



**MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT**
HĪKINA WHAKATUTUKI

Future demand for construction workers

Projections from the National Construction
Occupations Model

2nd Edition





ABOUT THIS REPORT

Published July 2017

By Ministry of Business, Innovation
and Employment

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ISBN 978-1-98-853502-9 (print)
ISBN 978-1-98-853503-6 (online)
Published July 2017 (second edition)
Published July 2016 (first edition)

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1 Highlights

- The nationwide increase in construction investment, expected to peak at \$42 billion in 2020, will increase demand for construction-related occupations to at least the end of 2022.
- Employment in construction-related occupations (estimated at 515,000 employees for 2016) is greater than employment in the construction industry (estimated at 245,600 for March 2017), because many people with construction-related skills are employed in other industries.
- **Across New Zealand**, demand for construction-related occupations is projected to increase by 11 per cent between 2016 and 2022, by approximately 56,000 employees (including working proprietors) to a total of 571,300. Occupations that are expected to experience the largest growth to 2022 include *plumbers* (15 per cent), *electricians* (14 per cent), and *civil engineering professionals* (12 per cent).
- **Auckland** has the largest construction workforce requirements in New Zealand, requiring just over 190,000 construction-related employees by 2022. Overall construction-related employment levels increase by 18 per cent between 2016 and 2022, i.e. by just over 28,000 employees. Occupations that are expected to experience the largest levels of growth over the period include *plumbers* (32 per cent), *project builders* (27 per cent), and *carpenters & joiners* (27 per cent).
- **Waikato and Bay of Plenty** construction-related employment demand increases by an overall 15 per cent (11,000) to 90,000 employees by 2022. The occupations that are expected to experience the largest levels of growth include *plumbers* (19 per cent), *project builders* (18 per cent), and *electricians* (18 per cent).
- **Wellington** construction-related employment demand increases by 9 percent (4,200), to just over 52,000 employees by 2022 in order to sustain the projected levels of construction activity. Occupations that are expected to experience the largest levels of growth include *project builders* (14 per cent) and *truck drivers* (10 per cent).
- **Canterbury** has ongoing and substantial construction-related workforce requirements due to the earthquake rebuild, but from 2021 demand for these occupations is expected to slightly decline by 1 percent (1,200), to a total of 83,000 employees. Occupations that are expected to experience the largest declines include *project builders* (down 15 per cent), and *carpenters & joiners* (down 14 per cent). Demand for *truck drivers* will rise (up 5 per cent).
- The **National Construction Projections web tool** enables anyone to examine and compare the projections for specific construction-related occupations to 2022, in each of the specified regions. The web tool is located on <http://constructionprojections.mbie.govt.nz>

2 Introduction

This report presents key projections from the updated *National Construction-related Occupations Model* (NCOM). The objective for the NCOM is to help the construction industry plan for their future workforce needs, by providing information on the occupations which are expected to be in demand to the end of 2022.

In 2015 the Ministry of Business, Innovation and Employment (MBIE) commissioned Market Economics Ltd to develop the NCOM, building on the 2014 Auckland Construction Industry Occupations Model and the Canterbury Earthquake Workforce Model. The first set of NCOM projections for the 2015 – 2021 period were summarised in the *Future Demand for Construction Workers* report released in July 2016. The updated NCOM presents occupations forecasts at the national and regional level, to the end of 2022.

The NCOM also expands on the recent *Short-term Employment Forecasts 2017 – 2020* and the *Occupation Outlook 2017* reports prepared by MBIE, by projecting across a broader range of career opportunities within the construction sector.

The NCOM uses information from the 2013 Census, and the *National Construction Pipeline Report 2017* (the fifth Pipeline report). The NCOM translates the construction investment projected in the Pipeline report, including residential, non-residential and infrastructure, into estimates of employment growth in construction-related occupations. Appendix 1 to this report provides further technical details on the structure of the NCOM.

The NCOM produces forecasts for construction-related occupations across all New Zealand industries, and is not limited to the construction industry. This is because many other industries demand construction-related skills (for example, manufacturing employs substantial numbers of machinists, and the transport industry employs many drivers), and occupations which are important for construction are not included in the industry (for example, most architects are classified in the professional services industry).

The focus on construction-related occupations is appropriate because our education and training systems are based on developing skills in professions and trades, and are not tied to particular industries. Similarly, the immigration system is designed to attract skilled workers throughout our economy. Experience has also shown that people with construction-related skills tend to flow in and out of other industries, as market conditions change.

The resulting occupations projections have the potential to benefit the construction industry, education and training providers, local and central government, and individuals. The projections can help inform workforce planning, course provision, policy development, and career decisions.

3 Growth in construction



This section outlines information on the increase in construction activity and employment in the construction industry.

3.1. Increase in building activity

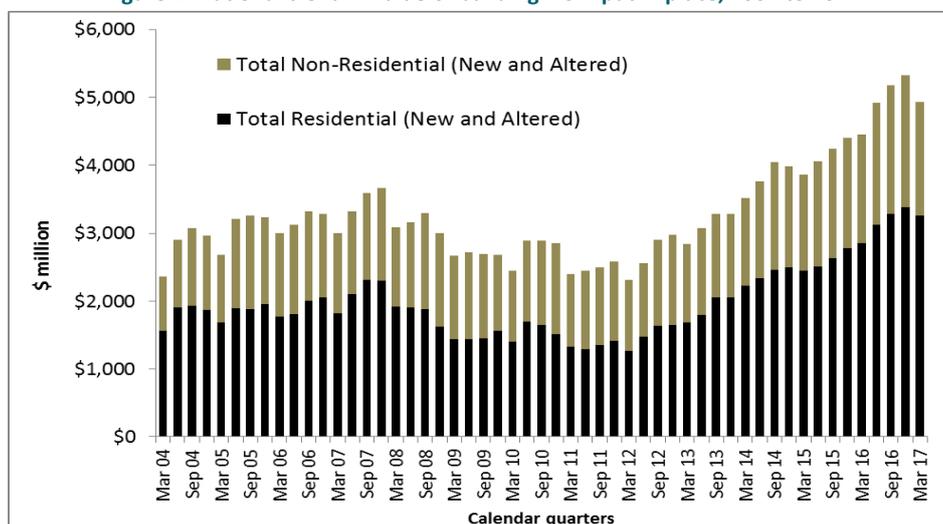
New Zealand’s construction industry is experiencing substantial growth. Auckland housing and infrastructure investment, the Canterbury (including Kaikoura) earthquake rebuilds, Wellington earthquake strengthening and major roading projects, are examples of the demands on New Zealand’s construction and related industries.

For the March 2017 quarter compared with the March 2016 quarter:

- Residential building activity rose 14.2 per cent, to \$3.3 billion.
- Non-residential building activity rose 5.1 per cent, to \$1.7 billion.

Overall, the value of building work in the March 2017 quarter was at its highest level since the series began in late 1989. During the year ended March 2017 the construction industry contributed 6.1 per cent of New Zealand’s Gross Domestic Product. Construction was New Zealand’s second-most valuable goods producing industry, after manufacturing.

Figure 1: National trend in value of building work put in place, 2004 to 2017



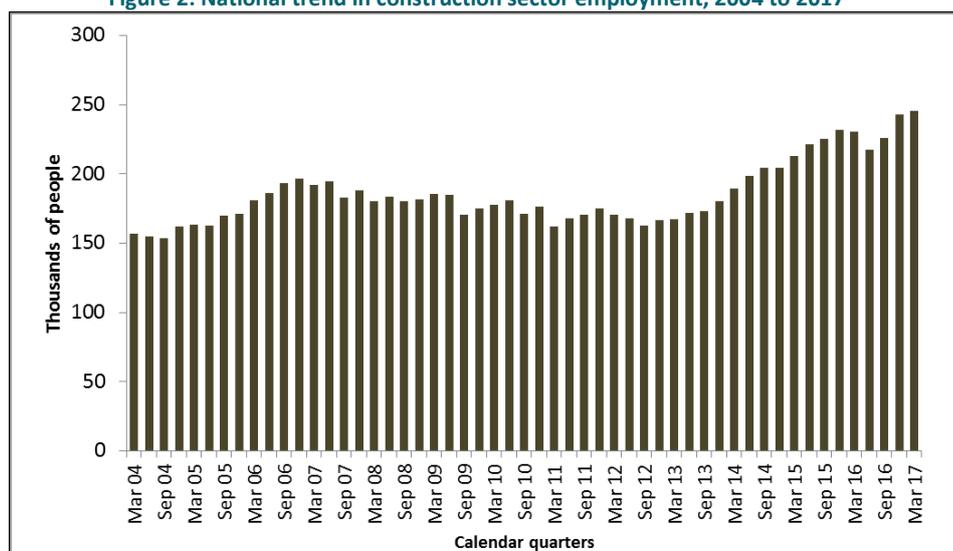
Source: Statistics New Zealand Building Activity Survey

3.2. Construction leads employment growth

The construction industry is a large contributor to annual employment growth, with 15,300 more people employed in the industry over the year to March 2017. The estimated total of employment in construction was 245,600 people for the March 2017 quarter.

