specialist Occupation	Estimate	Forecasts									
Cadastral	592	534	512	508	443	442	569	628	525	465	467
Construction	372	373	324	307	298	308	329	359	354	331	331
Engineering	393	355	319	321	332	343	397	405	389	358	298
Mining	97	75	47	42	48	61	71	76	58	29	28
Other Surveyors	134	126	112	109	107	109	123	141	132	118	122
All Surveyors	**1,588**	**1,462**	**1,314**	**1,288**	**1,228**	**1,263**	**1,489**	**1,609**	**1,457**	**1,301**	**1,246**
Licensed Surveyors	*521*	*470*	*451*	*447*	*390*	*389*	*500*	*552*	*462*	*409*	*411*
Total Spatial Scientists	707	665	592	578	566	574	649	695	653	622	643
Total Technicians	231	222	195	189	185	188	222	232	213	203	210
Total 'Other' Professionals	290	272	243	235	229	236	265	284	268	255	264
Total Skilled Labour Demand	**2,816**	**2,623**	**2,345**	**2,289**	**2,208**	**2,262**	**2,624**	**2,819**	**2,593**	**2,381**	**2,362**
Existing Workforce (a)											
Cadastral Surveyors	592	571	551	530	510	489	469	450	430	410	391
Construction Surveyors	372	370	367	365	362	359	355	350	346	341	337
Engineering Surveyors	393	386	378	371	363	356	347	338	330	321	312
Mining Surveyors	97	95	93	92	90	88	86	84	81	79	77
Other' Surveyors	134	132	130	129	127	125	123	120	117	114	112
All Surveyors	1,588	1,554	1,520	1,486	1,452	1,417	1,380	1,342	1,304	1,266	1,228
Licensed Surveyors	*521*	*496*	*471*	*446*	*422*	*397*	*376*	*356*	*335*	*315*	*294*
Spatial Scientists	707	693	680	666	652	638	619	599	580	561	542
All technicians	231	228	224	220	216	212	206	201	196	191	186
'Other' Professionals	290	284	279	274	269	264	257	250	243	236	229
Total skilled labour	2,816	2,759	2,703	2,646	2,588	2,531	2,462	2,393	2,323	2,254	2,185
Workforce Gap											
Cadastral Surveyors	-	(37)	(39)	(22)	(66)	(47)	99	178	95	55	76
Construction Surveyors	-	3	(43)	(58)	(64)	(51)	(26)	9	8	(11)	(6)
Engineering Surveyors	-	(31)	(59)	(50)	(31)	(13)	50	67	59	37	(14)
Mining Surveyors	-	(20)	(47)	(50)	(41)	(27)	(14)	(7)	(23)	(50)	(49)
Other' Surveyors	-	(6)	(18)	(19)	(20)	(16)	0	21	15	4	10
All Surveyors	-	(92)	(206)	(198)	(223)	(154)	109	267	154	35	17
Licensed Surveyors	-	*(26)*	*(21)*	*1*	*(31)*	*(7)*	*124*	*197*	*127*	*95*	*117*
Spatial Scientists	-	(28)	(88)	(88)	(86)	(64)	30	95	73	61	101
All technicians	-	(5)	(28)	(31)	(30)	(23)	15	30	17	12	24
'Other' Professionals	-	(12)	(36)	(40)	(40)	(28)	8	34	25	19	35
Total skilled labour	-	(137)	(358)	(357)	(380)	(269)	162	427	269	127	177

(a) Existing workforce is generated by adjusting the size of the current skilled workforce for natural attrition rates such as retirements and death. Source: BIS Shrapnel, ABS

(b) Workforce gap is calculated as labour demand less existing workforce. A positive number implies a shortage of labour

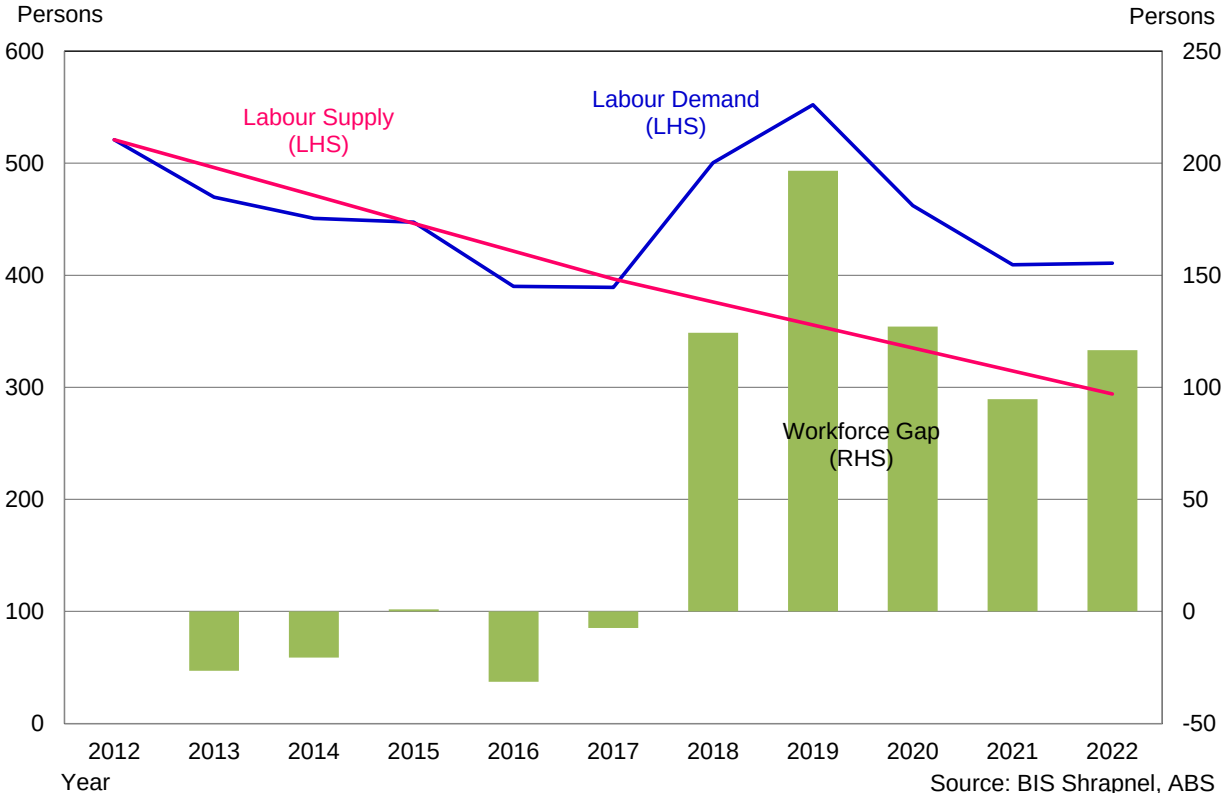
Numbers in brackets imply an excess supply as new supply exceeds the forecast workforce gap.

