Australian Government | Infrastructure Australia

Supporting appendices Infrastructure Market Capacity 2024 Report

December 2024

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Appendix A: Demand- side analysis methodology

Infrastructure Australia's Major Public Infrastructure Pipeline

The analysis in the 2024 *Infrastructure Market Capacity* report is based on the aggregation of project-level data to inform a portfolio view of Australia-wide infrastructure, with data current as at June 2024.

Infrastructure Australia established the 'Major Public Infrastructure Pipeline' in the 2021 *Infrastructure Market* Capacity report – this included a database of identifiable publicly funded infrastructure projects which met certain criteria for inclusion.

Projects were included in the database if the investment value was above a threshold capital cost (over $50 million for South Australia, Tasmania, the Northern Territory and the Australian Capital Territory, and over $100 million for all other Australian states). The periods covered within the portfolio were between 2014–15 and 2030–31; that is projects were included on the basis that there was (or would be) a non-zero amount of construction activity across those ten years.

Project data gathering and collation

The 'Major Public Infrastructure Pipeline' presented in this report has involved an update to project-level information contained in the National Infrastructure Project Database, using the most recent obtainable information. The project-level data that provides the basis for analysis within this report is a product of collaboration between private sector supplier GlobalData, Infrastructure Australia, Australian states and territories governments, and the Australian Department of Infrastructure, Transport, Regional Development, Communications and the Arts. The Department has provided budgeted transport infrastructure project expenditure from 2017–18 onwards, while the data received from states and territories included infrastructure projects that were allocated funding in 2023–24 budgets.

The inclusion of project-level data in the major public infrastructure pipeline follows the same criteria as in 2023 (i.e. threshold value cut-offs and publicly funded works). Furthermore, the collation of project-level data has expanded during the development of the 2024 Infrastructure Market Capacity report – identifiable public energy projects, as mentioned above, have also been gathered and added to the project database. While these projects are not reported in the five-year pipeline of major public infrastructure projects, the entire project database is examined in *Section 2: Understanding demand*.

For each project, the database includes information, where available, on the following fields:

- Location (including jurisdiction)
- Investment cost
- Installed capacity (for MW - energy generation, km -- transmission lines, and m2 - detached and semi-detached housing)
- Project stage (pre-construction, under construction or completed)
- Project construction schedule
- Funding source (public, private, public/private)
- Project type (project classification)

Data classification

The National Infrastructure Project Database aggregates and organises infrastructure project data supplied by the Australian Government (including Defence), state and territory governments (public investments), the Australian Bureau of Statistics (housing building activity) and GlobalData (private and public investments) – each project is assigned a 'typecast' of which there are 83 distinct areas of activity.

Each typecast lies within a corresponding 'master type' of which there are 22 different subsectors. Finally, the master types can be aggregated into the four following infrastructure 'sectors':

- **Buildings:** non-residential buildings for health, education, sport, justice, transport buildings (such as parking facility and warehouse), other buildings (such as art facilities, civic/convention centres and offices), detached, semi-detached and multi-detached residential, apartments and renovation activities (using all residential building activities captured in the Australian Bureau of Statistics Building Approvals).
- **Transport:** roads, railways, level crossings, and other transport projects such as airport runways.
- **Utilities:** water and sewerage, energy and fuels, gas and water pipelines, and telecommunications.
- **Resources:** base metals, precious metals, critical minerals, hydrogen and ammonia, chemical & pharmaceutical plants, oil and gas, and ports.

A full list of (sub)sectors is available in *Appendix C: Infrastructure typecasts*.

Projects are classified according to project stage and funding source, as follows:

Project stage classifications:

- Pre-construction
- Under construction, and
- Completed

Funding source classifications:

- Public
- Private
- Public/Private.

Creating a portfolio of major project activity

The transformation of project-level data into a portfolio (i.e., a monthly timeline) follows the principles established in the 2021 *Infrastructure Market Capacity* report. For each individual project, the total investment cost is split across time using start and finish dates. This distribution of costs assumed that each project undergoes three distinct phases of investment, in order of size: the construction phase (80%), planning phase (15%) and the commissioning stage (5%).

Project investment costs are allocated to the planning and commissioning phases in a linear fashion, whereas a sigmoidal function (or 'S-curve') has been applied to the proportion of investment within the construction phase.[1] This method of cost distribution best reflects the general pattern of project expenditure over the construction phase: activity starts from small beginnings then accelerates over time to reach a climax before slowing to project completion.

Translating portfolio activity to resource demands

Similarly, translating the portfolio of project activity into resource demands follows the same process established in the 2021 *Infrastructure Market Capacity* report. Construction resources cost breakdowns were developed for each project typecast over each resource category (plant, labour, equipment and materials). These cost breakdowns have remained largely unchanged from the 2021 *Infrastructure Market Capacity* report although the expansion of the project database to include new typecasts has required the development of new cost breakdowns.

The costs are adjusted with an appropriate level of escalation applied in 2023-24. In occurrences where there were variances within costs for certain items, an average of all costs collated was applied.

Resource classifications used in this analysis

The key resource categories used in the analysis remain unchanged from the 2021 *Infrastructure Market Capacity* report. However, there have been numerous additions to the resources within these categories to account for the sectoral expansion of the project database (for instance, plasterboard and timber due to the inclusion of residential building).

The key resource categories developed for the infrastructure portfolio can be summarised by the acronym 'PLEM':

- Plant
- Labour
- Equipment
- Materials.

Plant covers individually distinct (and mostly mobile) capital items typically used in the implementation of major projects. It is further classified as either:

- Site plant: including cranes, scaffolding and scissor lifts
- Preliminaries: including site offices, lunchrooms and toilets
- Civil plant: including mobile plant such as excavators, graders, bulldozers and compactors
- Specialty plant: including items that are purpose built, modified or manufactured for a specific application/use such as tunnel boring machines, modified excavators and pile driving plant, augers, heavy transportation and low loaders amongst other items.

Labour covers workforce occupation categories and subcategories across the following major occupational groups (see *Appendix D Resource classifications* for a complete list):

- Project Management Professionals: including occupational roles in Risk Management, Project Management, Commercial Management, Construction Management and Environmental and Occupational Health Professionals
- Engineering, Scientists and Architects: including a range of professional non-management roles including different types of Engineers, Surveyors, Architects, IT Professionals, Geologists, Maintenance Planners, Safety Officers and Procurement roles.
- Trades and Labour: including Plant Operators, Concreters, Bricklayers, Carpenters and Joiners, Drillers, Rail Track Workers and Structural Steel Erectors, Telecommunications Field Staff and Cablers, Plumbers, Electricians, Electrical Line Workers, Tilers, Glazers, Plasterers and Painters amongst other roles.

Equipment reflects generally non-distinct capital investment items and have been categorised as either control, electrical or mechanical equipment. Being non-distinct (and often bespoke) items, demand for equipment is expressed in dollar terms, not as units. This also applies to electrical bulk which is included in the materials category.

Materials cover the resources which are 'put in place' and include the following distinct items:

- Concrete, including aggregates, sand and cement
- Wall and frame materials, including timber, bricks, and plasterboard
- Rock and bluestone
- Steel: including structural and reinforcing steel as well as rail track
- Bitumen binders
- Asphalt
- Electrical bulk, representing mainly electrical cables, accessories and fittings, conductors, insulators, transformers, switches and other related items.

Appendix B: Supply- side analysis methodology

Introduction and methodology

Methodology

Unlike labour, where relatively consistent and detailed data is collected regularly by the Australian Bureau of Statistics, there is no equivalent single source of quantitative 'truth' for the supply capacity of some critical non-labour infrastructure inputs. This includes concrete and quarry products, other construction materials or construction plant and equipment.

- In the case of quarry materials, different state jurisdictions are responsible for publishing their own state production data (although not all state production is readily available) as well as a diverse range of information about individual quarries. Critically, there is little or no data on latent capacity (or legal capacity, given restrictions on production and truck movements) of the quarrying industry to increase production to meet rising demand.
- Unpublished plant and equipment sales data may be obtainable from private databases, though the Australian Bureau of Statistics maintains detailed data on the volume of construction plant and equipment exported and imported through trade statistics.
- For other key construction inputs materials – including fuel, oil, cement, concrete, clay bricks, roofing tiles and sawn timber – the Australian Bureau of Statistics historically published local production data through its Manufacturing Production (Cat. No. 8301.0.55.001) and Production of Selected Construction Materials (Cat. No. 8301.0) surveys, but these were discontinued in 2004 and 2014 respectively.[2]

Because quantifying supply is challenging, we have combined published production and trade data with industry surveys and interviews. See *Appendix F: Industry confidence surveys* for further detail.