During the year to March 2017 the largest share of construction employment growth was in the Auckland region, with 6,800 more people employed during the year. Wellington also contributed to employment growth in the construction industry (up 4,300). Construction employment in Canterbury reduced by 5,000 people over the year to March 2017, as the earthquake-related rebuild passed its peak.

Figure 2: National trend in construction sector employment, 2004 to 2017



Source: Statistics New Zealand Household Labour Force Survey

3.3. The construction sector

The construction sector, as it is defined in this report, has three components:

The construction industry, which includes many core construction workers (such as plumbers) but also many occupations, such as accountants, that do not require construction-specific skills. This is measured by the Household Labour Force Survey.

Construction-related occupations, includes the main labour supply sources for the construction sector, but many of whom are not working on construction activities. For example, truck drivers might be working directly for construction firms, working on construction activities but for transport firms, or working outside the construction sector (for example milk tanker drivers).

Construction workers are those workers who are in construction-related occupations and are working directly on construction activities. It includes, for example, architects, who nearly all work on construction activity but are mostly employed in the professional services industry.

Market Economics Ltd has estimated that, of the 515,000 employees and working proprietors working in construction-related occupations during 2016 (see section 5.3 of this report), approximately 202,000 were working in construction activities.

4 Construction investment

The *National Construction Pipeline Report 2017* (the Pipeline) provides a view of national construction investment to the end of December 2022. The information in the Pipeline is prepared by BRANZ and Pacifecon (NZ) Ltd.

The Pipeline data is a compilation of known projects and economic forecasts of building and construction. The nature, value and timing of these projects are estimated using industry knowledge. These estimates form the demand pressures that translate into demand for workers within a range of occupations. The demand pressures are represented by region and the type of construction activity.

The values in the National Construction Pipeline report are expressed as *Gross Fixed Capital Formation*. Gross fixed capital formation is a measure of the net new investment by producers on durable real assets, such as buildings, motor vehicles, plant and machinery, roading, and improvements to land. In measuring the outlays, sales of similar goods are deducted. Land is excluded from gross fixed capital formation.

4.1. National outlook

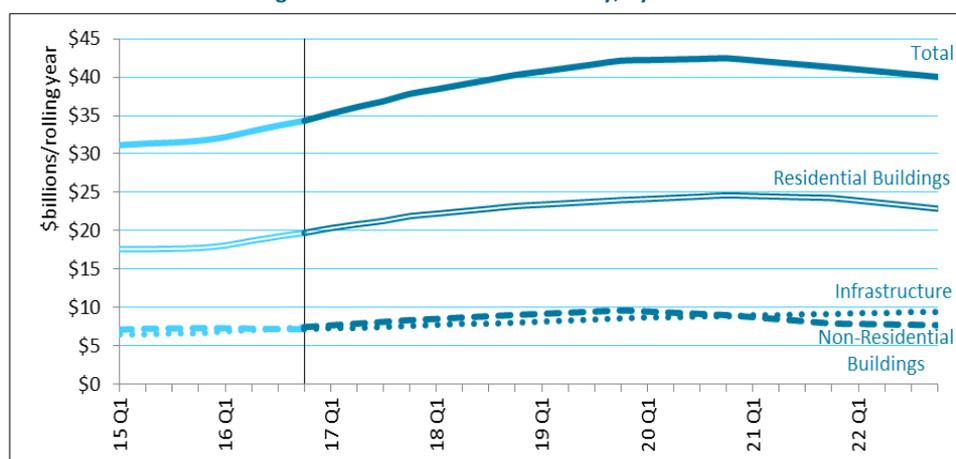
New Zealand continues to construct more by value than ever before, with current levels of recorded activity reaching \$34.3 billion for 2016 and continuing to climb. Total value increased by 8 per cent in 2016, and is expected to grow another 23 per cent to a peak of \$42.4 billion towards the end of 2020. The annual value of all construction nationally is forecast to remain above current elevated levels until the end of 2022.

Residential investment increased by 11 per cent in 2016 to \$19.7 billion, and is expected to increase a further 24 per cent before levelling out in 2020 at around \$24.5 billion.

The value of non-residential building increased by 12 per cent in 2016 to \$7.4 billion, and is forecast to increase by another 29 per cent to a high of \$9.6 billion in 2019.

The value of infrastructure activity decreased by two percent in 2016 to \$7.2 billion, and is then forecast to increase by 32 per cent to reach \$9.5 billion in 2022.

Figure 3: All construction nationally, by value



Source: BRANZ/Pacifecon

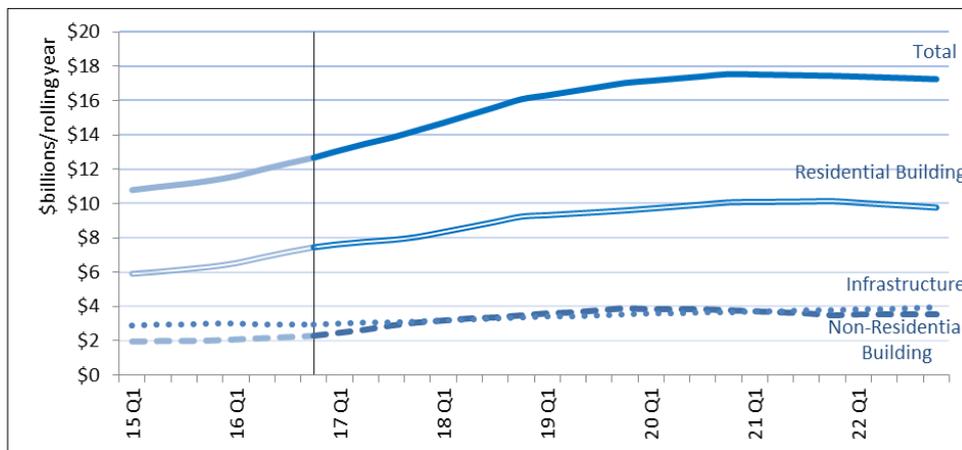
4.2. Auckland

Auckland dominates the national demand for building and construction. In 2016 the total value of construction investment in Auckland increased by 12 per cent, to a total of \$12.7 billion. This increase in value is forecast to continue and peak in 2020 at \$17.5 billion, and to remain at this elevated level for the remainder of the forecast period.

In 2016 the value of residential construction increased by 18 per cent, compared to a 4 per cent increase for all non-residential construction.

Residential building investment is forecast to increase by 36 per cent to a peak of \$10.1 billion in 2021. All non-residential building is forecast to increase by 69 per cent to a peak of \$3.9 billion in 2019.