Chart 6.8: Victoria
Total Surveyors (1.5% Productivity Growth)



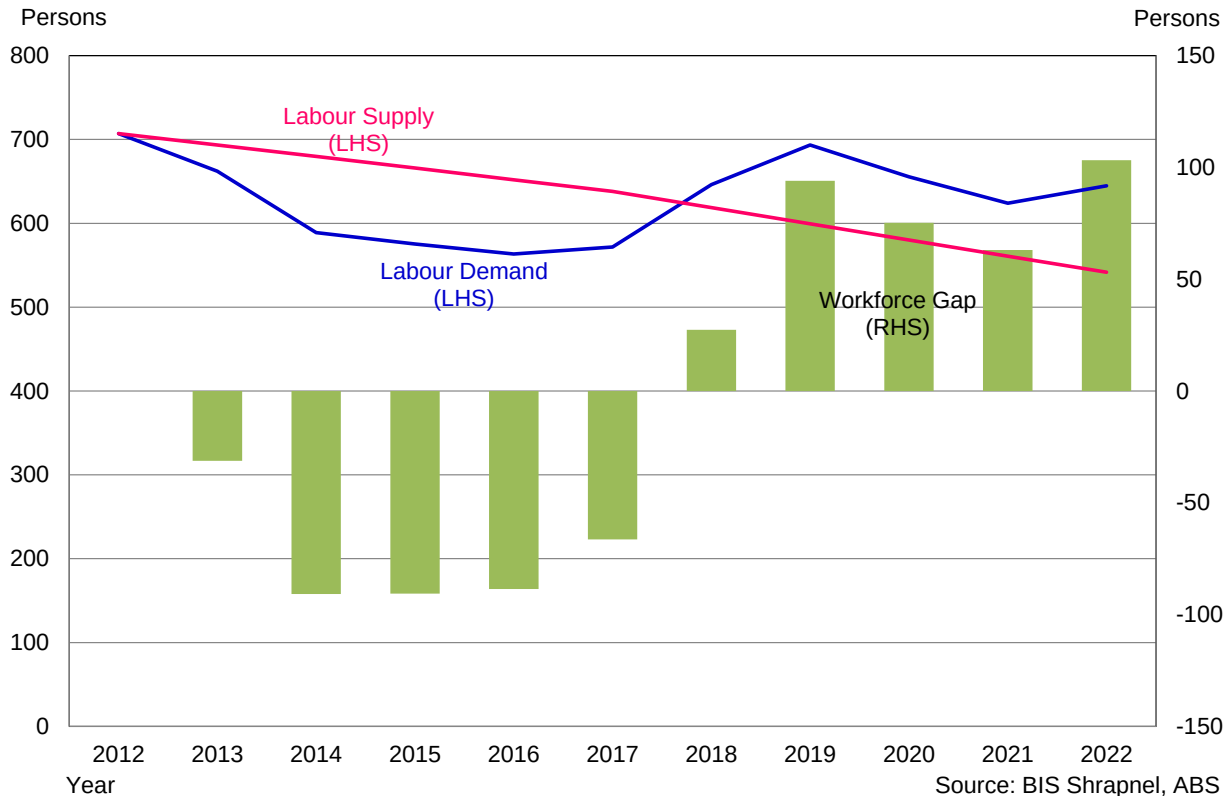
Source: BIS Shrapnel, ABS

Chart 6.9: Victoria
Licensed Surveyors (1.5% Productivity Growth)



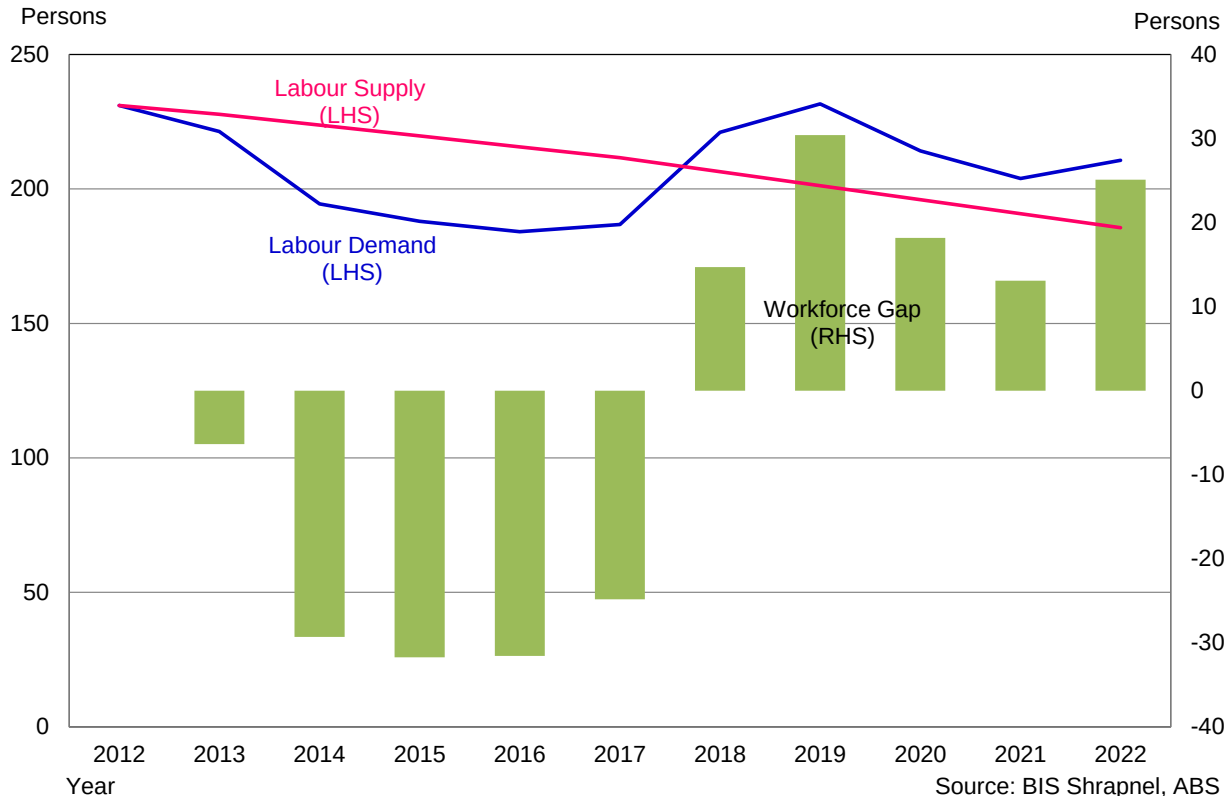
Source: BIS Shrapnel, ABS

Chart 6.10 Victoria
Spatial Scientists (1.5% Productivity Growth)



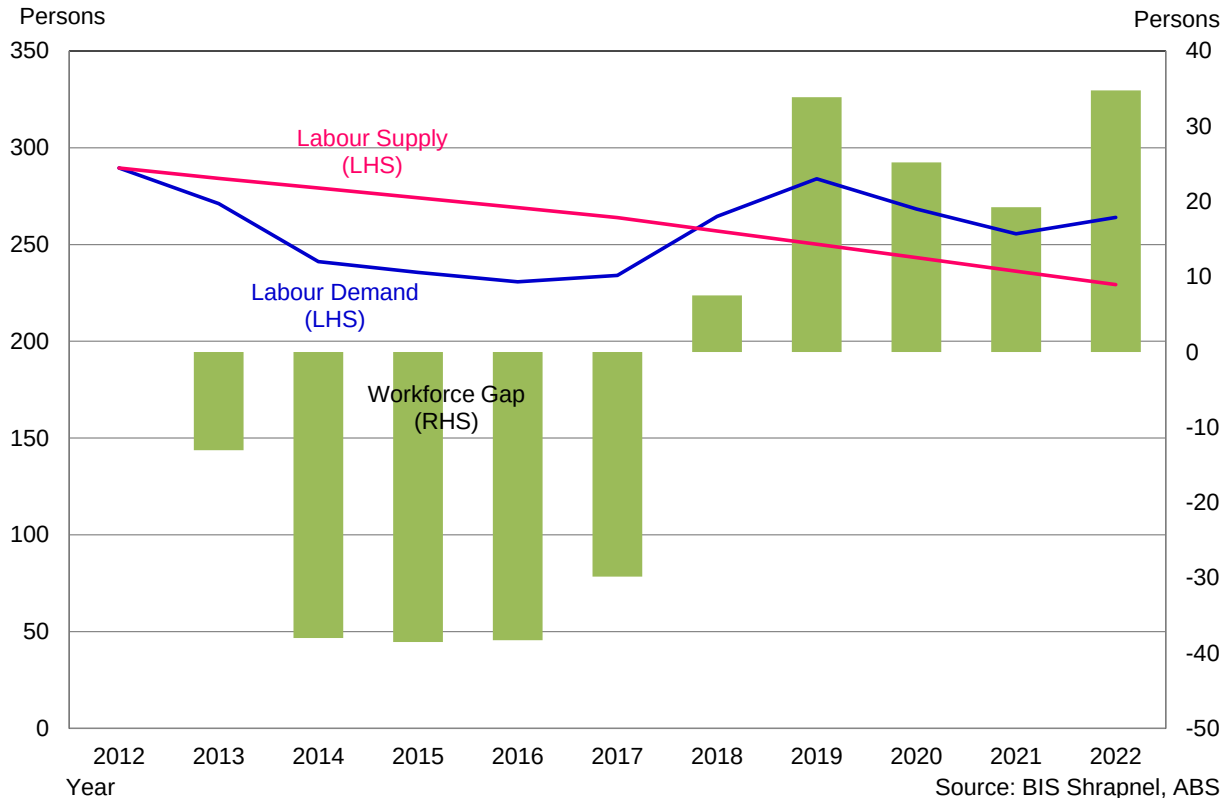
Source: BIS Shrapnel, ABS

Chart 6.11: Victoria
Technicians (1.5% Productivity Growth)