Domestic steel- fabrication supply capacity analysis

This year's report provides quantitative analysis of data on local steel fabrication capacity, provided by the Australian Steel Institute. We analysed the capacity and location of 296 domestic steel fabricators representing an estimated 70% of total domestic capacity, each with annual capacity ranging from 100 tonnes up to 100,000 tonnes. The aggregate capacity of these businesses, if all were being operated at full utilisation, is estimated at approximately 1,000,000 tonnes per annum. Table below shows local steel fabrication capacity assumptions.

Table 1: Australia steel fabrication capacity – annual estimates

Capacity Range	Number	Assumed Output (t)	Aggregate(t)
<2,000t	205	1,000	205,000
2,000 to 10,000t	93	6,000	558,000
10,000 to 15,000t	10	12,500	125,000
>15,000t	4	25,000	100,000
Totals	314		988,000

Appendix C: Infrastructure typecasts

Project information sources and data difficulties

Project information sources

The project-level data that provides the basis for analysis within the *Infrastructure Market Capacity* report is a product of collaboration between private sector supplier (GlobalData), Infrastructure Australia, the Jurisdictions, the Department of Defence and the Australian Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA).

The Major Public Infrastructure Pipeline is developed from publicly funded project information mainly sourced from data-sharing partnerships between Infrastructure Australia, Australian States and Territories, and DITRDCA. The data received from the states and territories included infrastructure projects that were allocated funding in the 2023—24 budget. The data received from DITRDCA included transport infrastructure projects that have been allocated federal funding since 2017–18.

Both these datasets contained information on projects that had commenced prior to 2020–21 (2017-18) if they were still underway. However, these datasets did not provide information on projects that had already finalised by those years. Project-level data provided by GlobalData was used to fill gaps in the project database – these included projects which had finalised before the dates above, or projects that were otherwise outside of the scope of the jurisdictional/federal lists (for instance, council projects that were valued above the $50/$100 million cut-off).

In some instances, projects were disaggregated so that they could be appropriately categorised across different infrastructure typecasts. For instance, a rail project that involved stations, tunnelling and aboveground line works would be split into three components that would sit in three different typecasts – those being 'Station (Rail)', 'Tunnel (Rail)', and 'Main Line Works (Rail) (Greenfield)'.

The expansion of the project database to include privately funded projects and publicly funded projects beneath the threshold value cut-off was facilitated by data provided by GlobalData.

Data difficulties

The gathering and collation of project-level data across the variety of sources has allowed for an enhanced view of project activity across Australia. In combination, the data sources provided more than 17,000 project entries. This was then reduced to approximately 8,500 unique entries that would constitute the Total Infrastructure Pipeline.

The substantial reduction in project entries is reflective of an intensive manual data cleaning process during the development of this report. This process was required for numerous reasons, most importantly, the project-level data provided by the different sources was not tailored to the data requirements of this report. As such, each source (including different jurisdictions) contained unique formatting that had to be collated and standardised.

Due to the above, the main difficulty was the duplication of project entries across different data sources – for instance, transport projects with split state and federal funding would be contained in two lists. Furthermore, the project-level data sourced from GlobalData contained both publicly and privately funded infrastructure such that the aforementioned transport project could potentially be found across four datasets. The unique formatting (and naming conventions) of the different data sources made identifying these duplicates an intensive manual process.

The main difficulties, with the guidelines used to deal with them, are summarised below:

- Duplication across data sources: in the instance where the same project was identified across numerous data sources, jurisdictional and federal project information was treated as the most accurate source.
- Projects outside of scope: despite the widening of the project database, there are still certain types of projects which were excluded in this report. This includes offshore projects, projects that were finalised before 2014-15, projects with insufficient explanatory detail, projects that had not yet been confirmed (speculative, not relevant to jurisdictional/federal data).

- Programs of work: programs of work and the individual projects that constitute these programs were identified across the data sources. In the instance where the individual projects provided additional detail (compared to the program of works), then they were included in the database and the program of works was excluded to avoid a double count of expenditure. In the instance where the individual project expenditure did not sum to the total value of the program of works, then the program of works was included and assigned a capital cost equal to the difference between the total program value and the summed individual projects.

Infrastructure typecasts

The portfolio comprises 4 broad infrastructure sectors:

- Transport
- Utilities
- Buildings, and
- Resources

The portfolio breaks these three sectors down across the following 22 Master Types and 83 separate typecasts as shown in Table 1 below.

Table 2: Infrastructure typecasts

Super Sector	Master Type	Typecast
Buildings	Health	Hospital (Greenfield)
Buildings	Other Building	Civic/Convention Centre
Buildings	Health	Hospital (Addon/Brownfield)
Buildings	Justice	Correctional Centre
Buildings	Other Building	Office
Buildings	Sports Facility	Arena/Sporting Facility
Buildings	Education	School (Greenfield)
Buildings	Other Building	Arts Facility
Buildings	Justice	Courthouse
Buildings	Aviation	Airport Building
Buildings	Education	School (Brownfield)
Buildings	Retail	Retail Store
Buildings	Telecommunications and Digital	Data Centre
Buildings	Residential	Detached Residential
Buildings	Residential	Multi Residential
Buildings	Residential	Semi-detached Residential
Buildings	Transport Building	Parking Facility
Buildings	Residential	Accommodation

Super Sector	Master Type	Typecast
Buildings	Education	Higher Education (Brownfield)
Buildings	Education	Higher Education (Greenfield)
Buildings	Health	Health Facility (Greenfield)
Buildings	Health	Health Facility (Brownfield)
Buildings	Transport Building	Warehouse
Buildings	Justice	Police Facility
Buildings	Justice	Fire and Emergency Facility
Buildings	Other Building	Laboratory
Buildings	Health	Aged Care Facility (Greenfield)
Buildings	Health	Aged Care Facility (Brownfield)
Buildings	Health	Health Facility (Addon/Brownfield)
Buildings	Health	Aged Care Facility (Addon/Brownfield)
Buildings	Education	Higher Education (Addon/Brownfield)
Buildings	Residential	Detached Residential - Forecast
Buildings	Residential	Semi-detached Residential - Forecast
Buildings	Residential	Home Renovations and Additions
Resources	Critical Minerals	Critical Minerals - Mine
Resources	Base Metals	Other Base Metals - Mine

Super Sector	Master Type	Typecast
Resources	Precious Metals	Precious Metals - Mine
Resources	Oil & Gas	FPSO
Resources	Oil & Gas	Offshore - FLNG
Resources	Oil & Gas	Offshore oil facility
Resources	Oil & Gas	Offshore gas facility
Resources	Oil & Gas	Onshore oil facility
Resources	Oil & Gas	Onshore gas facility
Resources	Oil & Gas	Onshore - LNG Plant
Resources	Ports	Port infrastructure
Resources	Hydrogen and Ammonia	Green hydrogen or ammonia facility
Resources	Hydrogen and Ammonia	Blue hydrogen or ammonia facility
Resources	Chemical & Pharmaceutical Plants	Chemical & Pharmaceutical Plants
Resources	Critical Minerals	Critical Minerals - Processing and Refining
Resources	Base Metals	Other Base Metals - Processing and Refining

Super Sector	Master Type	Typecast
Resources	Precious Metals	Precious Metals - Processing and Refining
Resources	Base Metals	Iron Ore - Processing and Refining
Resources	Base Metals	Iron Ore - Mine
Transport	Road/Rail	Level Crossing
Transport	Rail	Station (Rail)
Transport	Rail	Main Line Works (Rail) (Greenfield)
Transport	Road	State Road (Highway/Freeway)
Transport	Rail	Tunnel (Rail)
Transport	Road	Bridge (Road)
Transport	Rail	Bridge (Rail)
Transport	Rail	Light Rail (Greenfield)
Transport	Road	Low Use Road
Transport	Road	Tunnel (Road)
Transport	Aviation	Airport Runway
Transport	Rail	Light Rail, Stabling, and Signalling Works (Brownfield)
Transport	Road	Routine Road Maintenance
Transport	Road	State Road (Highway/Freeway) Rehabilitation Maintenance

Super Sector	Master Type	Typecast
Transport	Road	Low Use Road Rehabilitation Maintenance
Transport	Rail	Main Line Works (Rail) (Brownfield)
Utilities	Energy and Fuels	Gas Pipeline
Utilities	Water and Sewerage	Water Pipeline
Utilities	Water and Sewerage	Dam
Utilities	Water and Sewerage	Water Treatment Plant
Utilities	Telecommunications and Digital	Telecommunications
Utilities	Energy and Fuels	Wind
Utilities	Energy and Fuels	Utility Solar
Utilities	Energy and Fuels	Hydro
Utilities	Energy and Fuels	Pumped Hydro
Utilities	Energy and Fuels	Transmission Line: Single Circuit
Utilities	Energy and Fuels	Transmission Line: Double Circuit
Utilities	Energy and Fuels	Transmission (other)
Utilities	Energy and Fuels	Coal
Utilities	Energy and Fuels	Gas and Liquids

Appendix D: Resource classifications

Resource Classifications

Labour was focused on the following occupational breakdowns considered most relevant to the infrastructure market and consistent with the Australian and New Zealand Standard Classification of Occupations (ANZSCO).