Figure 4: All construction in Auckland, by value

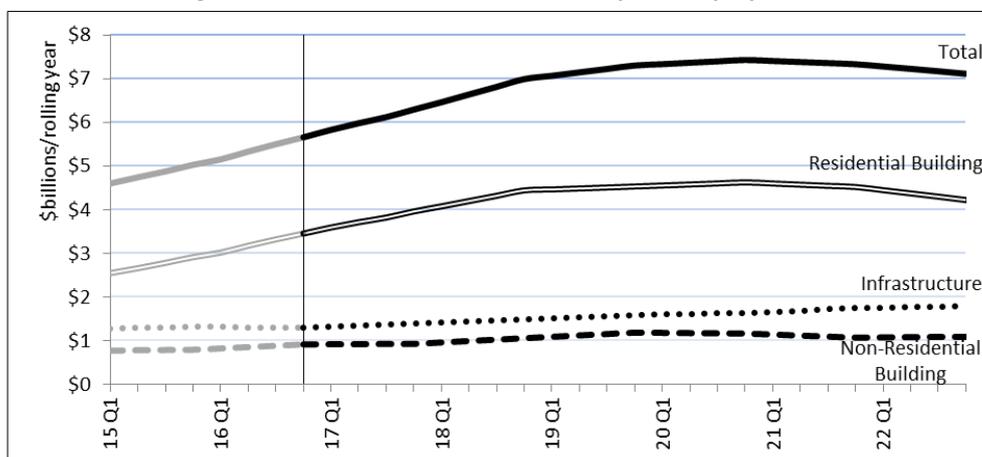


Source: BRANZ/Pacifecon

4.3. Waikato and Bay of Plenty

2016 was a year of further significant growth for the Waikato and Bay of Plenty regions, with an increase of 19 per cent in residential building by value. The total value of all building is expected to peak in 2020 at \$7.4 billion. Residential activity is forecast to remain elevated above 2017 levels to the end of 2022. Non-residential activity is expected to be relatively stable over the period.

Figure 5: All construction in Waikato and Bay of Plenty, by value

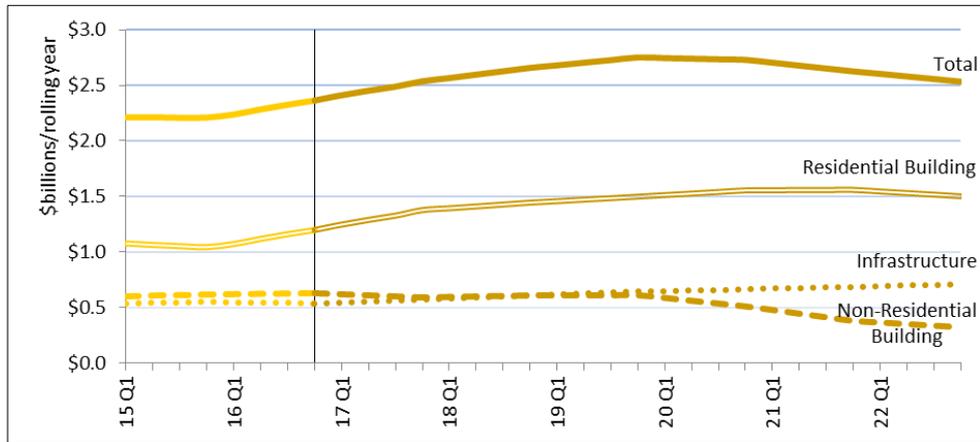


Source: BRANZ/Pacifecon

4.4. Wellington

The total value of all construction investment in Wellington is expected to increase by 16 per cent from \$2.4 billion in 2016 to a peak of \$2.8 billion in 2019, and then to remain above 2017 levels until the end of 2022. Residential building investment is expected to increase 30 per cent, from \$1.2 billion in 2016 to a peak of \$1.6 billion in 2021.

Figure 6: All construction in Wellington, by value



Source: BRANZ/Pacifecon

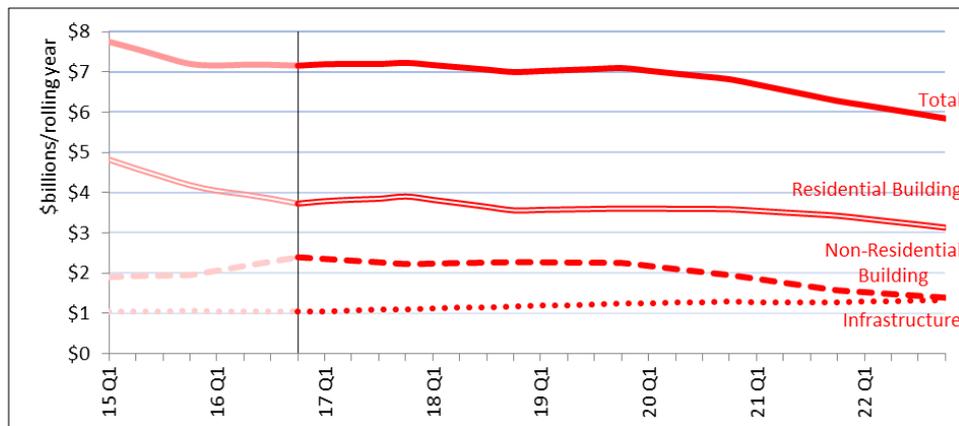
4.5. Canterbury

In Canterbury construction investment has reduced from the peak levels of 2014, with total construction investment forecast to remain around \$7.1 billion to the end of 2019. Residential activity reached its peak at the end of 2014, and is forecast to decline to \$3.1 billion by 2022.

Non-residential building activity has increased over the past few years and peaked at \$2.4 billion by the end of 2016, before slowly reducing to \$1.4 billion by the end of the forecast period.

Infrastructure investment is projected to grow from \$1.0 billion in 2016 to a peak of \$1.3 billion in 2022.

Figure 7: All construction in Canterbury, by value



Source: BRANZ/Pacifecon

4.6. Rest of New Zealand

For the rest of New Zealand, the annual value of all building and construction is forecast to rise from \$6.5 billion in 2016 to a peak of \$7.9 billion around 2019. Non-residential building activity is forecast to slowly increase throughout the forecast period to a peak of \$1.7 billion in 2019.

Residential building investment is forecast to rise by \$0.8 billion, from \$3.9 billion in 2016 to plateau at around \$4.7 billion from 2019 to 2020, before declining to \$4.1 billion by 2022.

Figure 8: All construction in the Rest of New Zealand, by value

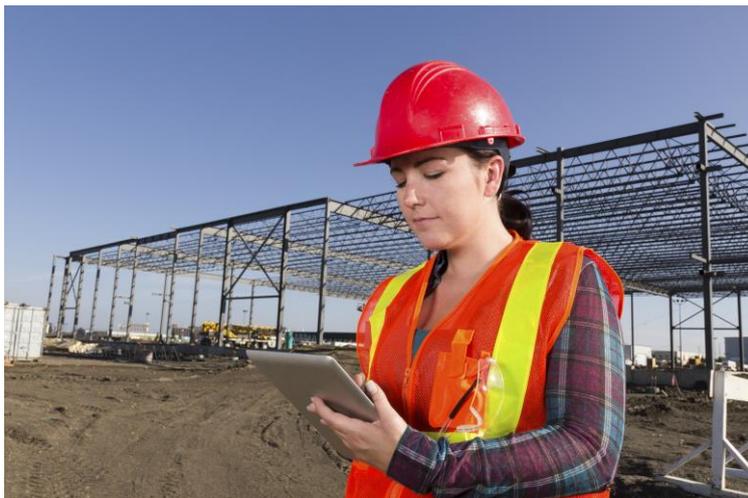


Source: BRANZ/Pacifecon

4.7. Summary

The *National Construction Pipeline Report 2017* forecasts that construction activity will continue to increase across most of New Zealand, with particular growth in residential building in Auckland, Hamilton, Wellington and Tauranga.

5 The national construction occupations model



5.1. Description

The National Construction-related Occupations Model (NCOM) has been developed by Market Economics Ltd. The NCOM is an extension of the Pipeline. The NCOM translates the construction investment projected in the Pipeline, both residential, non-residential and other construction, into estimates of employment growth by occupation.

The resulting NCOM projections for construction-related occupations are much broader than employment in just the construction industry, as many other industries employ people with construction skills. The NCOM adopts *occupation by industry profiles* derived from the 2013 New Zealand Census. This captures industry at the Australia and New Zealand Standard Industrial Classification (ANZSIC) level, and occupations at the Australia and New Zealand Standard Classification of Occupations (ANZSCO) level, for each regional council. The model identifies 62 construction-related occupations from the total of 1,022 ANZSCO occupations.