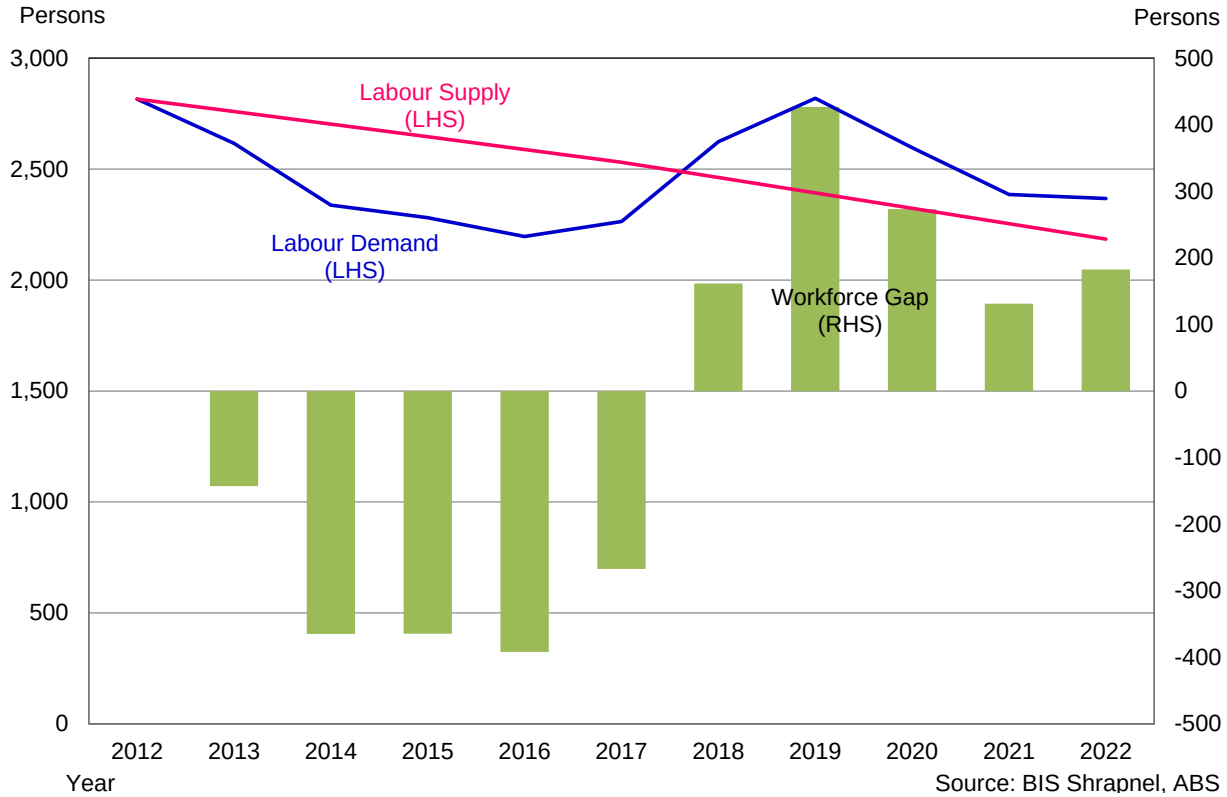
Source: BIS Shrapnel, ABS

Chart 6.12: Victoria
'Other' Professionals (1.5% Productivity Growth)



Source: BIS Shrapnel, ABS

Chart 6.13: Victoria
Total Skilled Labour (1.5% Productivity Growth)



Source: BIS Shrapnel, ABS

CHAPTER SEVEN

Qualitative Results for Surveying Industry Demand Study

7. QUALITATIVE RESULTS FOR SURVEYING INDUSTRY DEMAND STUDY

This chapter presents the results of qualitative research on how surveying firms have changed over the last 10 years and what surveying firms will look like in 10 years time. This chapter is written by Dr Veronica Bondarew, Chief Executive Officer of Consulting Surveyors National.

7.1 Methodology

7.1.1 The Qualitative Survey: Aim and Choice of Methods

Qualitative research has been described as an unfolding model that occurs in a natural setting that enables the researcher to develop a level of detail from high involvement in actual experiences (Creswell, 1994). One identifier of a qualitative research study is the social phenomenon being investigated from the participant's viewpoint. The aim of the qualitative component to the demand study therefore is to study some of the results which have turned up in the quantitative survey conducted by BIS Shrapnel, to a deeper level. The aim is also to bring out some new perspectives and to review them as they were seen by a representative group of 18 consulting surveyors selected across Victoria and NSW. Inspiration has also been sought in previous literature and research on the growth of firms and skills shortages in the surveying profession in both New Zealand and Australia.

7.1.2 Choice of Survey Method

The rationale underpinning this study is the assumption that a more exhaustive analysis and understanding of the factors affecting the demand for surveying skills cannot be carried out *exclusively* through "representative" surveys by sending out questionnaires. Analyses of such factors and processes may more expediently be made by various forms of qualitative methods, including combinations of studies of theories and literature.

It is important that the aim of the survey should determine the choice of method. The choice has to be made among a spectrum of available qualitative methods including phenomenology, grounded theory, ethnography and case studies. Choices can also be made from various combinations of survey methods from representative *population surveys* of *multiple case studies* to the *single case study*. This study has chosen the multiple case study methodology.

By choosing the multiple case study as the method, the aim is to find out whether there is a basis for generalisation by comparing the empirical, detailed results of the research with established theories and the quantitative analysis of the quantitative component of the study.

Although the qualitative method chosen here is not a real case study in the traditional sense, but a series of qualitative interviews, inspiration has still been sought in the methodical approach used in connection with multiple case studies.

The choice of qualitative interviews as a method has opened up the possibility of gradations as well as more profound studies, updated regular interpretations, and specifications of important issues. The combination of the deductive and the empirical inductive methods we call the "the integrative method", with an explanatory and an explorative aim, respectively. The personal interview has also been used to generate ideas, and it has provided room for new fields of study and problems, which the interviewees have been allowed to raise themselves.

It will always be a problem to find the extent to which the results of qualitative interviews can be "generalised", but by standardising the form of semi-structured interviews it has been possible to search for patterns in the respondents' attitudes, opinions, and descriptions of their own behaviour.

7.1.3 The Question Framework and its Development

The dialogue with the 18 consulting surveyors was structured via an interview guide with 5 themes, each comprising a number of specific questions being 14 in total. The themes have been chosen and formulated on the basis of results from the quantitative part of the survey concerning the changing nature of the Australian economy as the context within which the surveying firms are situated. The framework of the questioning is based on the Resource Based View (RBV) of the growth of the firm as proposed by Penrose (1959; 1995) and enhanced by Lockett (2005); Hugo & Garnsey (2005); Teece (1997; 1980). The entrepreneurial literature (Shane (2000); Schumpeter (1961)) provides another theoretical framework for this study. This study proposed that undertaking research on only one of the firm's resources, namely skills, provides a very narrow perspective of the phenomenon. Therefore by taking a RBV, the study has been able to investigate the impact of the external environment on entrepreneurial activity creating the need to adjust resource utility for firm sustainability and growth.

The external market for the surveying profession includes economic activity, government policy, technological change and client needs and expectations. Service provision and therefore skills requirements and organisational structures have been adjusted over the last decade by participating firms to address the changing nature of the external environment. These topics have provided the study with its 5 themes of investigation although economic activity and government policy have been condensed into one theme given their inter dependence. The study has attempted to demonstrate these changes and how they have been addressed by surveying firms. In the process it is expected to identify the critical problems that have provided both threats and opportunities for the participating consulting surveying firms.