Table 3: Labour occupation classification

PLEM Category	Major Subdivision	Minor Subdivision	Detailed Item
Labour	Engineering, Scientists and Architects	Architect	Architect
Labour	Engineering, Scientists and Architects	Civil Engineer Professionals	Civil Engineer
Labour	Engineering, Scientists and Architects	Civil Engineer Professionals	Geotech Engineer
Labour	Engineering, Scientists and Architects	Civil Engineer Professionals	Quantity Surveyor
Labour	Engineering, Scientists and Architects	Civil Engineer Professionals	Structural Engineer
Labour	Engineering, Scientists and Architects	Draftsperson	Draftsperson
Labour	Engineering, Scientists and Architects	Electrical Engineer	Electrical Engineer
Labour	Engineering, Scientists and Architects	Electronic Engineer	Electronic Engineer
Labour	Engineering, Scientists and Architects	Engineering Manager	Engineering Manager
Labour	Engineering, Scientists and Architects	Environmental Professionals	Environmental Professionals
Labour	Engineering, Scientists and Architects	Geologists, Geophysicists and Hydrogeologists	Geologists, Geophysicists, and Hydrogeologists
Labour	Engineering, Scientists and Architects	Industrial, Mechanical and Production Engineers	Mechanical Engineer

PLEM Category	Major Subdivision	Minor Subdivision	Detailed Item
Labour	Engineering, Scientists and Architects	IT Professionals	IT Professionals
Labour	Engineering, Scientists and Architects	Landscape Architect	Landscape Architect
Labour	Engineering, Scientists and Architects	Maintenance Planner	Maintenance Planner
Labour	Engineering, Scientists and Architects	Other Professional Engineers	Other Professional Engineers
Labour	Engineering, Scientists and Architects	Procurement	Procurement
Labour	Engineering, Scientists and Architects	Safety Officer	Safety Officer
Labour	Engineering, Scientists and Architects	Surveyor	Building Surveyor
Labour	Engineering, Scientists and Architects	Surveyor	Land Surveyor
Labour	Engineering, Scientists and Architects	Telecoms Engineer	Telecoms Engineer

PLEM Category	Major Subdivision	Minor Subdivision	Detailed Item
Labour	Project Management Professionals	Enviro. & Occupational Health Professionals	Enviro. & Occupational Health Professionals
Labour	Project Management Professionals	Project Management Professionals	Commercial Management
Labour	Project Management Professionals	Project Management Professionals	Construction Management
Labour	Project Management Professionals	Project Management Professionals	Project Management
Labour	Project Management Professionals	Project Management Professionals	Risk Management
Labour	Trades and Labour	Electrical Line Workers	Electrical Line Workers
Labour	Trades and Labour	Electricians	Electricians
Labour	Trades and Labour	Glazer	Glazer

PLEM Category	Major Subdivision	Minor Subdivision	Detailed Item
Labour	Trades and Labour	Painting Trades	Painting Trades
Labour	Trades and Labour	Plasterers	Plasterers
Labour	Trades and Labour	Plumbers	Plumbers
Labour	Trades and Labour	Telecoms Cabler	Telecoms Cabler
Labour	Trades and Labour	Telecoms Field Staff	Telecoms Field Staff
Labour	Trades and Labour	Bricklayer	Bricklayer
Labour	Trades and Labour	Carpenters and Joiners	Carpenters and Joiners
Labour	Trades and Labour	Concreter	Concreter
Labour	Trades and Labour	Crane Op	Crane Op
Labour	Trades and Labour	Driller (Piling/ Foundations)	Driller (Piling/ Foundations)
Labour	Trades and Labour	General Construction Labourer	General Construction Labourer
Labour	Trades and Labour	Other	Other
Labour	Trades and Labour	Plant Op	Plant Op
Labour	Trades and Labour	Rail Track Worker	Rail Track Worker
Labour	Trades and Labour	Rigger & Dogman	Rigger & Dogman
Labour	Trades and Labour	Road Based Civil Plant Op	Road Based Civil Plant Op
Labour	Trades and Labour	Road Based Civil Plant Op	Road Based Civil Plant Op
Labour	Trades and Labour	Structural Steel Erector	Structural Steel Erector

Plant, materials and equipment was classified according to the system adopted in Table 3.

Table 4: Plant, material and equipment classification

PLEM Category	Major Subdivision	Minor Subdivision	Detailed Item
Plant	Site	Mobile Cranes	Mobile Cranes
Plant	Site	Tower Cranes	Tower Cranes
Plant	Site	Scaffold (tubular)	Scaffold (tubular)
Plant	Site	Scissor Lifts	Scissor Lifts
Plant	Prelims	Site Offices, Lunchrooms	Site Offices, Lunchrooms
Plant	Prelims	WC	WC
Plant	Civil	Excavators	Excavators
Plant	Civil	Graders	Graders
Plant	Civil	Bulldozers	Bulldozers
Plant	Civil	Compactor	Compactor
Plant	Speciality Plant	Speciality Plant	Speciality Plant
Material	Concrete	Concrete	Aggregate
Material	Concrete	Concrete	Sand
Material	Concrete	Concrete	Cement
Material	Steel	Steel Re-inforcement	Steel Re-inforcement
Material	Steel	Steel - Structural Elements	Steel - Structural Elements
Material	Steel	Rail Track	Rail Track
Material	Rock/ Bluestone	Rock/Bluestone	Rock/Bluestone
Material	Bitumen Binders	Bitumen Binders	Bitumen Binders
Material	Asphalt	Asphalt	Asphalt
Material	Electrical Bulk	Electrical Bulk	Electrical Bulk
Equipment	Electrical Equipment	Electrical Equipment	Electrical Equipment
Equipment	Control Equipment	Control Equipment	Control Equipment
Equipment	Mechanical Equipment	Mechanical Equipment	Mechanical Equipment
Plant	Civil	Street Sweeper	Street Sweeper

PLEM Category	Major Subdivision	Minor Subdivision	Detailed Item
Material	Walls	Bricks	Bricks
Material	Walls	Timber	Timber
Material	Walls	Plasterboard	Plasterboard
Material	Other	Linemarking & Road Furnitures	Linemarking & Road Furnitures
Material	Steel	Girders	Girders
Material	Electrical Bulk	Electrical Bulk	Copper
Material	Electrical Bulk	Electrical Bulk	Aluminium
Material	Electrical Bulk	Electrical Bulk	Fiberglass
Material	Electrical Bulk	Electrical Bulk	Plastics and Polymeric materials
Material	Electrical Bulk	Electrical Bulk	PV Panels
Material	Electrical Bulk	Electrical Bulk	Glass (HV Insulators)
Material	Steel	Steel - Transmission Cable	Steel - Transmission Cable
Equipment	Electrical Equipment	Electrical Equipment	Building Services - electrical equipment
Equipment	Mechanical Equipment	Mechanical Equipment	Building Services - machanical equipment
Equipment	Electrical Equipment	Kitchen Fitout - electrical equipment	Kitchen Fitout - electrical equipment

Appendix E: Workforce and skills methodology

Definitions

Demand

- **Major Public Infrastructure Pipeline:** Publicly funded infrastructure projects valued over $100 million in New South Wales, Victoria, Queensland and Western Australia, and over $50 million in South Australia, the Australian Capital Territory, the Northern Territory and Tasmania.
- **Small Capital Public Infrastructure Pipeline:** Publicly funded infrastructure projects valued $100 million and under in New South Wales, Victoria, Queensland and Western Australia, and $50 million and under in South Australia, the Australian Capital Territory, the Northern Territory and Tasmania.
- **Private Infrastructure Pipeline:** Privately funded public infrastructure, such as a wind farms, that is funded, delivered and operated by the private sector.
- **Private Buildings:** Residential and non-residential buildings projects.
- **Road Maintenance:** Resource demands for road-maintenance projects

Occupations and roles

Occupations were defined using the Australian and New Zealand Standard Classification of Occupations (ANZSCO), through consultation with Infrastructure Australia's industry experts and additional key stakeholders.

Roles were defined using job advertisement data from Lightcast and consultation with industry stakeholders. Roles provide a greater specificity on the workforce needed to support the current and future infrastructure pipeline that would otherwise be masked by occupational analysis.

Lightcast aggregates job advertisements to create insight into the supply and demand for talent. The data set includes millions of job advertisements covering every occupation and industry in Australia.

Skills

Skills were defined using the Lightcast skills taxonomy. Lightcast developed this taxonomy using proprietary algorithms that defined and referenced over 1,500 general and technical skills identified by employers as important for new hires. This can be used to understand trends in skill demand, including skill needs for specific occupations.