The employment projections are measured in Modified Employee Counts (MECs). MECs include both employees and working proprietors. This measure is used because the construction industry is known to employ large numbers of self-employed people and sole operator businesses.

Combining the National Construction Pipeline Report 2017, along with 2013 Census employment data, provides an outlook of employment and estimated growth within each occupation for the next five years up to the end of 2022.

The NCOM projections can be modified to reflect the different crew mixes for the construction industry in Auckland and Canterbury. Crew mix refers to which occupations make up a labour force (for example, builders, plasterers, and labourers). Specific crew mixes were analysed for Auckland and Christchurch because previous labour force modelling had been done in these regions.

The default crew mix for the occupations projections is based on the 2013 Census. The Census crew mixes are specific for each region, and so reflect the demand for different skills that each region has.

The key concepts and economic tools that underpin the NCOM are explained in greater detail in Appendix 1.

5.2. Web tool

The National Construction Projections web tool enables an easy search of the forecasts for the construction-related occupations, by each of the regions specified in the National Construction Pipeline 2017, to the end of 2022. The web tool is located on <http://constructionprojections.mbie.govt.nz>

5.3. National-level projections

This section summarises the top ten construction-related occupations for New Zealand, and for each of the regions based on the 2013 Census crew mix.

Auckland has the largest construction workforce demand in New Zealand, requiring just over 190,000 employees and working proprietors by 2022.

Canterbury currently has a large workforce demand due to the earthquake rebuild (including Kaikoura infrastructure and housing), but from 2020 this falls below the levels in Waikato & Bay of Plenty. Wellington requires the smallest construction-related labour force of the regions, needing just over 52,000 employees to sustain the projected levels of construction activity in 2022. The 2018 Census findings will enable a check of the accuracy of the NCOM projections.

A comparison with the previous NCOM projections shows that Auckland and Waikato/Bay of Plenty occupations demand will further increase to 2022. Canterbury demand will be sustained until 2020, before starting to reduce from 2021. Wellington demand will be largely unchanged.

Figure 9: Construction-related occupations employment by region, 2013 - 2022

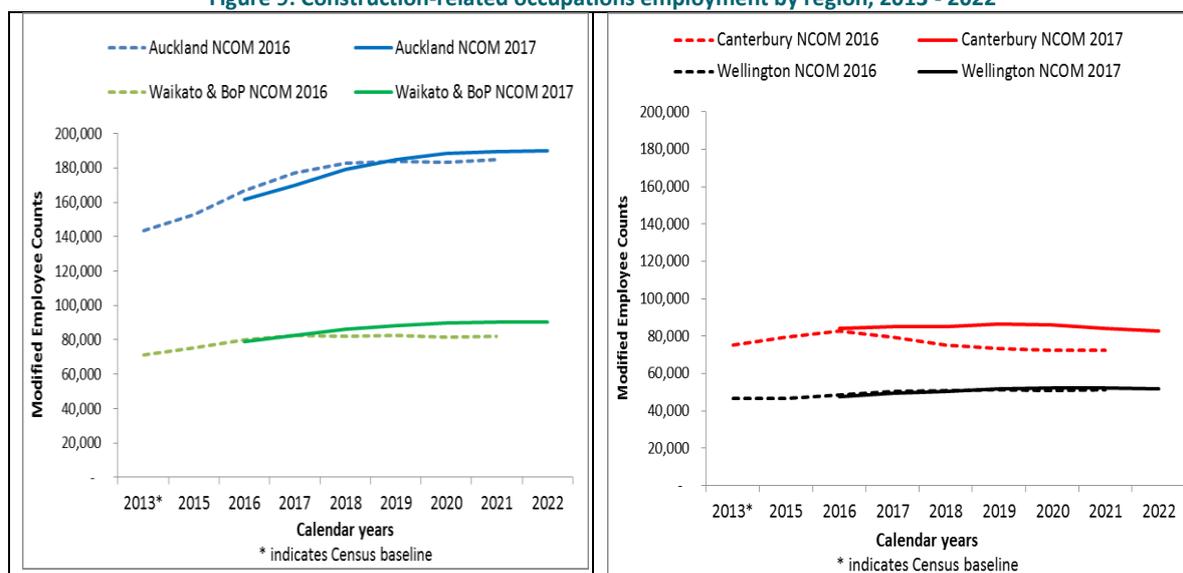


Table 1: Construction-related occupations employment by region, 2013 - 2022

Note: Based on 2013 Census crew mix

	2013	2016	2017	2018	2019	2020	2021	2022
<i>Auckland Region</i>	143,391	161,685	170,084	179,175	184,676	188,392	189,447	190,084
<i>Waikato & Bay of Plenty</i>	70,963	78,854	82,501	86,297	81,976	88,484	89,892	90,273
<i>Wellington</i>	46,727	47,824	49,443	50,622	51,657	52,118	52,107	52,079
<i>Canterbury</i>	75,316	84,249	85,366	85,269	86,515	85,969	84,192	83,020
<i>Total New Zealand*</i>	469,318	515,190	537,351	553,492	567,063	573,295	572,585	571,339

*This figure is not the sum of the four key regions, as it includes other New Zealand regions which are not specifically projected in the National Construction-related Occupations Model.

5.4. Total New Zealand

Across New Zealand demand for construction employees is projected to increase on average by 11 per cent between 2016 and 2022. Occupations expected to have the largest increases to 2022 include 'Electricians' (14 per cent), 'Plumbers' (15 per cent), and 'Project Builders' (12 per cent).

The overall increase in construction-related occupations is approximately 56,000 between 2016 and 2022. Over the period to 2021 an additional 33,000 employees will be required to meet demand, when compared to the previous projections prepared in 2016.

Figure 10: Total New Zealand key construction-related occupations, 2016 - 2022

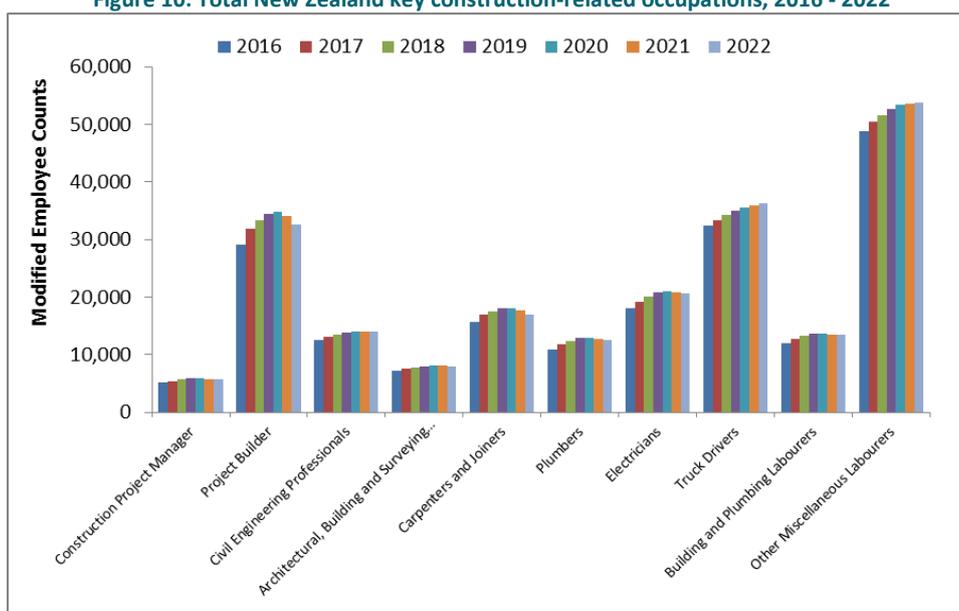


Table 2: Total New Zealand top 10 construction-related occupations, 2016 - 2022

Note: Based on 2013 Census crew mix	2016	2017	2018	2019	2020	2021	2022	% change, 2016 - 2022
Construction Project Manager	5,106	5,451	5,706	5,910	5,925	5,796	5,714	12%
Project Builder	29,056	31,951	33,428	34,435	34,839	34,082	32,551	12%
Civil Engineering Professionals	12,598	13,102	13,515	13,872	14,020	14,015	14,056	12%
Architectural, Building and Surveying Technicians	7,190	7,546	7,804	8,030	8,110	8,067	8,033	12%
Carpenters and Joiners	15,633	16,906	17,529	18,044	18,104	17,640	17,034	9%
Plumbers	10,866	11,736	12,356	12,838	12,925	12,678	12,488	15%
Electricians	17,984	19,240	20,160	20,872	21,055	20,790	20,586	14%
Truck Drivers	32,355	33,397	34,281	35,092	35,606	35,902	36,215	12%
Building and Plumbing Labourers	12,078	12,738	13,197	13,582	13,690	13,547	13,400	11%
Other Miscellaneous Labourers	48,832	50,403	51,640	52,745	53,357	53,556	53,749	10%
Total (all occupations)	515,190	537,351	553,492	567,063	573,295	572,585	571,339	11%
Previous projected totals (NCOM 2016)	521,753	535,957	539,021	540,102	536,922	539,503	n.a.	