7.1.4 The Interview and the Interviewer as Part of the Instrument

An influential factor in connection with an interview is the interviewer. When the analyses try to explore the persons' attitudes, motives, and characteristics, the reliability and validity of the surveys will be influenced significantly by the interviewer's behaviour. This may have a negative and/or a positive effect on the atmosphere and the relationship of trust created when the interview takes place. It is impossible to isolate the influence of the interviewer, and it is not practical, either. To mitigate negative influences the interviews were all undertaken by one person being the CSN CEO who was known to the interviewees by association with the organisation. The qualitative question framework was structured so as to increase the possibility of making a comparison of the 18 interviews. In addition, to promote validity, the interviewees were all promised anonymity to ensure that they were comfortable in expressing their personal views without fear of repercussions.

7.1.5 Validity and Reliability of Qualitative Interviews

An important question in connection with qualitative studies is the evaluation of the validity and reliability of the surveys. The validity can be evaluated on the basis of the soundness of the material which is presented as documentation for the relevance, reliability, and authenticity of the applied methods and interpretations. The validity is therefore a crucial point also in qualitative surveys, because validity is an indicator of whether the areas or questions have been illustrated as intended. For example, there exist possibilities that communication filters and misinterpretations in the dialogue between the respondent and the interviewer may occur. Still it is possible to argue for the view that by a determined effort it is possible to increase the

validity by semi-structured interviews rather than by quantitative surveys. This is due to the fact that there is a chance of assessing whether the question has been understood, and as the interview proceeds, to discuss it in detail, to conclude, interpret, and verify.

In this form of survey, reliability is an indicator of the extent to which it is intended that identical answers can be obtained from the consulting surveyors if the interview should be repeated. Therefore it is often more difficult to evaluate reliability in connection with qualitative interviews, as an exact repetition of the same interview can never be achieved. Reliability problems can also arise when the interview is put in writing. In this survey an attempt has been made to improve the quality of the direct transcripts of tapes by having the interviewer as far as possible transcribe the tape and checking with interviewees with follow up questions. Reliability was also established through the development of a case study protocol, and a case study database (Yin, 1984). The case study protocol included 'table shells' to record data (Miles and Huberman, 1994). Construct validity was established by using multiple sources of evidence, the creation of a chain of evidence, and by having key informants review drafts of the case study. These steps were undertaken to increase the reliability of the qualitative survey to the practical maximum.

7.1.6 Selection of Respondents – The Composition of the Respondent Group

The selection of respondents was based on the need to research the differences in entrepreneurial activity within different structures and geographic locations in an effort to identify the impact of various external environments on consulting surveyor behaviour in a number of geographic regions. This means that they are consulting surveyors in all but one case either running their own business or a director of that consulting surveying firm. Firms were chosen only if they had survived at least 15 years and were therefore able to demonstrate knowledge of the changing nature of the firm over the last decade and provide some discussion on the constraints that may be faced by the profession in the near future.

Firms whose core service did not include surveying were not included in the qualitative interviews. Nor does the survey include the firms which have been closed down. Although covered by the quantitative component of the study, the qualitative study did not investigate the public sector seeing it as responding to different drivers. Although this is a limitation of the study it was not possible under the assigned time constraints. Such research is definitely an area that should be addressed in future research.

The enterprises included in the qualitative survey represent the "representative firm" within their size, structure and geographic location. The representative group consisted of large metropolitan firms with a number of regional branches, medium size firms of 25 – 50 employees, small firms with 15 or less employees and firms without employees where the partners of the firm did all the work. Regions covered in the study included the north coast of NSW, New England, the Hunter Region, central west NSW, metropolitan and CBD firms in both Victoria and NSW and firms working on the border in both states.

The response rate from other states for the quantitative component of the study were below target and were therefore not included in the qualitative component of the study in this instance. The Australian estimates of the research were made possible on BIS Shrapnel background research within the construction industry. Further research to include additional states for qualitative analysis will greatly enhance the information provided in this study.

7.1.7 Identification of Patterns in the Interview Material

For the purpose of being able to identify "generalisable" patterns in these consulting surveyors' attitudes and opinions in connection with the changing nature of the profession over the last decade, a number of themes have been selected, as described in the interview guide. The

interpretation of the interviews has been systematised by reviewing, editing and analysing the 18 interviews in relation to the following themes:

The overarching question – How have surveying firms changed in the last 10 years and what will surveying firms look like in 10 years' time?

- Motives behind the decision to set up in business
- Would you say there has been a change in the business environment since you came into the business?
- What are the core services provided by the firm and have they changed from the initial position?
- What has driven the change in service delivery?
- Has the change meant changes in the skill requirements of your firm?
- Have you found difficulty in finding people with those skills?
- Does the firm have training and development policies?
- Has the clientele changed over the last decade?
- Have you been able to achieve productivity improvements in the last few years and if so, how has this been achieved?
- Can you compare the amount of cadastral work you used to do to the amount of cadastral work now done by your firm?
- Would you say that the work carried out by a cadastral surveyor now is much different to say a decade ago?
- Have you considered changing the structure of the firm?
- Does the firm undertake marketing, strategic planning?
- What do you see as some of the major constraints currently facing surveyors now and into the future?

The identifiable patterns that can be "generalised" in relation to the above mentioned themes are supported by and built up in the report around selected quotations from the interviews, but new and interesting points of view are also presented. Thereby this part of the analysis is also used to generate ideas.

7.2 Limitations of the qualitative study

- The study focuses on the behaviour of surveyors who own or are senior staff in consulting firms. There are many more surveyors working for the public sector and their views on the profession will add valuable insights which are not presented here. Further study on this sector is recommended.
- Only 18 out of a possible 350+ firms were interviewed. Although the qualitative methodology attempts to generalise findings from a small number of participants, it would be interesting to compare additional interviews with a larger population to determine how the views of our 18 firms compare.

- Student choices and perspectives on making the profession attractive to new cohorts of young students would also add insights into why the current academic institutions are not attracting greater numbers of students into their surveying courses. Universities are particularly constrained by government funding models and may therefore be locked into delivery models that are not appropriate to the modern day surveying student. This is another necessary area of study.
- Finally only consulting surveyors from NSW and Victoria have been part of the qualitative study. There are different drivers in regional areas of these states and therefore it follows that the variety of experiences will be even greater on a national scale. It is hoped that this exercise can be extended into other states in the near future.

7.3 Some results of the qualitative survey

The qualitative findings supported the quantitative data collected by BIS Shrapnel. Additional rich data for the 5 themes set out below were derived from the 14 interview questions outlined above.

The findings are presented under the 5 themes outlined in the previous section.

7.4 External environment

7.4.1 Changing business environment

All participants reported that the key driver for the services provided by the surveying profession is the external business environment. Changes in economic conditions such as the period of the GFC impacted heavily on the profession. As expected during periods of tight financial conditions, developers, the key clients of the surveying profession, are forced to reduced activity due to the lack of availability of financial resources and demand for construction products. Government spending in the form of the Education Revolution and Nation Building provided a buffer for a number of firms working on infrastructure projects. However as these projects near completion, work, especially in most regional areas is drying up. Firms reported that since 2008, they have either downsized or are 'treading water' in anticipation of new projects commencing as promised by the NSW government. In Victoria, as the recent State projects also come to completion, most firms have reported a consolidation period with staff departures not being replaced.

Such findings however were not global. In some areas like Orange in NSW, the impact of the GFC has been negligible. Work provided by the local mining works created strong growth in the area both in mining works and in housing activity.

> *"Throughout the 1980s there were two surveying firms in Orange now there are five. They are pretty much fully employed and we often contract work out to each other."*

In addition participants reported that government legislation had impacted decisively on their activity especially in the areas of planning requirements.