Workforces

The engaged workforce is made up of those workers engaged on public infrastructure construction work. The adjacent workforce is made up of those in the rest of the construction industry, who would take zero to six months to train. The trainable workforce is made up of those working outside the construction industry who have a high level of overlapping skills, who would take approximately six to 12 months to train. The distant workforce is made up of those working outside the construction industry who have only some overlaps in skills, who would take one to three years to train.

The trainable and distant workforces work in industries such as professional, scientific, and technical services; transport, postal and warehousing; public administration and safety; and mining.

Modelling methodology

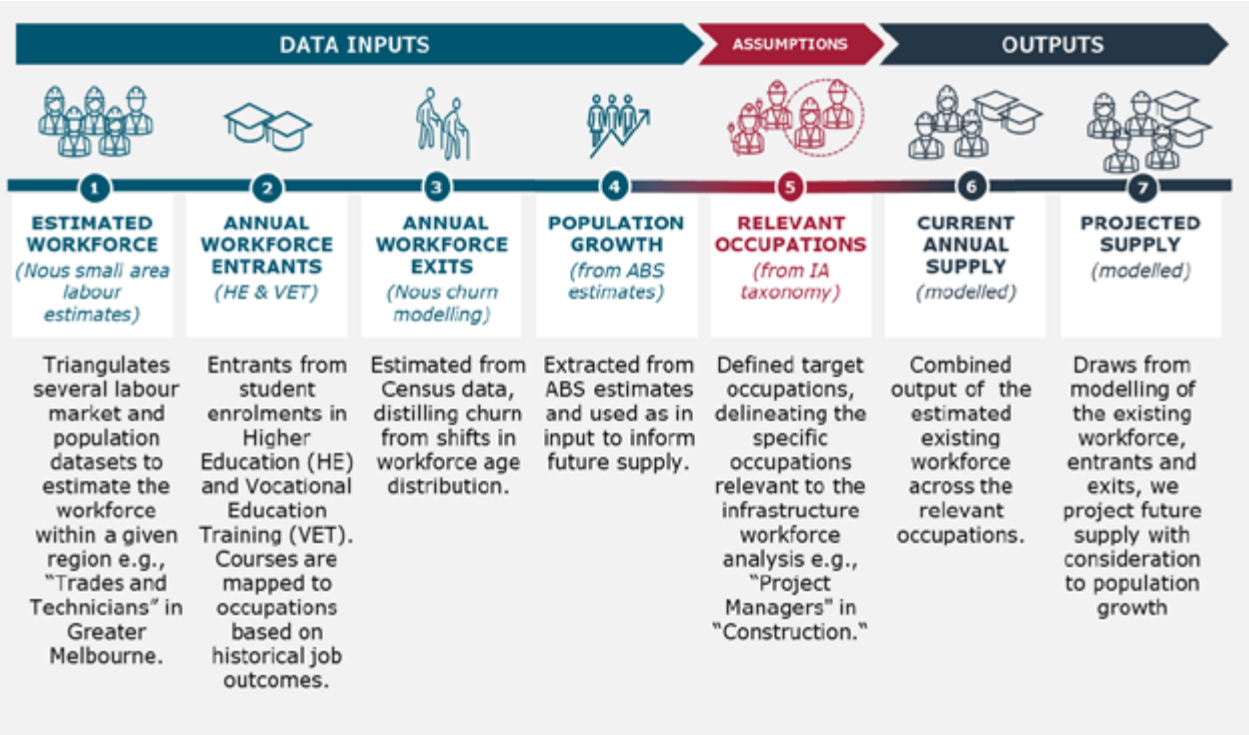
Introduction

The fundamental question addressed by this report is to what extent the current and projected supply of labour can support Australia's proposed investment in public infrastructure. To understand this, it was necessary to clearly define the occupations and skills that underpin this workforce and to estimate the numbers of workers available at different points in time, including projections for the future. The broad approach was:

- To estimate numbers of workers in or near the infrastructure workforce as determined by official statistics and our own forecasts or modelling based on those statistics
- To confront these estimates with additional data (such as job advertisements) that provides extra information on variables (such as skills) not covered by the official statistics, and extra granularity (such as estimates down to the level of 'roles', below existing ANZSCO unit groups) on variables which required further detail than official statistics provided.

The analytical work has two elements: developing classifications and making estimates. The two elements overlap, as we used data-based estimates to define our classifications, but it is useful to understand the steps separately.

Figure 1: Workforce quantification modelling methodology



Two key classifications were developed for this work and are used throughout the report. Note there have been updates to the definitions used to segment the infrastructure workforce with the aim of improving our ability to define other construction sectors that compete for labour with the Infrastructure sector.

These classifications build on the standard classifications used for occupation and industry: the Australian and New Zealand Standard Classification of Occupations (ANZSCO) and the Australia and New Zealand Standard Industrial Classification (ANZSIC). Using data to categorise, combine (and in some cases add) our final occupational classifications added additional granularity to the standard measures. The updated classifications are:

1. Which occupations and roles are relevant to public infrastructure construction?
2. Which parts of the workforce are engaged in, adjacent to, trainable for or distant from public infrastructure construction?

These classifications were developed to capture the full range of occupations that contribute to infrastructure in a single streamlined taxonomy. They also support a more nuanced view of the labour force that recognises the portability of skills across and between sectors. Finally, the addition of roles provides a level of granularity which is not present in ANZSCO but which is critical to understanding skill needs.

There were six key pieces of data analysis that built on those classifications, seeking to estimate:

1. Historical and current labour supply
2. Anticipated workforce attrition
3. Future labour supply
4. Workforce shortages
5. Skill profiles
6. Demographics.

The methods used for these classifications and six pieces of analysis are outlined in more detail below.

The most important data sources across the project were the 2021 Census and the ongoing Labour Force Survey, to quantify where supply matched demand until 2037; and job advertisement data from Lightcast as an indicator of demand. Each of these data sources has its own strengths and weaknesses, which limits the conclusions that can be drawn:

- The Census is comprehensive but infrequent; it is self-completed and depends on respondents identifying their own occupation and industry.
- The Labour Force Survey is carefully calibrated to definitive population totals and has higher quality consistent use of classifications, but it is based on a sample.
- The job advertisements are also a sample, but of a varying and unknown proportion of the full quantum of demand – varying not just over time but also by occupation and industry.
- The classification of job advertisements to industry and occupation is done by a statistical / machine learning algorithm based on analysis of the original text, introducing its own statistical noise.

Key limitations of the analysis can be understood in several categories:

- measurement noise – such as Census respondents misclassifying their industry or occupation in a way different to any misclassification that takes place in the Labour Force Survey
- processing noise – such as the Lightcast machine learning algorithm misclassifying the occupation of a job advertisement
- analytical assumptions – such as assuming that the proportions of detailed job titles within an ANZSCO unit group in the workforce reflect the proportion of those titles appearing in job adverts for that ANZSCO unit group; or that the proportion of people in each industry working in each occupation at the time of the Census (the best source at that level of granularity) has not changed materially since.

Every effort has been made to control for these problems, as outlined in the detail below, but significant uncertainty and limitations are inevitable.

Defining public infrastructure relevant occupations and roles

Methodology

An occupational and role taxonomy was previously developed by Nous in partnership with Infrastructure Australia (IA) and their other consulting partners.

This comprises a three-tier taxonomy, going from group at the highest level, down to classification, sub-classification, and role. The first three levels were defined by IA, then mapped to ANZSCOs to enable alignment with key data sources; roles were defined through job advertisement data from Lightcast.

As in previous years, a share of non-project-management occupations are apportioned into project management occupations, to reflect that many project management roles on public infrastructure projects are undertaken by individuals captured under other occupations.

This was done using job advertisement data to assess cosine similarity of skills for roles. Any ANZSCOs that contained less than one per cent of project management professional roles in its job advertisements were excluded from further analysis.

Assumptions

The following assumptions were adopted in defining infrastructure-relevant occupations:

1. Job advertisements are matched appropriately to ANZSCO unit groups in the Lightcast data set.
2. All individuals covered by a mapped ANZCO unit group have skills relevant to public infrastructure.

Limitations of analysis

1. Potential limitations identified in completing our analysis include:
2. The workforce engaged in public infrastructure is diverse. Several occupations involved in pre-planning stages have been omitted from the analysis, such as construction lawyers, transport economists and policy analysts.
3. Infrastructure-relevant occupations are limited to those identified as working in the sector. Individuals outside defined occupations may share a sufficient base of skills to be relevant for public infrastructure. This is most likely true for labouring occupations such as general construction labour, riggers or operators of basic plant.