5.5. Auckland

Auckland is expected to demand the largest numbers of construction-related occupations to 2022. Total employment levels increase by 18 per cent over the period. The most demanded occupations will be 'Project Builders' (up 27 per cent) and 'Plumbers' (up 32 per cent).

The overall increase in construction-related occupations in the Auckland region is approximately 28,000 between 2016 and 2022. Over the period to 2021 an additional 4,700 employees will be required to meet demand, when compared to the previous projections prepared in 2016.

Figure 11: Auckland key construction-related occupations, 2016 - 2022

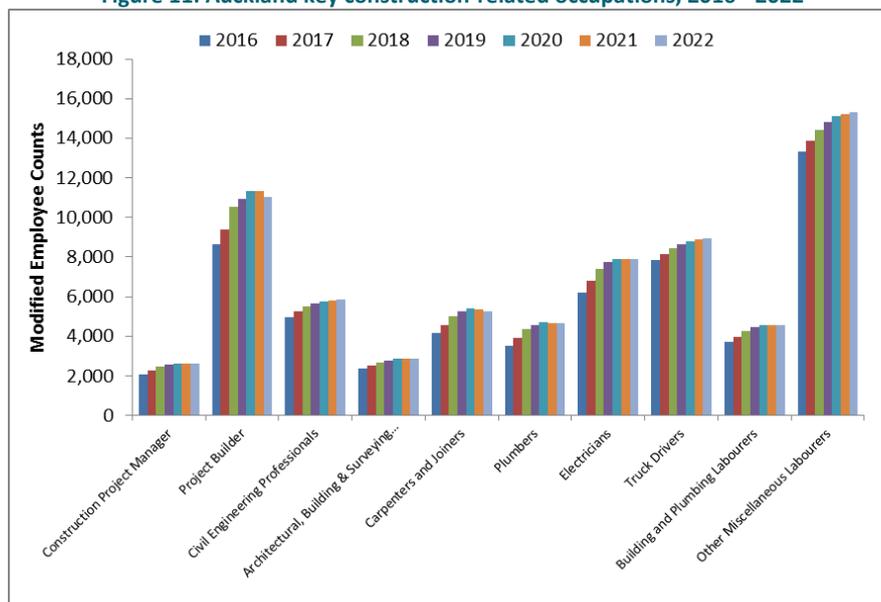


Table 3: Auckland top 10 construction-related occupations, 2016 - 2022

Note: Based on 2013 Census crew mix only.	2016	2017	2018	2019	2020	2021	2022	% change, 2016 - 2022
Construction Project Manager	2,055	2,264	2,463	2,584	2,633	2,612	2,607	27%
Project Builder	8,669	9,402	10,532	10,947	11,337	11,333	11,045	27%
Civil Engineering Professionals	4,960	5,237	5,496	5,679	5,779	5,806	5,848	18%
Architectural, Building & Surveying Technicians	2,388	2,539	2,697	2,795	2,854	2,866	2,873	20%
Carpenters and Joiners	4,169	4,546	5,027	5,239	5,389	5,368	5,279	27%
Plumbers	3,530	3,925	4,344	4,573	4,695	4,670	4,645	32%
Electricians	6,207	6,783	7,388	7,731	7,921	7,906	7,893	27%
Truck Drivers	7,837	8,140	8,435	8,653	8,799	8,875	8,953	14%
Building and Plumbing Labourers	3,700	3,976	4,280	4,450	4,554	4,560	4,552	23%
Other Miscellaneous Labourers	13,310	13,866	14,442	14,831	15,099	15,219	15,323	15%
Total (all occupations)	161,685	170,084	179,175	184,676	188,392	189,447	190,084	18%
Previous projected totals (NCOM 2016)	167,002	177,220	182,981	183,728	183,451	184,776	n.a.	

5.6. Waikato and Bay of Plenty

Demand for construction-related employees in the Waikato & Bay of Plenty region is expected to increase by an overall 14 per cent, from 2016 to 2022. The most demanded occupations are 'Project Builders' (up 18 per cent), 'Electricians' (up 18 per cent) and 'Plumbers' (up 19 per cent).

The overall increase in construction-related occupations in the Waikato & Bay of Plenty region is approximately 11,000 between 2016 and 2022. Over the period to 2021 an additional 8,300 employees will be required, when compared to the earlier projections prepared in 2016.

Figure 12: Waikato and Bay of Plenty key construction-related occupations, 2016 - 2022

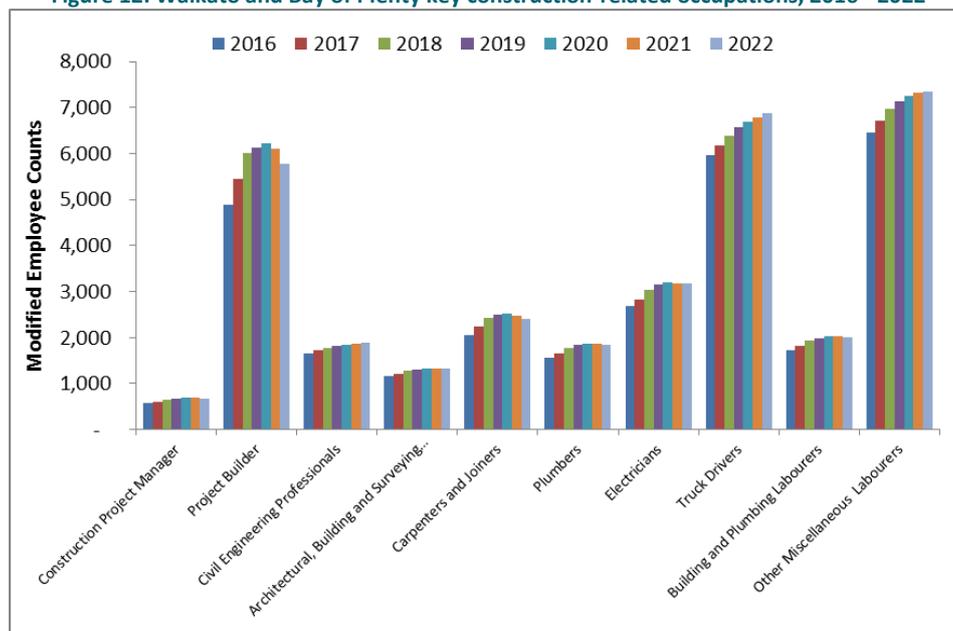


Table 4: Waikato & Bay of Plenty top 10 construction-related occupations, 2016 - 2022

	2016	2017	2018	2019	2020	2021	2022	% change, 2016 - 2022
<i>Construction Project Manager</i>	576	613	656	681	690	686	680	18%
<i>Project Builder</i>	4,883	5,444	6,003	6,138	6,233	6,097	5,786	18%
<i>Civil Engineering Professionals</i>	1,654	1,717	1,782	1,826	1,854	1,870	1,880	14%
<i>Architectural, Building and Surveying Technicians</i>	1,170	1,222	1,277	1,311	1,331	1,338	1,338	14%
<i>Carpenters and Joiners</i>	2,059	2,239	2,429	2,494	2,527	2,483	2,400	17%
<i>Plumbers</i>	1,553	1,653	1,774	1,845	1,873	1,863	1,851	19%
<i>Electricians</i>	2,675	2,837	3,030	3,144	3,194	3,183	3,168	18%
<i>Truck Drivers</i>	5,962	6,182	6,394	6,563	6,692	6,795	6,877	15%
<i>Building and Plumbing Labourers</i>	1,723	1,826	1,935	1,993	2,025	2,026	2,012	17%
<i>Other Miscellaneous Labourers</i>	6,465	6,720	6,975	7,142	7,257	7,321	7,350	14%
Total (all occupations)	78,854	82,501	86,297	88,484	89,892	90,273	90,174	14%
<i>Previous projected totals (NCOM 2016)</i>	80,022	82,437	81,976	82,370	81,558	81,917	n.a.	