> "*Twenty years ago you could almost do a Development Application (DA) on the back of an envelope but now the amount of reporting required for a DA has made it too expensive for most of our smaller clients."*
>
> *"I recall doing an application on a 30 lot subdivision which was a 7 page submission. Now it would have to be a 70 to 100 page submission. That adds a lot of additional cost".*

Onerous planning requirements have impacted on participating firms in various ways. For the smaller firm especially in regional areas work for 'mum and dad' subdivision has mostly dried up.

> *"It is harder and harder for the small private developers to take on the risk of development. We are in the corridor that had plenty of orchard owners looking into developing their land into residential property (with the spread of urban development). They would do it themselves in the past but now it is too expensive for them and a developer will come in and buy 10 orchards and the surveyor will be working on a 400 acre job rather than lots of 40 acres."*

Firms have responding to changing legislative requirements in various ways. Some firms have extended their planning services by employing planning graduates who are fully conversant with changes in planning legislation requirements rather than taking the risk of leaving the work to surveyors in the company. Others focused on infrastructure development and have walked away from doing any jobs that involve DAs altogether.

> *"We try to avoid town planning because these days the town planning laws are so complex that you need to be a town planning expert to deal with any town planning matters."*

In NSW participants also reported the frustration with council engineers still not understanding that NSW surveyors are qualified in doing engineering design work. The need to either get an engineer to sign off on the work or spend time arguing to the validity of the appropriate qualifications but especially the loss of client confidence from such a lack of understanding is not just annoying but can also be very costly. Despite confirmation from past surveyor generals and senior levels of the Department of Planning and lobbying by the relevant Association, the anomaly persists. Again the experience is not global. How the engineering design work is accepted by the council changes from council to council depending often on the relationship the surveyor is able to establish with the planning department within the council and the attitude of the General Manager.

A growing number of firms have used the additional planning requirements as an opportunity to extend the services provided including the addition of planning expertise. Diversifying into service provision to a 'one stop shop' concept was reported by a number of expanding firms.

> *"We have steadily added disciplines to the business including planning experience, home design, landscape and architecture more recently."*

> *"If we weren't in engineering and project management we probably wouldn't have a third of the work we now have."*

Participants explained that the motive behind such a strategy is to mitigate the risk of having 'all the firm's eggs in one basket' and as one sector declines there are opportunities elsewhere. Although it was interesting to note that a number of other firms have actually chosen to work on building loyalty with one or two very major developers for a constant stream of high paid work.

Work Health and Safety (WHS) legislation has also added to the costs of survey work. Although at times the requirements are onerous, the cost is usually factored into the cost of doing the work and there was no pronounced dissatisfaction with the current requirements. The major concern expressed was that some competitors don't price in the cost of WHS and are therefore able to undercut the price for tenders. Several participants noted that unless they had WHS and Quality Assurance processes in place there may be difficulty in obtaining appropriate insurance. In addition any large clients such as RMS, Vic Roads or Sydney Water demand that these are in place before any work will be granted.

In terms of Industrial Relations, apart from the odd case here and there, in the main, participants reported there were no real issues in the profession. Although there had been some wage pressure of the last 5 years this was not considered by all participants to be a bad thing since it raised the profile of the profession as being able to attract new entrants. A stated characteristic of people in the profession was that they hated change and generally stayed in the same job for, in some cases, decades.

> *"If you recruit a country kid who likes playing sport and treat them well, you don't have any industrial relation problems. That's probably one of the good things about the surveying profession. Most of the people who end up doing surveying generally like fitting in."*

> *"I reckon we made this a good place to work. We do a lot of other things besides working here and that's why people stay. We are pretty family based and I have been pretty proactive with the guys doing things like running and riding bikes and that sort of thing"*

7.4.2 Clients

The critical external factor enabling the surveying firm's survival and sustainable growth are their clients. Most firms reported that their initial services included surveying, engineering and planning work. Most firms have diversified in many cases taking on a project management role to meet client needs and mitigate risks of economic activity by being situated in only one sector. The changing nature of the 'client market' has occurred in the last two decades for a number of reasons.

> *"The days when you could sit by the phone waiting for the next job to come in have long since gone."*

Partly the loss of the luxury referred to by the last comment has occurred because of the lack of demand for identification surveys. Requests used to come into surveying offices almost at every change of ownership of a property or every new home that was connected to a bank loan. Banks have preferred to take the risk rather than employ the need for an identification survey and clients not being instructed as to the need for such a survey are not making the phone calls. This was once the 'bread and butter' income for many small firms in the past but has been significantly reduced over time.

Interestingly the 'no employee' firms in the survey confirmed that its clients have not changed a great deal over the years. The partners continue to do a number of identification surveys and with a recent change in dual occupancy laws a significant percentage of all allotments in subdivision have got their DA through dual occupancy. Other bread and butter clients include a variety of council work, railways, road acquisitions and smaller builders mainly for the residential market. These tend to be established clients that generally stay loyal although all public sector clients no longer have the autonomy that they once had to allocate contracts and must go to tender for each job.

All participants agreed that if they were to build their business, it was necessary to find loyal clients. The surveying firm needs to become necessary to the client's existence. However all participants also agreed that clients' expectations had increased dramatically.

> *"Clients are expecting things can be done easily and don't understand that you are not always working just on their work. We used to be able to say, "ok there will be a 5 day delay because of the amendments you want", but now they ask "can you have it done by 12.00 pm today?"*

Several of the participating firms agree that the pressure can be immense and can be very challenging but it also becomes much more rewarding. They agree that some operational issues can be difficult but it is easier to manage a small number of very large clients than having to deal with a great number of small jobs. The pressure is constant.

> *"We just can't say to our client, "You are not going to get your plans or your marks next week because we are too busy". We just have to find a way to do it. We have managed to rise to such challenges by growing our business by an additional 55% in staff numbers. Our client loyalty depends on us getting it right."*

Although the loyalty factor is crucial for continued work, it is not always achievable.

> *"The bigger clients have a project manager who is reporting up in line. The consultants including the surveying firm, is the easy target to blame for something going wrong. There is not as much loyalty as there used to be."*

Cash flow is critical for any business but as pressure on the developer grows and margins are squeezed tighter, the need to choose clients carefully so as to ensure constant cash flow is paramount. Several of the bigger firms reported that they adhere to a classification of clientele from A to D. An 'A' client is generally one of the larger developer clients that pay their accounts within 30 days or sooner. They understand the surveying firm and its business. The surveyors have a clear indication of what the work requires and what their surveyors or engineers have to do. There is regular contact with the directors and owners of the client company who are pleased with the work that the consultant surveyors produce and are happy to continue working together.

> *"Two of us have really done most of the relationship and marketing for the last 10 years. We have our key clients that we basically dedicate a week a year to. We entertain and look after them and make sure that we get their business next year."*

The public relationship (PR) role referred to in the above comment is not one that surveyors generally feel comfortable in. However most of the larger participating firms agreed that given the competitive market, and the waning loyalty factor, if you have a good client, PR cannot be avoided if you want to stay in business. However the smaller firms especially many country firms still resist such PR activity.

A 'B' client is one of the larger construction companies who although they signed a contract that says they will pay within 45 days, do not and there is constant need to chase them for money. The loyalty factor with these clients is reasonably high but the surveying firm can never be sure how long that will last. The 'C' clients are the smaller mum and dad client who pay regularly but their jobs are small and valuable time needs to be invested to guide them all the way through a project because it will most likely be their only construction project. A 'D' client needs to be considered carefully and monitored closely. It is often better to refer them onto someone else if possible.

In summary, the clientele market has changed over the last decade due to the kind of work required and constant pressure of increasing expectations on time and price. Such pressures have created the need for additional activities not generally necessary in consulting surveying firms several years ago such as public relations and client monitoring to increasing levels.

7.4.3 Technology

Schumpeter (1961) argued that technological change provides the basis for the creation of new processes, new products, new markets and new ways of organising, and entrepreneurship is central to this process. Before technological change leads to new processes, products, markets or ways of organising, entrepreneurs must discover opportunities in which to exploit the new technology.

Participants in this study agree that although there have been sweeping changes to the way surveyors do their work because of new technology that has indeed created new process, new products, new markets and new ways of organising, many surveying firms have not found ways to exploit the new technology to their financial benefit.