Defining the engaged, adjacent, trainable and distant share of the workforce

Methodology

Individuals were allocated to ANZSIC (industry) group segments by ANZSCO (occupation) based on 2021 census data. ANZSIC groups were then classified based on those directly linked to the construction of public infrastructure and those that were not. ANZSIC groups identified as directly linked included ANZSIC E, 692, 942 and 529. These formed the basis of engaged and adjacent estimates, with trainable and distant drawn from the remaining ANZSICs.

Weightings were developed to apportion the share of workers engaged and adjacent to public infrastructure. Workforce-to-spend ratios provided by Infrastructure Australia were used to calculate public-private split estimates based on labour, rather than for the total value of projects by state and type of project. Occupational profiles by ANZSIC groups were then used to estimate which occupations were most likely to be working on public and private projects, allowing us to map the monetary public-private split data to the actual supply of labour for engaged and adjacent individuals.

For each ANZSIC group not identified as directly linked, a skills profile was developed using Lightcast job advertisement data. This was compared to the profile for the same occupation in directly linked ANZSICs using cosine similarity analysis. Based on similarity score the ANZSCO-ANZSIC segment was allocated to either the trainable or distant category.

Assumptions

The following assumptions were adopted in defining the engaged, adjacent, trainable and distant shares of the public infrastructure related workforce:

1. ABS data collections capture the full extent of government investment in public infrastructure.
2. ANZSIC E, 692, 942 and 529 account for most of the building and engineering construction activity.
3. Ratios provided by Infrastructure Australia to translate value to employment are consistent with industry practice.

Limitations of analysis

Potential limitations identified in completing our analysis include:

1. Our definition includes work funded by all tiers of government (Australian Government, state and territory governments and local councils). We are unable to differentiate based on funder.
2. The ABS expenditure data does not present any split within the private sector that can be used to estimate work done on private projects destined for private ownership but meant for public use, some of which are included in demand estimates.

Estimating historical and current labour supply for public infrastructure

Methodology

Nous maintains bespoke estimates of workforce supply by ANZSCO unit and ANZSIC group, using iterative proportional fitting to combine latest-

available census data with more up-to-date Labour Force Survey data; these were drawn on for IA-relevant occupations.

The resulting estimate for total workforce in infrastructure-relevant roles was then apportioned based on weightings developed in the previous step to determine the number of engaged, adjacent, trainable or distant workers from 2016 to 2024.

Assumptions

The following assumptions were adopted to estimate the historical and current labour supply for public infrastructure:

1. The distribution of job advertisements by ANZSCO unit group is a reasonable approximation of the workforce under each ANZSCO minor group.
2. Individuals are classified in the same way under census, labour force survey and Lightcast data.

Limitations of analysis

Potential limitations identified in completing our analysis include:

- Small variations in estimates may occur at sub-jurisdictional level from official statistics due to the approach adopted to overcome limitations in census microdata.

Estimating anticipated future workforce attrition

Methodology

Estimates of workforce attrition are based on changes to the age profile of the current infrastructure workforce between two consecutive census surveys.

Age profiles of individuals in the current workforce were approximated using 2021 ABS Census demographic data on individuals working in construction-related industries, split by five-year age groups. The attrition rate was calculated based on movement between the 2016 Census and 2021 Census of consecutive five-year age groups for individuals older than 45 years old under the construction ANZSIC. The change between the two Census surveys and consecutive age groups captures mortality, retirement and career changes.

Due to exceptional circumstances surround the 2021 census – namely the COVID-19 pandemic and the associated economic disruption – it was estimated that the attrition rates produced would be an underestimate over the projection period: in particular due to people delaying retirements and even re-entering the workforce, higher attrition is expected than the shift between the censuses would suggest. An adjustment factor was applied to account for this.

Nous then iteratively shifted the age distribution of the current workforce every five years, and applied attrition estimates to the respective five-year age groups. This produced attrition estimates by occupation and age to 2037.

Assumptions

The following assumptions were adopted in projecting workforce attrition:

1. The age distribution of the current infrastructure workforce is well-approximated by the age profile of individuals working in construction related industries.
2. The change in workforce between the two Census surveys mostly captures mortality and retirement.
3. The change in workforce at an ANZSCO 6-digit level is well approximated by changes at the ANZSCO 4-digit level.

Limitations of analysis

Potential limitations identified in completing our analysis include:

1. Estimated attrition ranges may vary within the ANZSCO 6-digit level compared to the ANZSCO 4-digit level.
2. We are unable to differentiate attrition by mortality, retirement or career changes.

Estimating future labour supply for public infrastructure

Workforce supply forecasts from 2024 to 2037 were developed by integrating current supply with education and migration inflows modelled after 2024. Inflows were modelled at an ANZSCO occupation level; neither education nor migration were modelled directly at the workforce (i.e., engaged/adjacent/trainable/distant) level. To estimate this breakdown, the current and historical

supply were used to derive an average engaged/adjacent/trainable/distant workforce composition, and these proportions were applied to inflows.

Education inflow

New entrants via education were estimated based on the number of workforce-ready graduates across higher education and vocational education and training (including apprenticeships and traineeships, qualifications, and individual units of competency) in each year and mapped to infrastructure-related ANZSCOs. This was done in three steps:

Forecast population to 2037 by five-year age groups

Population projections derived by the Australian Institute of Health and Welfare (AIHW) were used to model population in five-year age groups at the Statistical Area Level 2 granularity up until 2032. Population projections between 2033 and 2036 were interpolated using the compound annual growth rate (CAGR) from 2028 to 2033.

Projecting the number of workforce-ready graduates (all pathways)

Domestic bachelor (higher education) commencements were calculated each year using the Tertiary Collection of Student Information data (TCSI) from the Department of Education, formerly called the Higher Education Information Management System (HEIMS). This was done by age group and translated to a ratio of commencements in each region, per age group, by its population. The commencement ratio was then combined with population forecasts to 2036 to obtain commencements into 2036. Commencements were then overlayed with estimated completion rates from the Department of Education project graduations. Estimates were then adjusted to account for students who may delay workforce entry to pursue further study.

Vocational education and training graduates were calculated in three parts – apprenticeships and traineeships, qualification completers, and part-completers (people that may only undertake a few units of competency for occupational or high-risk licencing purposes). Apprentice and trainee completions were calculated with a similar approach used for domestic bachelor graduates, with completion rates based on prior Nous work. Our approach for non-apprenticeships or traineeship was adjusted to accommodate individuals who did not complete their full training but had completed all intended training to obtain the job they needed.

The completion rates for non-apprenticeships and non-completers who had completed all intended training draw on data from the National Centre for Vocational Education Research (NCVER). To avoid double counting of individuals already in the labour market, both apprenticeships and non-apprenticeship graduates were filtered to only include individuals studying to get a job or to transition careers.

The workforce-ready graduates were mapped to IA groups and IA subclasses using Nous' proprietary concordances that link education to occupation.

Migration inflow

Migration inflows were projected using data supplied by the Department of Home Affairs. Data was broken down by visa subclass at an ANZSCO unit group level. Four visa subclasses were modelled that relate to permanent labour increases: 186 Employer Nomination Scheme; 187 Regional Sponsored Migration Scheme; 189 Skilled – Independent; and 190 Skilled – Nominated. Temporary visas were excluded to avoid double counting of the workforce. Migration figures were apportioned to regions based on existing distributions.

Assumptions

The following assumptions were adopted to estimate future labour supply for public infrastructure:

1. New supply is estimated on an annual basis and distributed evenly across the calendar year.
2. Population forecasts from 2033 to 2037 follow the compound annual growth rate of the AIHW's 2028-2033 population forecast.
3. The current rates of people commencing vocational and higher education are maintained to 2037.
4. The current rates of people completing (and where relevant, partly completing) vocational and higher education are maintained to 2037.
5. The relationship between fields of education and/or qualification, and ANZSCO career outcomes, are maintained.
6. VET students have been segmented into different categories based on reason of study. 'Skillers' and 'starters' (as identified through the student outcomes survey) are students who represent a net addition to the workforce. The ongoing proportion of 'skillers' and 'starters' maintains the same ratio as per student survey outcomes.
7. The visa classes of interest are: 186 employer nomination scheme; 187 regional sponsored migration scheme; 189 skilled independent; and

190 skilled nominated. These permanent visa classes represent a net workforce migration to Australia.

8. Current rates of migration the above subclasses is assumed to be maintained to 2036.
9. Perturbed data instances in the migration data which have a value of "<5" have been assumed to take on a value of three.
10. The distribution of migration to different states is assumed to follow the current distribution of infrastructure workers.

Limitations of analysis

Potential limitations identified in completing our analysis include:

1. Education completion rates could vary due to factors including age, region, and field of study. This has not been individually estimated in this study.
2. Population estimates have not been updated since 2019; growth projections and geographical projections may have shifted somewhat, particularly due to impacts of the COVID-19 pandemic.
3. Distribution of migrants to states could vary depending on external market factors. This has not been individually estimated in this study.