5.7. Wellington

Wellington is projected to have a 9 per cent growth in demand for construction-related employees to 2022. The most demanded construction occupations for the Wellington region include 'Project Builders' (up 14 per cent) and 'Truck Drivers' (up 10 per cent).

The overall increase in construction-related occupations in the Wellington region is approximately 4,200 between 2016 and 2022. Over the period to 2021 an additional 700 employees will be required, when compared to the earlier projections prepared in 2016.

Figure 13: Wellington key construction-related occupations, 2016 - 2022

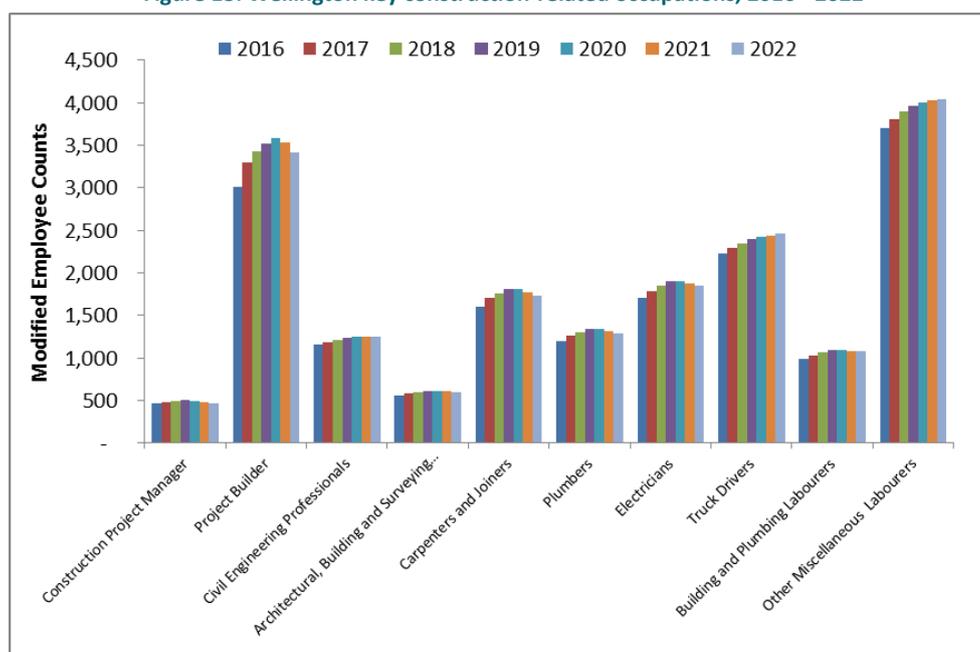


Table 5: Wellington top 10 construction-related occupations, 2016 - 2022

	2016	2017	2018	2019	2020	2021	2022	% change, 2016 - 2022
Construction Project Manager	462	476	491	501	492	473	462	0%
Project Builder	3,006	3,299	3,426	3,523	3,581	3,537	3,421	14%
Civil Engineering Professionals	1,159	1,186	1,213	1,237	1,244	1,244	1,250	8%
Architectural, Building and Surveying Technicians	562	581	597	611	612	606	603	7%
Carpenters and Joiners	1,599	1,705	1,762	1,806	1,812	1,774	1,727	8%
Plumbers	1,192	1,256	1,305	1,345	1,343	1,313	1,291	8%
Electricians	1,707	1,785	1,847	1,898	1,899	1,869	1,849	8%
Truck Drivers	2,232	2,294	2,346	2,395	2,425	2,442	2,462	10%
Building and Plumbing Labourers	992	1,033	1,062	1,087	1,093	1,085	1,076	9%
Other Miscellaneous Labourers	3,701	3,808	3,892	3,968	4,009	4,024	4,040	9%
Total (all occupations)	47,824	49,443	50,622	51,657	52,118	52,107	52,079	9%
Previous projected totals (NCOM 2016)	48,600	50,303	50,744	51,306	50,906	51,369	n.a.	

5.8. Canterbury

Following the peak of construction activity in the Canterbury region due to the earthquake rebuild (including the Kaikoura earthquake), overall construction-related employment demand is projected to decline by 1 per cent to 2022. 'Project Builders' and 'Carpenters and Joiners' experience the largest declines in demand, with 15 per cent and 14 per cent reductions, respectively, between 2016 and 2022.

Figure 14: Canterbury key construction-related occupations, 2016 - 2022

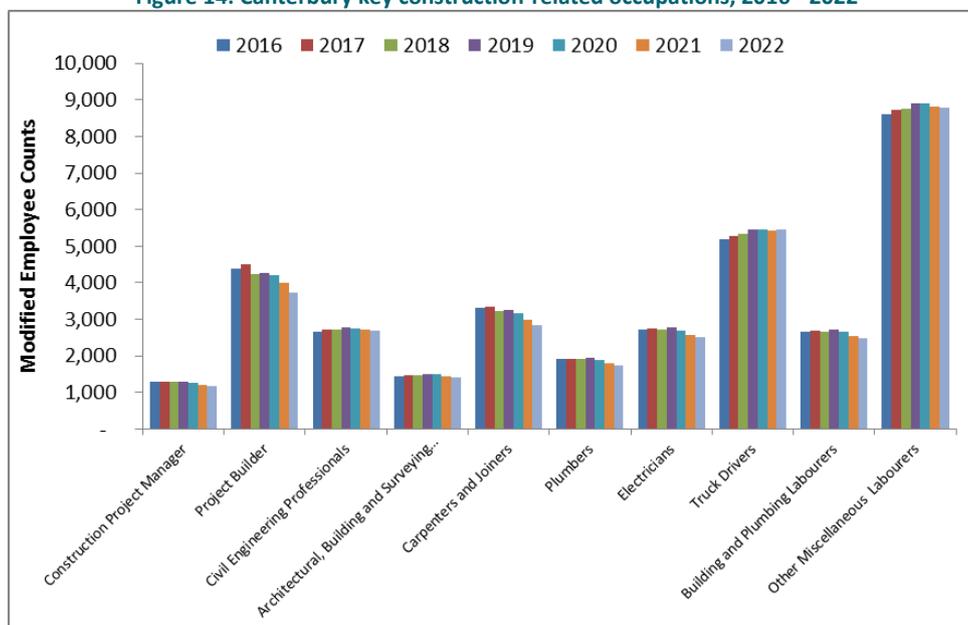


Table 6: Canterbury top 10 construction-related occupations, 2016 - 2022

Note: Based on Census 2013 crew mix	2016	2017	2018	2019	2020	2021	2022	% change, 2016 - 2022
Construction Project Manager	1,280	1,291	1,279	1,299	1,267	1,203	1,161	-9%
Project Builder	4,384	4,497	4,240	4,279	4,207	4,001	3,735	-15%
Civil Engineering Professionals	2,671	2,708	2,726	2,773	2,761	2,708	2,685	1%
Architectural, Building and Surveying Technicians	1,446	1,471	1,469	1,498	1,487	1,445	1,420	-2%
Carpenters and Joiners	3,300	3,342	3,224	3,252	3,169	2,999	2,833	-14%
Plumbers	1,913	1,927	1,919	1,952	1,898	1,792	1,728	-10%
Electricians	2,728	2,744	2,731	2,768	2,703	2,581	2,502	-8%
Truck Drivers	5,195	5,286	5,350	5,446	5,469	5,440	5,445	5%
Building and Plumbing Labourers	2,660	2,693	2,665	2,705	2,658	2,550	2,472	-7%
Other Miscellaneous Labourers	8,592	8,713	8,765	8,899	8,903	8,815	8,781	2%
Total (all occupations)	84,249	85,366	85,269	86,515	85,969	84,192	83,020	-1%
<i>Previous projected totals (NCOM 2016)</i>	82,978	79,738	75,265	73,542	72,693	72,565	n.a.	