Among the new surveying technology, Global Positioning Systems (GPS) and one man total stations have made a major difference to the way surveyors produce surveying products. One person can go out and do in one day the work that a 3 man party would do in 2 days 30 years ago. Using a third of the workforce has greatly improved productivity in the field. Furthermore what was measured would then be written into books by hand. When the surveyor came back into the office, the data were all hand produced and hand plotted. Now it's all straight from the instrument into the computer. CAD drafting software and design software have also added to productivity enhancement. There is also no need to upload information because it is now already in the computer and there is no need to do as many field checks as was once required, the instruments quite often check themselves. In addition computers have enabled the maintenance of extraordinary databases which has further enhanced surveyor's capability, productivity and market value. Although costs for new equipment continue to fall, it is still expensive.

> *"We've just taken on a big 3 year job with the Department of Defence. We spent over $30K in upgrading some of our technology to meet the demand for that job. It's taken a year to find a job that will allow us to spend the money to do that".*

Overall the instrumentation that surveyors use is much more sophisticated than it was 10 to 15 years ago. Consequently the plans that are prepared are also more sophisticated and are used by clients and contractors in new and different ways. For instance pegs for road building are a thing of the past. Plans in 3D models are prepared for the road builder and they load it into their GPS machine or their scriber or grader to do the work.

An additional benefit of new technology is the advent of ePlan which allows for the electronic lodgement of plans especially for country surveyors. ePlan has provided many functions that impact on positive cash flow for any business. In addition the SIX View system initiated by LPI in NSW has been described as leading the world.

Although some participants felt that the massive speed of technological change in this profession has peaked, others note that it appears to continue the trend set over the last two decades. They refer to brand new technology with smart phones and the increasing ability to use aerial photogrammetry with drones especially in the mining industry.

It would be expected that such major advances in technology would make a major impact on the demand for surveying skills and indeed many registered/licenced surveyors in the larger companies do not spend much time in the field any more. The work can be carried out by less qualified employees. However although the field work has provided opportunities for greatly enhancing productivity in the field, most participants agreed that there is now a lot more office

work to support the new systems. The digital world requires processes to ensure that it is accurate and equally important that it is up to date. Field work is now so dependent on digital data that processes have to be put in place to ensure that it is current all the time and that it exists in only one updated record. The process is a significant additional cost. The digital world has also meant that small changes to a plan which would take perhaps 5 minutes to rub out and redraw, now requires digital adjustment which can take up to 2 hours. Participants noted that the huge amount of data is not user friendly.

Perhaps the biggest problem with the improved technology is the lack of entrepreneurial perspective. As noted in the first paragraph of this section, the explosion of new technology should be exploited by surveying firms for financial benefit but that has not been the case. The recording and maintaining of data bases which costs time and effort was estimated by one firm to provide a sound return as value add to projects till they found out that other firms who had similar data bases were providing it to the clients for free. Other examples included when savings can be made on speed and efficiency of doing a job, this results in a price reduction to the client. Such price cutting behaviour can only lead to lack of appreciation for the value of surveying work and reduces client expectation of that value. It is difficult to understand such market behaviour and the whole profession suffers. Given the highly competitive current market surveyors are going to extreme lengths to get jobs even though financially this not sustainable and the products that such price cutting establishes can only be inferior.

In summary although there has been some process revolutionising new technology in the market place that have trebled the productivity of surveyors and their employees in the field, registered surveyors in NSW are still in short supply. The ability for less qualified staff to undertake some of the tasks out in the field that surveyors used to do has lessened the impact of the skills shortages that recent literature has discussed. However the checking of data that has been gathered stored and maintained throughout the digital process still requires the services of senior surveyors with a strong underpinning of surveying skills and qualifications. No matter how much technology advances there will still be a need for the human highly skilled professional who will create new ideas, good solutions and provide management skills for those in the profession following in their footsteps.

7.5 Internal changes

7.5.1 Structure

Several factors impacted on the structure of the firms that participated in this survey perhaps based on a combination of personal characteristics together with perceived market forces. A number of the partners in the smaller firms originally had experience in much larger organisations but did not enjoy the lack of control. Others saw the expansion of management issues and time spent in meetings and other organisational activity required in structures with lines of command as not what they wanted to do which was solving surveying problems.

> *"Less people to look after and less business management required. We see each other in the office every day rather than having meetings maybe once a month in other towns. Financially we seem to be better off than we were as a group."*

> *"We are open to offers and to being taken over but this is a good size for us. We have been in bigger organisations but we are more comfortable and have more control in this structure."*

> *"We looked at geographic expansion and we had a strategic plan to becoming multi-disciplinary but the areas we were considering to expand into were ultra-competitive and we could not make the numbers work. Same with becoming a multi-disciplinary firm, it would have been a backward step causing a lot of headaches."*

In direct contrast, growing, diversified firms felt that,

> *"Smaller companies are drying up over the next 5 to 10 years and the big companies are merging and operating a wide range of services."*

Others expressed financial freedom by becoming part of a very large organisation that spread their risk and provided them with a more secure future by having established systems in place especially in terms of financial management. Their house was no longer under the bank's control and they did not need to concern themselves about selling the business when the time came for retirement. In such a large national organisation they also welcomed the opportunities to perhaps work for a few hours a week rather than retiring from the profession all together. Although such opportunities could also be available in a smaller firm, the rewards could not be as good. In addition it was noted that surveyors as a general rule are fitter than the general population because of their work and their sporting orientation and therefore they can be expected to be around a lot longer providing services to the community although it may be within shorter hours.

Others have merged to solve skills problems. For instances in some cases firms merged to acquire necessary missing skills so a firm with a surveyor partner and another with an engineering partner joined to establish a multi-disciplinary firm that has been very successful due to the merger and no problems of missing skills during a time that was seen as experiencing severe skills shortages.

Although one partner stated that,

> *"People go into surveying for the love of it not to make a fortune."*

Others said that they went into business to create wealth and were focused on growth. Their focus was on servicing large clients that are service driven and do not mind paying for a better product. Five year plans include mergers and take overs in areas where large projects are expected to be situated. In such situations, due diligence to establish cultural fit, can be critical. There is always the potential risk of a firm driven by the 'love of the work' joining a firm that is driven by growth to clash badly.

Firms that had successful experience with expanding resources through mergers and acquisitions have found that they are more likely to experience a smooth transition with like-minded companies rather than setting up in opposition. An additional problem with expansion into several regional areas occurs when a regional area/s goes into a down turn and regional headquarters needs to carry them. However diversification strategies provide staff with the opportunities to move around and do a variety of work without having to change jobs.

Growing firms recognise that they need to address the issue of keeping staff and making sure that they can service their clients. Combining those two objectives, structural strategies include share options for deserving staff. Not all firms are able to do this. Some owners state that they would have trouble having to share decision making responsibilities with their staff. Again there is that issue of control. Others recognise that generation Y and those that come after do not have the same loyalty ideals that previous generations had and if they are really entrepreneurial they will not want to stay around for a wage. The strategy to provide shares for such employees ensures that many years of investment in the training of intelligent employees is not lost and there is a built in commitment from the employee by the fact of ownership. This strategy has further benefits for the owners of the firm who may be willing to sell larger and larger segments of their shareholding as they get older and will not need to find a buyer for the whole firm in one go which is a problem expressed by a number of participants in the study for many surveyors who are trying to sell their business in the current market.

In summary, surveyors are not a homogeneous group of professionals. Their work orientation colours their expectations of the services they provide which does not augment well for any industry body trying to bring change to the industry.

7.5.2 Skills

All participants indicated that they had had problems recruiting new skilled staff especially registered/licensed surveyors. But to extrapolate the sourcing difficulty with a breakdown in the system is a little simplistic. All firms with skills shortages demonstrated some very inventive strategies to overcome their difficulties.

In some of the bigger firms in both states, senior members of staff volunteered to assist with teaching programs in universities teaching surveying degrees. Such a strategy provided them with access to students, especially country students before they graduated.