Identifying shortages based on modelled supply and demand

Methodology

Demand estimates provide by Infrastructure Australia were matched to Nous supply forecasts by sub-classification to estimate potential shortage or surplus at Infrastructure Australia group, classification, sub-classification, and when relevant, geographical region.

Assumptions

1. The following assumptions were adopted to estimate future labour supply for public infrastructure:
2. Occupational definitions are consistent for demand- and supply-side estimates.

Limitations of analysis

Potential limitations identified in completing our analysis include:

1. Demand estimates are based on known infrastructure investment at 30 June 2024.
2. Demand estimates do not incorporate demand from individual councils for public infrastructure.
3. Demand estimates outside of public infrastructure is sourced through a private data provider which limits inferences that can be made about private infrastructure and private non-infrastructure construction.
4. Not all demand data can be appropriately assigned to geographical regions; while this has no impact on any aggregate analysis, regional analysis may underestimate some shortages and overestimate others. This varies by jurisdiction, depending on the quality of data provided.

Identifying shortages based on labour market indicators

Method for occupational indicators of shortage

Each occupation has been assessed for signs of shortages using four independent methods which answer the following questions respectively:

1. Is the occupation in shortage on the National Skills Commission's Skills Priority List?
2. Does our supply and demand analysis of public infrastructure show a shortage?
3. Do the number and kind of job advertisements indicate a shortage?

An occupation is classified under 'Likely Shortage' if three or more of these assessments showed a shortage, 'Potential Shortage' if two showed a shortage and two did not or were unclear, and 'Unlikely Shortage' if only one or none of the assessments showed a shortage.

Assumptions

The following assumptions were adopted to identify shortages based on labour market indicators:

1. Movement in indicators reflects difficulties by employers in sourcing labour.

Limitations of analysis

Potential limitations identified in completing our analysis include:

1. A range of factors may contribute to movement in identified indicators. Consequently, indicators should be viewed in conjunction with other assessments of shortage to provide a fuller picture.
2. Stakeholder engagement was not undertaken as part of the project in 2024; accordingly, the indicator for views from key industry bodies and participants was dropped.

Developing skills profiles for identified occupations

Methodology

Lightcast job advertisements were used to develop skills profiles by occupation and roles based on the Lightcast skills taxonomy and text analytics algorithm.

Nous assessed each skill identified by whether they were general, or specialist as defined by Lightcast and the distinctiveness of the skill – how likely a skill is requested in a job advertisement from a particular industry compared to the entire labour market. These combined to create the three categories – general, technical and specialist – used in analysis.

Nous also assessed the degree of change in mentions of particular skill. Two periods, 2017 to 2019 and 2020 to 2022 (selected for full years of data), were compared to identify skills with increasing, declining or stable demand.

Assumptions

The following assumptions were adopted to develop skills profiles for relevant occupations:

1. Mentions of skills in job advertisements are representative of an employer's skills needs for a given occupation.

Limitations of analysis

Potential limitations identified in completing our analysis include:

1. Sample sizes can be small for some occupations. To ensure sufficient samples all job advertisements were used for a given occupation, rather than restricting to those industries directly linked to public infrastructure.

Demographic analysis

Methodology

Detailed tables from the 2021 census provided employment data by gender, age, jurisdiction, and ANZSCO.

The figures were used to summarise age and gender distribution across occupations in scope for this report. The geographic indicators were used to explore the distribution of the infrastructure labour force across Australia.

The data used for these analyses required no modeling or estimation, just summary of data available through the ABS' TableBuilder.

Assumptions

1. Gender, age, and geographic distributions within infrastructure-specific occupations are consistent with broader industry trends and population estimates over relevant periods.
2. Gender and age distributions for common job titles within the infrastructure industry do not differ significantly from distributions in other industries.

Limitations of analysis

1. Demographic information could not be explored by ANZSIC industry classifications because of (1) table size restrictions imposed by the ABS and (2) individual categories with small numbers, which the ABS is unable to provide to protect individual privacy.
2. A key implication for analysis was the inability to accurately explore different segments of the infrastructure workforce (such as engaged, adjacent, trainable, and distant) by demographic breakdown. Only broader aggregations were possible.

Occupational shortage assessment

The table below shows how the overall assessment of occupational shortages was produced. **IA overall assessment** reflects whether occupations were likely in shortage (fulfilled three or more criteria), potentially in shortage (fulfilled two criteria) or unlikely to be in shortage (fulfilled less than two criteria). Overall assessment is derived applying four key indicators per occupation to try and triangulate on the severity of the shortage (per workforce modelling) as well as the likelihood of that shortage manifesting. These indicators are explained below.

	External Indicators		Nous analysis Indicators			
Occupation	Skills priority list 2023	Shortage Survey (% of respondents)	Labour market indicator	Shortage (total)	Shortage (% of supply)	IA Indicator
Geotech Engineer	○	21%	○	7,268	1,011%	Likely shortages

- **Skill priority list 2023** – This indicates whether occupations are in shortage on the 2023 Skills Priority List (SPL) from the National Skills Commission (now Jobs and Skills Australia).
- The SPL adopts similar conceptual methodology to the Labour Market Indicator (LMI), in that it draws on job ad data and considers similar metrics; however, there is enough difference in the metrics and data sources to make this meaningful for cross-validation.
- As the SPL is at the ANZSCO 6-digit level, and some occupations span multiple ANZSCO codes, the indicator is "on" if the simple majority of codes show a shortage.
- **Labour shortage survey** – Percentage of respondents in the labour shortage survey who responded that the occupation was in shortage when given the option to choose 3 occupations in each IA group.
- **Labour market indicators** – The Labour Market Indicator (LMI) uses job ads to assess a role's percentile rank within a state on:
  - **3-year salary change**
  - **5-year share of job ads**
  - **% of ads posted for >31 days in last 12 months**
- If a role ranks highly enough across a combination of three metrics, it is deemed **Likely** to be in shortage. It can also be deemed **Potential** or **Unlikely**.
- The occupation-level LMI reported is an aggregation across the roles that it comprises. The LMI is "on" if most roles (averaged) are Likely to be in shortage.
- **Shortage indicators** – Total shortage is reported to highlight the severity of the expected shortage; this is strictly shortage — the difference between demand and supply is cut off at zero so surpluses are not shown.
- Shortage as a percentage of supply is also reported to approximate how binding a shortage may be: if a shortage requires several multiples of the existing workforce to fill, it may be a blocker for completing projects.
- **IA overall indicators** – An overall indicator that combines the other four indicators (shortage total and shortage % of supply are considered the same when collating indicators).
  - If an occupation has 1 or no indicators demonstrating shortage, the role receives the rating "unlikely shortages".
  - If an occupation has 2 indicators demonstrating shortage, the role receives the rating "potential shortages".
  - If an occupation has 3 or 4 indicators demonstrating shortage, the role receives the rating "likely shortages".

Table 5: Assessment of shortage and the relevant indicators for each occupation by occupational group

Project management professionals

	External Indicators		Nous analysis Indicators			
Occupation	Skills priority list 2023	Shortage Survey (% of respondents)	Labour market indicator	Shortage (total)	Shortage (% of supply)	IA Indicator
Project Management	○	81%		13,054	205%	Potential shortages
Commercial management		38%		8,542	574%	Potential shortages
Environmental and Occupational Health Professionals		12%		4,740	354%	Potential shortages
Risk Management	○	38%		2,014	524%	Potential shortages
Construction Management	◐	50%				Potential shortages