6 Appendix: Structure of the national construction occupations model

6.1. Design

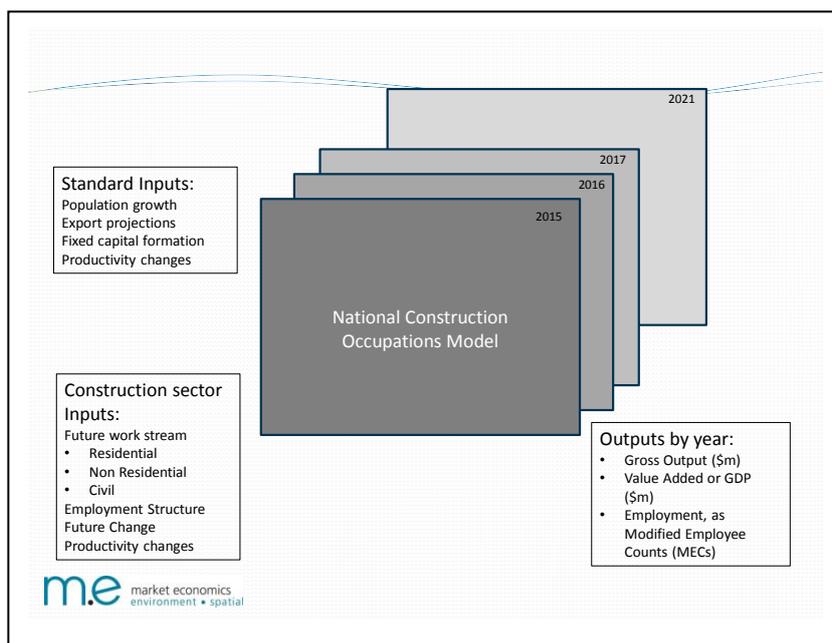
The NCOM combines demand vectors sourced from the Market Economics' *Economic Futures Model* and projected values from the *National Construction Pipeline Report 2017*. The demand vectors are multiplied using the Market Economics (M.E) inversed 2013 Input-Output (I-O) table, to produce projected gross output and growth vectors.

These growth vectors are available for each New Zealand region and by industry type, and reflect economic growth between 2013 and future years.

The growth vectors are then applied to the known Census 2013 employment figures (at a regional and industrial level, sourced from Statistics New Zealand Business Demography data) to estimate future employment levels.

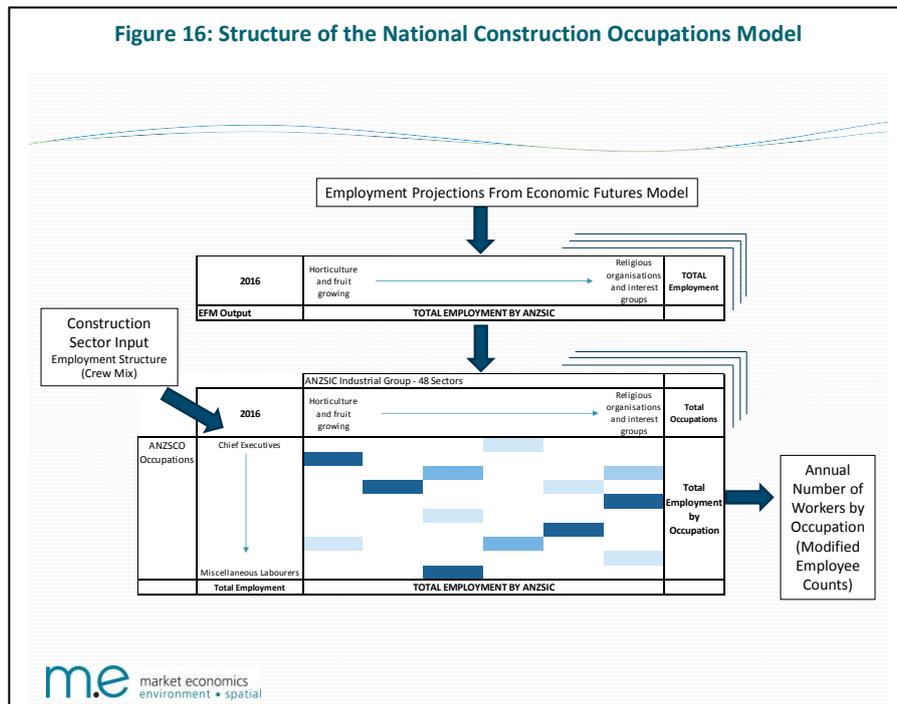
In this calculation, multi factor productivity (MFP) growth as well as labour utilisation capacity adjustment is accounted for. It is important to include these factors in order to account for changes in the labour environment, as otherwise the future projected employment may be over or under estimated.

Figure 15: Design of the National Construction Occupations Model



Employment can be broken down into 1,022 different occupations that span the entire labour force. The break down (**or crew mix**) of which occupations make up a labour force varies in each region and industry.

Therefore, a specific ANZSIC by ANZSCO by Regional Council matrix is required to distribute the different employment projections (which are aggregated to 106 industries and five regions) into different occupations. Statistics New Zealand provides Census data on occupations by industry and by region, subject to confidentiality requirements.



6.2. Input-Output Modelling

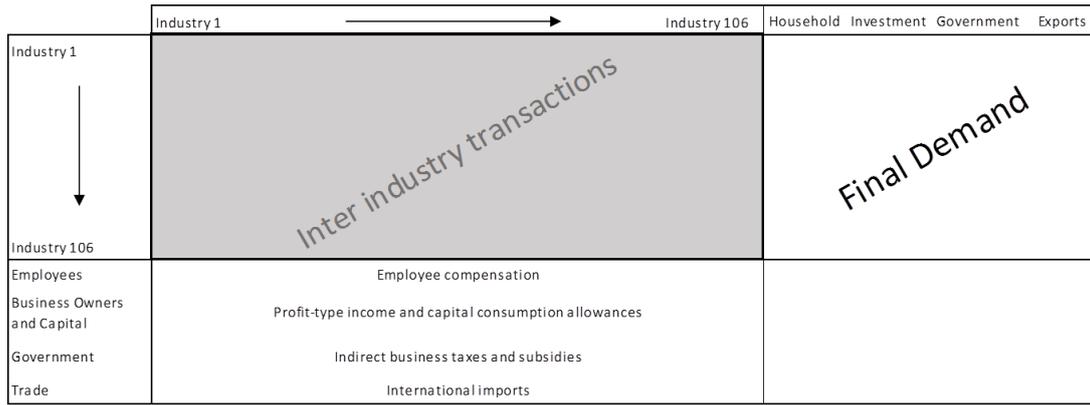
For this project M.E developed a 2013 Census based Input-Output (I-O) model, which essentially captures a quantified picture of interactions across the New Zealand economy at a point in time. To reflect the needs of this project, the 2013 I-O has been aggregated into five regions (Auckland, Bay of Plenty & Waikato, Wellington, Canterbury and Total New Zealand), and 106 economic sectors, resulting in 530 unique region-industry pairs. The data for the model was sourced from Statistics New Zealand, and was subjected to an optimisation process based on the 2007 model previously built by M.E.

Input-Output models replicate the transactions and purchase patterns within an economy, expressing these in tabular format. These tables form the core of any I-O modelling and they reflect the flows of money or goods among various sectors or industrial groups within an economy (or between economies).

These flows are recorded in a matrix or 'I-O table' using arrays summarising the purchases made by each industry (its inputs) and the sales of each industry (its outputs) from and to all other industries and sectors of final demand. The information contained within such a matrix enables calculations between industries for the whole economy.