Other firms recruited from Otago University. With the local universities on average producing only 5% of demand, immigration has become a fall back strategy. Participants reported that NZ graduates were an excellent source of skills because they were willing to work over their summers while still at university and fitted in very well. Also it was possible to ask them if they had friends that wanted a job and a good choice of CVs would arrive to choose from. The down side however was that at least 50% of these NZ graduates got home sick after 2 to 3 years and returned home. Participants also reported that they had employed other nationals who had migrated to Australia from the Philippines, Iran and Nigeria. Although like most migrants they were hard workers, it took several years to bring them up to speed in language and Australian standards. A very few did reach registration although in one instance as soon as he received registration, the employee went to work for the mining industry and all that training was lost to the surveying firm. It would not appear that a major campaign to attract overseas surveyors could be an immediate solution given the years of training that is required to bring them up to standard even though such a strategy would assist in reducing the pressure on any technical pressures.

The extent of the surveying skills shortage problem tended to be modified by geographic location. Firms in Metropolitan Victoria were currently rationalising their human resources but this was coming off a very active base over the last 5 years. Shortages were experienced which were beginning to reduce project opportunities. The tighter market conditions have reversed this position. The Sydney Metropolitan firms reported similar difficulties in attracting skills to their firm however expectations were that there were imminently greater difficulties ahead. Currently casuals are sometimes employed to assist with work in the short term. Country areas in both states experienced the biggest difficulty in attracting new staff.

> *"It's not just finding the appropriate skilled staff. You have to find a job for their partner and pay the transfer costs. If that person does not eventually fit in or moves on it can be a very expensive exercise."*

> *"Attracting registered surveyors to Orange is just about impossible. Even though we are very busy and Orange is a very beautiful rural city, they say to me, isn't it cold in winter? They prefer to get a job somewhere in the north preferably on the coast even if there is not as much work."*

Regional surveying firms report that they continue to advertise the possibility of doing a Gap year with the firm to HSC students. They will also provide assistance if the person wants to go on with gaining qualifications in surveying. They have found some success with such strategies but are desperate for TAFE and university courses that provide flexible delivery of courses to reduce costs and keep the country student in the country where they prefer to be.

In one case it was found that environmental scientists provided the answer.

> *"Environmental scientists are adaptable. They are willing to learn, they don't mind being out in the field because they have more versatility than an engineer or a town planner and they have a technical aptitude for surveying."*

In response to the lack of available of skills in the market place, all firms provided training and development to up skill their employees at all levels.

> *"University does not teach the person the job you only learn that when you get out so the learning doesn't stop for 10 to 15 years."*

Strategies to provide training include moving employees to various jobs and sectors of the firm so that they develop a broad range of skills.

> *"Every firm and every employee should have at least two or three skill sets. It is important to have a multi-disciplinary focus to satisfy the client's needs and also have control of the outcomes and the quality of work."*

For field hands and technicians there is the opportunity to attend TAFE courses and for graduates there is supervision and mentoring assistance for registration or licensing for those that would like to move to the next level which takes at least two years but usually much longer. Unfortunately not all graduates aspire to undertake the registration process and some of the participants lament that they have employees that are excellent surveyors but without registration cannot do the final signing off on projects which legislation requires. In house training also takes place for new equipment and other perceived skills shortages within the firm.

In some cases, firms have not gone out to the market to find new surveyors in the traditional sense.

> *"We have never advertised for a surveyor. Rather than hire someone, the acquisition took place. Since then we have attracted others without too much effort."*

Most owners of surveying consulting firms have understood that they need to supplement their surveying skills with management, especially financial management skills and have undertaken additional courses especially in business management. In larger firms with divisional structures management training has also been undertaken to assist skill development.

> *"Surveyors are technical people. They love to solve the technical problems but with promotion they need to manage people and learn to delegate but they often find that difficult to do."*

In summary, all participants reported that they had problems in filling positions especially for registered surveyors however they had all undertaken a number of strategies including working longer hours and hiring casuals for peak periods to maintain the sustainability of their business. The demand for registered surveyors is an integral part of national development. A lot of contracts specify signing off by a registered/licensed surveyor. Maintenance of the integrity and absolute accuracy of the cadastre also underpins the need for the surveying profession. How this demand can be met given the current lack of profile and inability to attract new participants is another area of research that is urgently needed.

The break-up of technicians, field hands, planners etc. within each business was developed in the quantitative component of the study and was not repeated in this segment.

7.6 Future constraints

The profession of consulting surveyors consists of very highly skilled people who provide critical skills for national development. The most quoted constraint for the sustainability of the profession is the lack of commercial perspective within the surveying population. Two main aspects of the commercial process have been highlighted. These are marketing and pricing.

Some firms understand the concept of marketing and include their profile and brochure with a quote for a tender. They support local sporting teams and have well developed websites and promotion strategies. But for most surveyors it is not a skill that comes easily.

> *"If you do good work and no one knows that you do good work it is pointless. We try and get our senior people to make a call to their clients at least once at the beginning of the year. But it does not come naturally to them."*

Being a relatively small professional group there have not been the funds to hire marketing professionals to promote the profession in a similar fashion to the accountants and the surveyors have attempted to promote the profession themselves. It follows that because marketing does not come naturally to surveyors, this could be the very reason that they have had such problems promoting the amazing profession that occupies their working lives. In Victoria this problem has been addressed jointly by the industry through the establishment of a Surveying Taskforce managed by a marketing company and has seen a growth in numbers of students applying for courses at RMIT. The Victorian experience has demonstrated that for the profession to improve its profile and promotion to a sophisticated young market, professional marketing assistance needs to be on a national scale. Otago University in NZ has reported that student application numbers for surveying degrees are consistently higher following marketing campaigns. Also Curtin University in WA reported that following a marketing campaign by the mining industry, student applications for surveying degrees increased. The profession will not go away, the country's national development and basis of economic financial structure depends on it. As the numbers of professionals cannot meet the demand for their skills national development opportunities are and will continue to be lost. This is not a problem for surveyors. It is a national problem.

The second most quoted constraint also reflects a lack of promotional focus. Price under cutting has made the ability to grow a surveying business very difficult. Financial benefits from efficiency and productivity gains are passed onto the client instead of being used to grow the business. Price fixing is illegal and the Guide to Fees once published by the relevant Associations, have been banned by the ACCC. Somehow the message that getting the job at unsustainable levels is very short sighted and only addresses the immediate problem needs to be addressed by the profession. Keeping that client is of no value because they now expect the unsustainable price but because it is only sustainable with an inferior product no one benefits.

But again this is not an issue to be solved by the individual surveying firm. Local councils are among the clients that have been instructed to accept the lowest price regardless of the product. The individual firm cannot address this issue. It needs to be dealt at higher levels.

Other constraints noted are the threat of commercialising the Land and Property Information (LPI) and the possibility of non-registered surveyors undertaking cadastral work. But these are political issues for the future. Surveyors have generally been very good in working with government and lobbying their politicians and these issues will be addressed as they arise but the immediate problem of a skills shortage is an issue that needs attention immediately.

The quantitative analysis of demand for surveyors demonstrates that the perceived shortage is manageable for the a few years but will become critical in a few years as construction plans in all sectors are ramped up. Proactively addressing the imminent surveying skills crises cannot be left to the individual surveying firm. Only collaborative action on a national scale will provide a solution.

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APPENDIX A

Survey Questionnaire

CSN Skills Demand Study 2011/12 to 2021/22 - Skilled Workforce Data Collection Survey

Please enter details in white cells

Where you see a downward arrow next to a box, please click on the downward arrow and choose response from the drop-down list

However, before you start, you should **ensure** that you have 'enabled all macros' in Microsoft Office Excel.
The instructions to enable macros are provided below:

For Microsoft Office Excel 2007

1. Click the Microsoft Office Button 
2. Click Excel **Option** and go to **Trust Center** category
3. Click on **Trust Center Settings**
4. Click on the **Macro Setting** category
5. Choose option "**enable all macro settings**" and click ok.

For Microsoft Office Excel 2010

1. Go to tab "**File**"
2. Click on "**Option**" category
3. Go to **Trust Center** category
4. Click on **Trust Center Settings**
5. Click on the **Macro Setting** category
6. Choose option "**enable all macro settings**" and click ok.