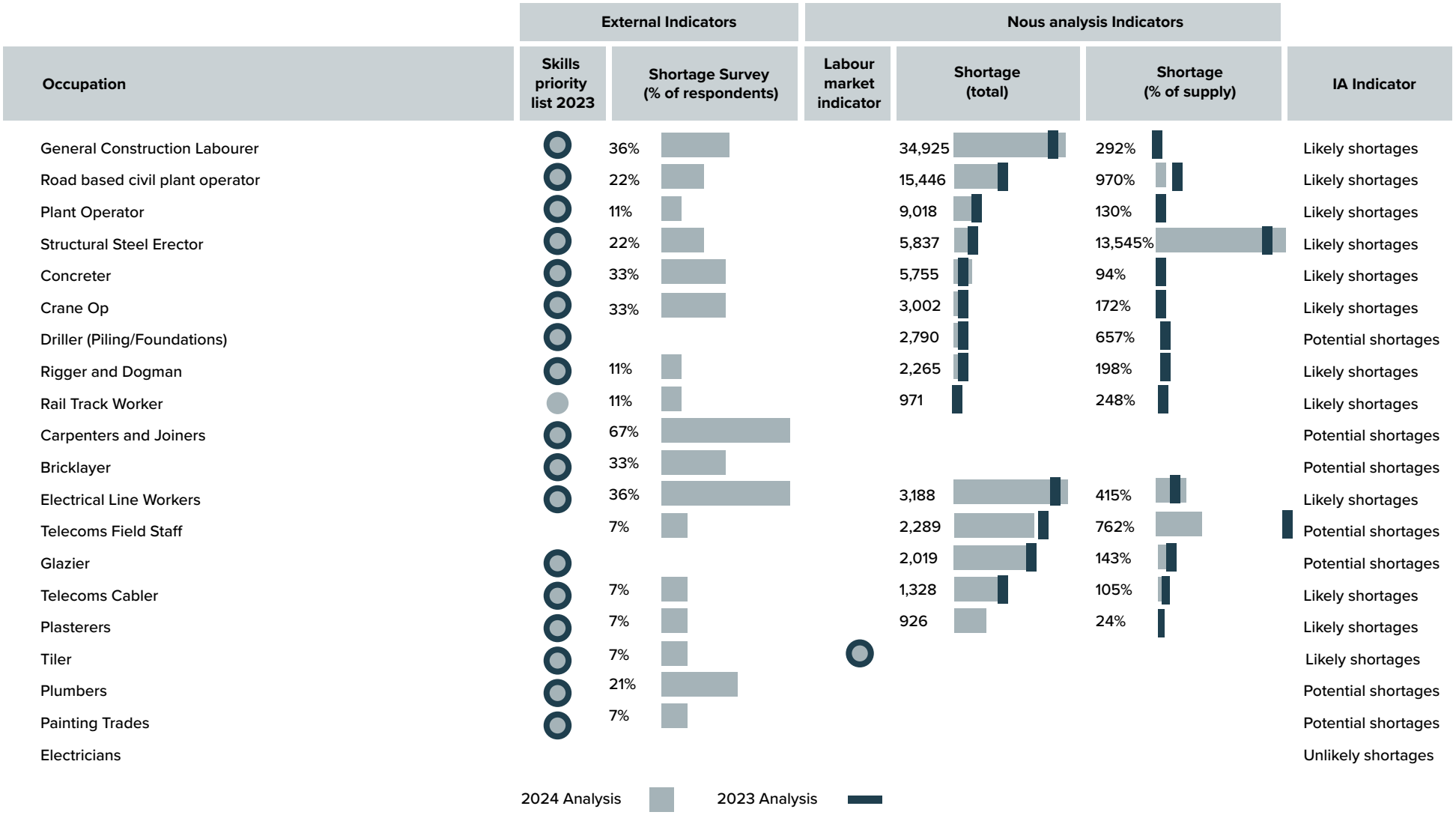
2024 Analysis 2023 Analysis

Engineers, scientists and architects

Occupation	External Indicators: Skills priority list 2023	External Indicators: Shortage Survey (% of respondents)	Nous analysis Indicators: Labour market indicator	Nous analysis Indicators: Shortage (total)	Nous analysis Indicators: Shortage (% of supply)	IA Indicator
Structural Engineer	●	37%		14,496	444%	Likely shortages
Procurement		25%		14,123	2,390%	Potential shortages
Civil Engineer	●	53%		11,618	126%	Likely shortages
Land Surveyor	●	5%		10,239	286%	Likely shortages
Quantity Surveyor	●	5%		8,886	473%	Likely shortages
Other professional engineers, scientists, etc.	●			7,342	1,418%	Potential shortages
Geotech Engineer	●	21%	●	7,268	1,011%	Likely shortages
Safety Officer		21%	●	6,020	303%	Likely shortages
Telecommunications Engineers			●	5,632	2,389%	Potential shortages
Mechanical Engineer	●	21%		4,772	197%	Likely shortages
IT professionals/Engineers	●	16%		4,679	3,038%	Likely shortages
Maintenance Planner				4,239	1,068%	Unlikely shortages
Geologists, geophysicists, and hydrogeologists	●	11%	●	4,027	733%	Likely shortages
Landscape Architect				2,536	194%	Unlikely shortages
Environmental Professionals		5%	●	2,526	145%	Likely shortages
Draftsperson	○	16%		2,095	29%	Likely shortages
Building Surveyor	●			383	37%	Potential shortages
Electrical Engineer	●	42%		274	9%	Likely shortages
Engineering Manager	●	16%				Potential shortages
Electronic Engineer	●					Unlikely shortages
Architect	○	11%				Potential shortages

2024 Analysis 2023 Analysis

Trades and labourers



Occupation	External Indicators: Skills priority list 2023	External Indicators: Shortage Survey (% of respondents)	Nous analysis Indicators: Labour market indicator	Nous analysis Indicators: Shortage (total)	Nous analysis Indicators: Shortage (% of supply)	IA Indicator
General Construction Labourer	●	36%		34,925	292%	Likely shortages
Road based civil plant operator	●	22%		15,446	970%	Likely shortages
Plant Operator	●	11%		9,018	130%	Likely shortages
Structural Steel Erector	●	22%		5,837	13,545%	Likely shortages
Concreter	●	33%		5,755	94%	Likely shortages
Crane Op	●	33%		3,002	172%	Likely shortages
Driller (Piling/Foundations)	●			2,790	657%	Potential shortages
Rigger and Dogman	●	11%		2,265	198%	Likely shortages
Rail Track Worker	●	11%		971	248%	Likely shortages
Carpenters and Joiners	●	67%				Potential shortages
Bricklayer	●	33%				Potential shortages
Electrical Line Workers	●	36%		3,188	415%	Likely shortages
Telecoms Field Staff		7%		2,289	762%	Potential shortages
Glazier	●			2,019	143%	Potential shortages
Telecoms Cabler	●	7%		1,328	105%	Likely shortages
Plasterers	●	7%		926	24%	Likely shortages
Tiler	●	7%	●			Likely shortages
Plumbers	●	21%				Potential shortages
Painting Trades	●	7%				Potential shortages
Electricians						Unlikely shortages

2024 Analysis 2023 Analysis

Data sources and usage

A range of data sources have been used to support analysis for this report. These are outlined in 6.

Table 6: Data sources used and their purpose

Data source	Definition of occupations	Definition of public infrastructure	Estimation of current and historical supply	Estimation of future workforce attrition	Estimation of future workforce supply	Modelled supply and demand dynamics	Labour market indicators of shortage	Development of skills profiles	Demographic analysis
Lightcast labour market data	✓	✓	✓			✓	✓	✓	
ABS Census 2016 and 2021[3]		✓	✓	✓	✓	✓			✓
ABS Engineering Construction Activity[4]		✓	✓		✓				
ABS Building Construction Activity[5]		✓	✓		✓				
ABS Payroll Jobs and Wages[6]		✓	✓						
Australian Institute of Health and Welfare[7]					✓	✓			
Department of Home Affairs migration data[8]					✓	✓			
Higher education completion rates[9]					✓	✓			✓

Data source	Definition of occupations	Definition of public infrastructure	Estimation of current and historical supply	Estimation of future workforce attrition	Estimation of future workforce supply	Modelled supply and demand dynamics	Labour market indicators of shortage	Development of skills profiles	Demographic analysis
Higher education graduates[10]					✓	✓			✓
VET completion rates[11]					✓	✓			
VET student outcomes survey data[12]					✓	✓			
TCSI enrolment data[13]					✓	✓			
NCVER Total VET Activity data[14]					✓	✓			
Infrastructure demand data[15]						✓			
Housing demand data[16]						✓			
ABS Labour Force Survey			✓			✓			
Australia & New Zealand Standard Industrial Classification (ANZSIC)		✓						✓	
Australia & New Zealand Standard Classification of Occupations (ANZSCO)	✓							✓	
Jobs and Skills Australia National Skills Priority List						✓			

Appendix F: Industry confidence surveys

Industry confidence research

Industry survey engagement

Supporting the quantitative analysis research each year, Infrastructure Australia also undertakes industry engagement to gauge industry confidence levels and better understand their perspectives on current market conditions affecting the broad spectrum of the infrastructure market.

This year, three surveys assessed a broader spectrum of the market focusing on both large Tier 1s and smaller businesses (Tiers 2 and 3) in the building and construction industry, supplemented with in-depth interviews:

- **The 2024 Industry Confidence Survey** (n=200) captured views across the infrastructure life cycle, across identification/planning, design, construction, operations and management. The survey sample were actively delivering contracts that ranged in value from less than $10 million to more than $1 billion over the last 12 months.
- **The 2024 Civil Contractors Federation Survey** of its members (n=122) captured views of civil-construction businesses, comprised of majority (63%) smaller Tier-3 and Tier-4 businesses with annual turnover of less than $100 million. CCF is the peak body representing Australia's civil construction industry
- **The 2024 Infrastructure Australia Labour Shortage Survey** (n=40), as one of various inputs into the workforce analysis, supplements quantitative data and provides additional nuanced insights into projected shortages. Surveyed businesses had operations covering all jurisdictions and all construction sectors (transport, residential, commercial and social infrastructure).
- **In-depth interviews** (n=20) with randomly selected building and construction businesses, with each tier represented, to get a more detailed understanding of the key issues for the year.