These relationships describe the interactions between industries, specifically, the way in which each industry's production requirements depend on the supply of goods and services from other industries. With this information it is then possible to calculate, given a proposed change (such as a new development) to a selected industry, all of the necessary changes in production that are likely to occur throughout supporting industries within the wider economy.

Figure 17: Structure of an Input-Output (I-O) Model



The resulting 106 sector table reflects the economic structure and economic interrelationships between the 16 regional councils in New Zealand. The I-O table used in the NCOM has been regionalised, utilising the *Generating Regional Input-Output Tables* procedure, to reflect the regions of Auckland, Waikato & Bay of Plenty, Wellington, and Canterbury.

The I-O table models how the sectors within each region are interconnected with each other and with sectors in other parts of the country, so capturing interregional trade. In other words, these tables explain the supply chain interdependencies between sectors across the country.

Input-output analysis has strengths and weaknesses. Compared to some other economic models, I-O is relatively straightforward and easy to use. It is especially useful for identifying and understanding the nature of relationships within an economy, but it provides a snap-shot rather than a dynamic picture of the relationships among industries. These relationships are assumed to remain stable/static over time. This assumption implies that the sectors' input structures remain static through time, and that the type of technology used during production remains stable. A key issue is that I-O models do not include price changes as a result of increased demand.

In addition, technical relationships will change over time as a result of new technologies, relative price shifts and product substitutions, and the introduction of new industries. Therefore I-O modelling is not suited to long run analysis of change.

I-O modelling also assumes that there are sufficient resources of labour, land and capital to sustain projected growth or change, and that growth in one industry does not constrain growth in others (for example, through competition for labour or capital, affecting the supply and/or price of these). As a consequence of this limitation, the results of the NCOM present employment requirements of levels of construction activity, as opposed to supply-constrained estimates.

6.3. Modified Employee Counts

In the NCOM the measure used for employment is Modified Employee Counts (MECs), as opposed to Employee Counts (ECs) or Full Time Equivalent (FTEs).

The MEC is an indicator which captures both employees and working proprietors that are not captured as employees. M.E calculates MECs based on Statistics New Zealand estimates of employee counts (ECs) and working proprietors (WPs).

The Employee Count (EC) is a head count of all salary and wage earners for the reference period. This is mostly employees but can include a small number of working proprietors (who pay themselves a salary or wage). The employee count is mainly sourced from the Inland Revenue Department's Employer Monthly Schedule, although there are some enterprises whose employee counts are collected by Statistics New Zealand surveys.

A working proprietor is either a sole proprietor or partner who is actively engaged in a business, or a shareholder in a limited liability company actively engaged in its management and classified by the respondent as a working proprietor consistently across survey periods. It is important to capture both employees and working proprietors at the sector level, as the proportion of working proprietors to employees differs across economic sectors.

6.4. National Construction Pipeline

The *National Construction Pipeline Report 2017* provides a forward view of national construction demand for the six years ending 31 December 2022. It was commissioned by the Ministry of Business, Innovation and Employment and jointly prepared by Pacifecon (NZ) Ltd and the Building Research Association of New Zealand (BRANZ). The previous reports were commissioned by the Building and Construction Productivity Partnership. The first report was released in November 2013, the second in October 2014, the third in July 2015 and the fourth in July 2016.

The Pipeline report is based on a compilation of construction projects known to Pacifecon and BRANZ's economic forecasts of building and construction. It includes graphs and commentary on forecast and actual building and construction work. The year beginning January 2015 is used as the base year for any comparison with the forecasts.

The forecasts in the Pipeline report show the nature and timing of future building and construction work, by type and region, through to December 2022. These forecasts are complemented by information on known non-residential building and construction intentions from January 2016 to December 2022, and actual building and construction data.

The values sourced from the Pipeline report are gross fixed capital formation. Gross fixed capital formation (GFCF) is a measure of the net new investment by producers on durable real assets, such as buildings, motor vehicles, plant and machinery, roading, and improvements to land. In measuring the outlays, sales of similar goods are deducted. Land is excluded from gross fixed capital formation. Routine maintenance is not included in GFCF. However, alterations and additions that significantly extend the life or capacity of an asset are included (i.e. all work done with an addition and alteration building consent, is included).

6.5. Economic Futures Model

Apart from the National Construction Pipeline projections to end 2022, the economic projections used in the NCOM have been sourced from Market Economics' Economic Futures Model (EFM).

Developed by Market Economics, the EFM is a multi-regional scenario model which traces the economic implications of growth by economic sector and households over a 20 – 30 year timeframe. The model adopts a 'systems' perspective, acknowledging that many of the issues we face today are highly interconnected and complex. It uses an integrated approach to assess the possible implications of plausible scenarios, given a range of assumptions.

The EFM is based on a multi-regional economic input-output table, capturing the impacts of growth on a study area, as well as on the wider regional and national economies. The impacts resulting from each growth scenario are compared with the 'baseline' Business-As-Usual (BAU) scenario, which is established by estimating sectoral domestic and export final demand, and by developing projections of population and export growth.

The EFM analyses the economic impacts for 106 industries within the study area, focusing on key (strong) industries. Results from the econometric projections (and qualitative information if collected), are combined to project the full BAU evaluation of economic growth. The model projects domestic and export market growth, and the impacts of changes to the study area's population and business requirements.

The EFM uses the data provided through the National Construction Pipeline, which takes the form of GFCF values for Residential Construction, Non-Residential Construction, and Infrastructure. However in forming the view of the future (using I-O modelling), GFCF is not the only input – local and central and government, households and firms all demand services from the various construction industries above and beyond the new buildings included in GFCF. In the EFM this is captured in the inter-industry transaction tables as purchases from the various construction subsectors.

6.6. Productivity Growth

The labour utilisation capacity adjustment, is a factor that has been included from the Christchurch model to account for the earthquake(s) affecting the regional industries. It can be used to estimate results when labour is over or under utilised by industry.

Due to the short term nature of the model outlook, multi-factor productivity growth (MFPG) does not have a large impact on the results. Within the model there are specific industry MFP values as well as a general number. The MFP growth value used for construction is small, which is consistent with Statistics New Zealand data on trend productivity growth in the industry.

7 Glossary and links

Building Research Association of New Zealand (BRANZ): *A independent research, testing and consulting organisation.* www.branz.co.nz

Market Economics Ltd (M.E): *A economic consultancy firm, based in Auckland.* www.me.co.nz

Ministry of Business, Innovation and Employment (MBIE): *The New Zealand Government department responsible for regulatory oversight of the construction industry.* www.mbie.govt.nz

Modified Employee Counts (MECs): *A measure which includes both employees and working proprietors.*

National Construction Pipeline (NCP): *The National Construction Pipeline Report 2017 provides a view of national construction demand for the six years ending 31 December 2022.*

Pacifecon (NZ) Ltd: *A business intelligence company, which provides future residential and non-residential project information to its client base.* www.pacifecon.co.nz

Key research web-links

National Construction-related Occupations Projections

<http://constructionprojections.mbie.govt.nz>

National Construction Pipeline Reports 2016 and 2017

<http://www.mbie.govt.nz/info-services/building-construction/skills-innovation-productivity/national-construction-pipeline>

National Construction Pipeline Report 2015

http://www.branz.co.nz/cms_display.php?sn=273&st=1

Upper North Island Key Sector Trends to 2015 and Labour Demand to 2020

<https://www.waikatoregion.govt.nz/services/regional-services/regional-growth-and-development/regional-planning-and-forecasting/upper-north-island-strategic-alliance-unisa/unisa-projects/>

Auckland's Construction and Infrastructure Labour Requirements: 2013 – 2023

<http://www.unitec.ac.nz/workforce/wp-content/uploads/2014/07/CI-Workforce-Roadmap-Details.pdf>

MBIE Short-term Employment Forecasts 2017 – 2020

<http://www.mbie.govt.nz/info-services/employment-skills/labour-market-reports/forecasting/short-term-employment-forecasts>

MBIE Occupation Outlook 2017

<http://www.mbie.govt.nz/info-services/employment-skills/labour-market-reports/occupation-outlook>

MBIE Canterbury Labour Market Reports

<http://www.mbie.govt.nz/info-services/employment-skills/labour-market-reports/canterbury-labour-market>