IF YOU ARE USING MICROSOFT OFFICE EXCEL 2010, PLEASE ENSURE THAT YOU ENABLE EDITING AS WELL BEFORE YOU BEGIN

1. Please provide the size of the current skilled workforce by qualification within your firm or organisation:

	Technicians Without formal qualifications	Technicians With formal qualifications (eg. Certificate/Diploma)	Graduates With a Bachelor degree - not licensed or endorsed	Graduates With a higher degree (Masters, PhD) or licence/registration
Surveyors				
Spatial Scientists				
Other Professionals				

2. Please provide the size of current skilled workforce by specialist occupation (ie surveyors, geospatial scientists, technicians and other professionals) and by age group within your firm:

	15-24	25-34	35-44	45-54	55-64	65+	**Total**
SURVEYORS							
Cadastral Surveyor							**0**
Construction Surveyor							**0**
Engineering Surveyor							**0**
Mining Surveyor							**0**
Other Surveyors							**0**
Total Surveyors	*0*	*0*	*0*	*0*	*0*	*0*	***0***
(of which Registered/Licensed Surveyors)							**0**
GEOSPATIAL SPECIALISTS							
Spatial Scientists							**0**
TECHNICIANS							
Surveying Technician							**0**
Spatial Science Technician							**0**
Total Technicians	0	0	0	0	0	0	**0**
OTHER PROFESSIONALS							
Planners							**0**
Environmental Scientists							**0**
Engineers							**0**
Others							**0**
Total Other Professionals	0	0	0	0	0	0	**0**
Total of defined skilled workforce	**0**	**0**	**0**	**0**	**0**	**0**	**0**

3. Please provide the average number of retirements by specialisation and by age group per annum over the last three years (ie from 2009/10 to 2011/12):

	15-24	25-34	35-44	45-54	55-64	65+	**Total**
SURVEYORS							
Cadastral Surveyor							**0**
Construction Surveyor							**0**
Engineering Surveyor							**0**
Mining Surveyor							**0**
Other Surveyors							**0**
Total Surveyors	*0*	*0*	*0*	*0*	*0*	*0*	***0***
(of which Registered/Licensed Surveyors)							**0**
GEOSPATIAL SPECIALISTS							
Spatial Scientists							**0**
TECHNICIANS							
Surveying Technician							**0**
Spatial Science Technician							**0**
Total Technicians	*0*	*0*	*0*	*0*	*0*	*0*	***0***
OTHER PROFESSIONALS							
Planners							**0**
Environmental Scientists							**0**
Engineers							**0**
Others							**0**
Total Other Professionals	*0*	*0*	*0*	*0*	*0*	*0*	***0***
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**

4. Please provide the average number of redundancies by specialisation and by age group per annum over the last three years (ie from 2009/10 to 2011/12):

	15-24	25-34	35-44	45-54	55-64	65+	Total
SURVEYORS							
Cadastral Surveyor							0
Construction Surveyor							0
Engineering Surveyor							0
Mining Surveyor							0
Other Surveyors							0
Total Surveyors	*0*	*0*	*0*	*0*	*0*	*0*	***0***
(of which Registered/Licensed Surveyors)							0
GEOSPATIAL SPECIALISTS							
Spatial Scientists							0
TECHNICIANS							
Surveying Technician							0
Spatial Science Technician							0
Total Technicians	*0*	*0*	*0*	*0*	*0*	*0*	***0***
OTHER PROFESSIONALS							
Planners							0
Environmental Scientists							0
Engineers							0
Others							0
Total Other Professionals	*0*	*0*	*0*	*0*	*0*	*0*	***0***
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**

5. Please provide the number of new hires by area of specialisation and by age group in 2011/12:

	15-24	25-34	35-44	45-54	55-64	65+	Total
SURVEYORS							
Cadastral Surveyor							0
Construction Surveyor							0
Engineering Surveyor							0
Mining Surveyor							0
Other Surveyors							0
Total Surveyors	*0*	*0*	*0*	*0*	*0*	*0*	***0***
(of which Registered/Licensed Surveyors)							0
GEOSPATIAL SPECIALISTS							
Spatial Scientists							0
TECHNICIANS							
Surveying Technician							0
Spatial Science Technician							0
Total Technicians	*0*	*0*	*0*	*0*	*0*	*0*	***0***
OTHER PROFESSIONALS							
Planners							0
Environmental Scientists							0
Engineers							0
Others							0
Total Other Professionals	*0*	*0*	*0*	*0*	*0*	*0*	***0***
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**

6. Please specify the sector from which you sourced your new hires in 2011/12:

	New Graduate	From Private Sector	From Public Sector	Total
Number of new hires during last 12 months by sector				0

6b. How would you rate the current level of difficulty in filling surveying and geospatial positions?

Minor difficulty - Managed to fill vacancies, but dissatisfied with the pool of candidates overall (with respect to size of pool, qualifications of candidates, etc)
Moderate difficulties - Able to fill vacancies only after extensive effort (eg. after readvertising a position)
Severe difficulties - Unable to fill vacancies satisfactorily

Surveyors

Technicians

Graduates

Registered/Licensed or endorsed by Surveyors Board

Higher degree

Please click on downward arrow and choose from drop-down list

Spatial Scientists
Technicians
Graduates
Higher degree
Other Surveying related occupations

6C. Do you perceive there is a skills shortage in surveying and geospatial occupations?

6D. If yes, do you expect the skills shortage to worsen over the short to medium term (ie over 2013 to 2016)?

7. Do you intend to hire more staff in 2012/13?

If yes, please provide the number of expected new hires in 2013/2014?

8. Characteristics of your firm:

8A. Are you a sole proprietor?
Are you a partnership firm?
Are you a company?

Please provide the number of employees employed by the firm

Is your main office located in a city or metropolitan area?
If yes, please specify major city?
If no, please specify regional area?
Please specify the number of branches of the firm

8B. Are you a Government Department?
If yes, please specify if you are a local council, state or federal government department?

9. Changing composition of firm or organisation workforce over recent decades:

Please provide a distribution (%) of your workforce by qualification during the 1990s:

Unskilled Diploma University Registered Surveyors

Please provide a distribution (%) of your workforce by qualification during the 2000s:

Unskilled Diploma University Registered Surveyors

Please provide a distribution (%) of your current workforce by qualification:

Unskilled Diploma University Registered Surveyors

9b. What percentage of your skilled workforce was trained within your state?

10. What are the core services offered by your firm or organisation?

Cadastral Construction Surveying Engineering Surveying
Geodetic Project Management Planning and Development
Mapping Mining Surveying Environmental Surveying
GIS Certification Infrastructure Design
Other

11. What client services do you think your survey practice or organisation will need to offer in the next 5 to 10 years?

12. What skills will be required for each type of new future service?

13. Improvements in technology have lifted the productivity of surveyors and spatial scientists immensely over recent decades. Do you foresee technological change and productivity improvements over the next 10 years?

If Yes, what areas do you see an increase in productivity?

If No, please provide some reasons?

14. Do you see any impediments to your practice due to the attitude, processes and relationships that you have with local and state Government?

If Yes, do you see a need for staff to have training or relevant experience when dealing with local and state Governments?

15. Can you identify potential constraints impacting on the viability of consulting surveying firms in the future?

16. To what extent is competition from large broad-based building and professional services firms (eg consulting engineers) an impediment for the sustainability of consulting surveying firms?

17. Please provide the contact details of your business:

Business Name

Address

Contact person and telephone number

Thank you for completing the survey

Instructions to send questionnaire:

1. Save the questionnaire on your computer as an 'Excel Macro-Enabled workbook'.

2. Enable all macros in Microsoft Office Excel (instructions to 'enable macros' are provided at the beginning of the survey).

3. Click on 'submit by email' option below and press 'send' in Microsoft Outlook'.

Alternatively, save the file on your computer and send the questionnaire as an attachment in an email to KSen@bis.com.au

If you encounter any problems, please call Kishti on (02) 8458 4251 or Catherine on (02) 8458 4254