All state and territories were represented in this year's industry surveys and were roughly representative of construction industry geographical spread across the country – most in New South Wales and Victoria, followed by Queensland, Western Australia and South Australia – with smaller minorities in Australian Capital Territory, Tasmania and the Northern Territory.

Survey questions asked

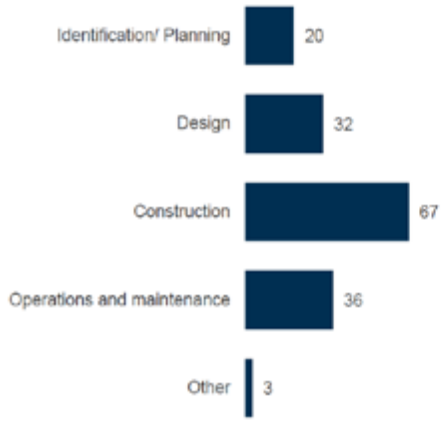
The main objectives of the research were to obtain a deep view of industry confidence, sentiment, and specific concerns or identification of constraints against market dynamics across infrastructure investment.

The structure of the 2024 Industry Confidence Survey was broadly as follows:

- Respondent characteristics (size, location, segment, ownership etc.)
- Recently experienced growth in activity
- Anticipated growth in activity in coming years
- Factors impacting capacity and capability
- Factors impacting productivity
- Specific supply chain challenges by input
- Recent experience with cost escalation (labour and non-labour inputs)
- Potential solutions to mitigate capacity/ capability risk
- Confidence in delivering infrastructure over next 12 months, two to four years, or beyond five years
- Confidence to proportionally scale up to meet increases in public infrastructure investment

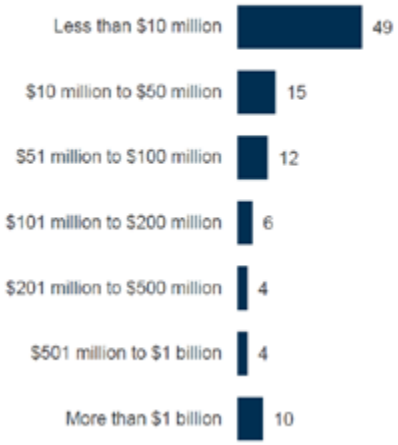
Figure 2: 2024 Industry Confidence Survey key firmographics

Infrastructure project lifecycle stages involved in (%)
(multiple response)



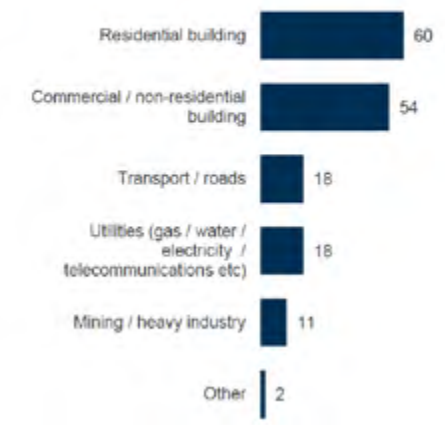
Roles in delivery of capital projects (%)
(multiple response)

Total capital value of largest current infrastructure projects (%)



Largest contract currently held by organisation (%)

Parts of the construction industry operated in (%)
(multiple response)



	Location of operations				Size of largest current contract		
	NSW	Vic	Qld	Rest of Australia	<$10 million	$10 million – $100 million	$101+ million
Residential building	58	59	41	62	64	69	40
Commercial / non-residential building	62	53	61	49	48	59	58
Transport / roads	22	28	33	24	8	13	46
Utilities (gas / water / electricity / telecommunications etc)	19	19	31	21	11	13	38
Mining / heavy industry	15	14	26	21	7	6	25
Other	3	3	4	1	3	0	2

Appendix G: Revision of cost escalation assumptions

Enhancements to the Market Capacity Intelligence System

Updating our assumptions using ABS price index data

Since its establishment in 2021, the Market Capacity system has used June 2020 as the cost datum for its assumptions. When first developed, the system was relatively insensitive to typical year-on-year escalation of resources. However, we have seen extraordinary cost escalation over the past four years, especially in non-labour resources, leading to a need to update the MCP assumptions.

Recent cost escalation data has indicated that the volatility of the past four years has reached a point of relative stability, meaning a refresh would be appropriate. To do so we updated and applied differential escalation rates to materials, labour, equipment, and services, providing a more realistic representation of the cost environment. To maintain the timeliness of our cost estimates going forward, the Market Capacity Intelligence System now has a process for updating assumptions and cost escalation calculations based on the latest ABS price indices.

Differential Escalation Explained

- **Resource-Specific Escalation Rates:** Different resource categories, such as materials, labour, equipment, and services, have unique escalation rates. For example, the cost of materials like steel or concrete have increased at a different rate compared to labour costs or equipment rental fees. This variation is due to factors such as supply chain dynamics, market demand, and industry-specific constraints.
- **Impact on Cost Breakdown:** When updating MCP assumptions, it is essential to account for these differential escalation rates to ensure that the cost breakdown accurately reflects the current economic conditions. For instance, if the cost of materials has escalated more rapidly than labour costs, the proportion of the total project cost attributed to materials will increase.

To update the MCP assumptions from their 2020 basis to 2024, we used the ABS's Producer Price Index (PPI) and Wage Price Index (WPI) data series. The ABS PPI and WPI data provides the actual cost escalation over time for non-labour and labour resources. These indexes are recorded for various industries, including construction and manufacturing. To bring the Market Capacity system's assumptions up to date, this data was deployed by IA to reflect changes in the project input resource prices and costs over the period from 2020 to 2024.

The process involved the following steps:

1. **Data Collection:** Relevant ABS PPI data for the construction and manufacturing industries was gathered. This data included index numbers and percentage changes for different subdivisions and classes within these industries.
2. **Categorisation:** MCP resources were categorised into different groups such as materials, plant, equipment, and labour. Each resource category was then mapped to the corresponding ABS PPI or WPI data. For example, materials like bitumen binders were mapped to the "Petroleum and coal product manufacturing" PPI, while equipment like electrical equipment was mapped to the "Electrical equipment" PPI.
3. **Index Mapping:** The ABS PPI and WPI index numbers were mapped to the MCP resource categories by aligning the start and end dates of the index data with the relevant time periods for the MCP assumptions. This ensured that the price changes over time were accurately reflected in the MCP resource categories.
4. **Adjustment and Validation:** MCP assumptions were adjusted based on the mapped ABS data. This involved recalculating the assumptions using the updated index numbers and percentage changes. To ensure that they accurately reflected the changes in prices and costs over the specified period, the adjustments were validated by comparing the total project cost escalations calculated by the MCP against the relevant Construction Output PPI from the ABS.

Endnotes

1 A sigmoid function is a mathematical function having a characteristic “S”-shaped curve or sigmoid curve. Cumulative construction activity on projects, when mapped against time, typically follow an ‘S-curve’ pattern.

2 The collection history of the Manufacturing Survey is reported by the ABS here: https://www.abs.gov.au/AUSSTATS/abs@.nsf/DSSbyCollectionid/87E111C47BE15BB2CA256BD000 26FB74?opendocument Reasons for discontinuing data collection range from a lack of interest from industry clients following substantial price increases when moving to a user funding model, unwillingness to fund from the Federal Government, industry closures and consequent consent problems.

3 Australian Bureau of Statistics (2016 and 2021), Various products on TableBuilder, ABS Website, accessed 1 May 2024.

4 Australian Bureau of Statistics (March 2024), Engineering Construction Activity, Australia, ABS Website, accessed 1 May 2024.

5 Australian Bureau of Statistics (March 2024), Building Activity, ABS Website, accessed 1 May 2024.

6 Australian Bureau of Statistics (15 June 2024), Weekly Payroll Jobs and Wages in Australia, ABS Website, accessed 1 May 2024.

7 Australian Institute of Health and Welfare, Population Projections, 2012-2027.

8 Data obtained via information request to the Department of Home Affairs.

9 Department of Education, Completion Rates of Higher Education Students

10 Department of Education, Student Data

11 National Centre for Vocational Education Research, Latest VET statistics

12 National Centre for Vocational Education Research, VET student outcomes

13 Tertiary Collection of Student Information (formerly Higher Education Information Management System) data

14 National Centre for Vocational Education Research data

15 Projected infrastructure demand data supplied by Infrastructure Australia

16 Projected Housing demand data supplied by Infrastructure Australia