BCATS

BUILDING, CONSTRUCTION AND ALLIED TRADE SKILLS

BCATS Industries

Unit Standard 31511 (v1), **Level 2**

Demonstrate knowledge of BCATS industries

4 CREDITS

BCITO buildingpeople

Building and Construction Industry Training Organisation (BCITO)

Level 5, 234 Wakefield Street
PO Box 2615
Wellington 6140
0800 422 486
www.bcito.org.nz

Table of contents

Introduction

This handbook contains information about a variety of Building, Construction, and Allied Trades Skills (BCATS) industries within the building and construction sector.

There are many career opportunities in the building and construction sector. While you are working your way towards achieving this unit standard you may discover ones you didn't know about or didn't know much about before. This could help you to decide which industry you want to go into after school.

There is a lot of other information about the industries and their specialities that you can discover through talking with people, paying attention to the names of businesses advertised on vehicles and buildings, and researching on the web. You might also build your knowledge during work experience, on an industry placement, or by doing research in the classroom.

The industries covered in this booklet are listed below. There are also many specialities within these that offer great careers. You can watch videos of people in these industries talking about what they do on the 'Careers' page of www.bcito.org.nz.

BCATS industries covered in this booklet are:

Carpentry		Concrete	
Exterior plastering		Floor & wall tiling	
Glass and glazing		Interior systems	
Joinery			

Other industries will be added to this resource over 2021.

How to use this handbook

This handbook has a lot of information in it. You are not expected to read and memorise it all!

Start instead with reading the first section. This has information that is relevant to all BCATS industries and is not repeated in each industry's section.

You may then wish to skim over all the industries' sections before you decide which ones you want to learn more about. Read their sections properly, referring back to the first section as needed.

Handy hint: We have tried to not repeat information within each section. For example, while there are 'Relationship with other trades' pages, you will also learn about how the chosen industry works with others through reading about what work they do.

How you will be assessed

You need to correctly complete a Knowledge Assessment Sheet.

You need to demonstrate to your teacher/tutor your knowledge of **at least two** BCATS industries. For these you need to:

- identify job roles in the industry and describe them in terms of scope of work, training requirements, and career paths
- identify overarching roles and responsibilities of those working in the industry (e.g., What would happen to a house if a carpenter didn't build according to the Building Code and best practice? Or if concrete foundations or pre-cast slabs weren't made properly? Or if glass wasn't strengthened or installed properly?)
- identify potential clients and describe the nature of the relationships
- describe the relationships between your selected industries in terms of crossover and compatibility
- identify industry bodies and their impacts on those who work in their industries.

Bay of Islands College's BCATS students' relocatable house in the process of being constructed.

Glossary of terms

Term	Meaning
Apprentice	A person who works for another under a legal agreement in return for instruction in a trade, art or business.
AS/NZS	Australia/New Zealand Standard
BS	British Standard
Building Code	Prescribes the functional and performance criteria requirements which buildings must comply with.
Building Consent	The formal document issued by a Building Consent Authority, confirming that a proposed construction project complies with the Building Code and allows the specific project to proceed.
Building work	All work relating to the construction, alteration, demolition or removal of a building.
Code Compliance Certificate	A certificate issued by a building consent authority confirming that the completed building complies with the building consent.
Industry	A much more specific group or a narrower focus of business than a sector (e.g. tiling).
Industry bodies	Organisations that play a role within an industry in a regulatory, support or advisory capacity. This includes regulatory bodies, industry training organisations and trade or professional associations.
Licensed Building Practitioner (LBP)	A person who has demonstrated that they have met the standards for licensing and are registered to carry out restricted building work.
Regulation	Rules that tell companies how work should be done or what the finished product should be like.
Regulatory body	An official group set up to organise and control an activity or process by making it subject to rules or laws.
Restricted work	Any building work that is critical to the integrity of the building and the health and safety of its occupants and requires a Building Consent.
Sector	A large segment of the economy (eg building and construction).

Industry bodies

There are a lot of organisations involved with all BCATS industries that set minimum standards and provide oversight, information and support. Their collective job is to protect both the people in the industry and the people that they do work for.

Below is an overarching summary of them and their roles. Aspects unique to a particular industry are included in the section relating to that industry. Make sure you refer to this section as well as the section within your selected industries.

"Regulatory bodies" or "industry bodies" include:

- Ministry of Business, Innovation and Employment (MBIE)
- Standards New Zealand
- WorkSafe NZ
- Building Consent Authorities
- Industry Training Organisations (ITOs)/Workforce Development Councils

Each of these bodies has a different job. Some look after safety, others look after quality, and others look after training.

Ministry of Business, Innovation and Employment (MBIE)

MBIE is responsible for the Acts and regulations affecting the building industry. Many are there to protect the client so that they have a safe and good quality building that meets legal requirements.

Regulations are rules that tell companies how work should be done or what the finished product should be like. Those that relate to the Building Act 2004 are written into a document called the Building Code.

Some Acts of Parliament that relate specifically to the construction industry are:

- Building Act 2004
- Construction Contracts Act 2002
- Fencing of Swimming Pools Act 1987
- Plumbers, Gasfitters, and Drainlayers Act 2006
- Weathertight Homes Resolution Services Act 2006
- Consumer Guarantees Act 1993
- Employment Relations Act 2000
- Health and Safety at Work Act 2015

MBIE is also responsible for occupational licencing. Occupational licensing aims to ensure that people in the building industry who are responsible for the work done are competent and accountable so that homes and buildings are designed and built right the first time.

The **Licensed Building Practitioners Scheme** was introduced in November 2007. There are a range of license classes covering carpenters, site supervisors, construction managers, designers and architects. There are also a number of specialist license classes for other trade areas including external plastering, roofing, brick and block laying.

Only a Licensed Building Practitioner (LBP) can carry out or supervise certain restricted building work on homes and buildings. Restricted building work is work that by its nature is important to the building, is complex to do, needs to be done right, and must therefore be done by an approved, competent person. LBPs are held personally responsible for ensuring all work on the project complies with the Building Code and are required to sign-off each stage as it is completed.

Standards New Zealand

New Zealand Standards (NZS) help people comply with the Building Code by setting out minimum standards on many aspects of building and construction. They are written by Standards New Zealand, which is a business unit within MBIE, and must be approved by MBIE as complying with the Building Code.

Standards New Zealand develops, distributes, and administers standards and standards-based solutions. They provide information, establish measurements, and set quality and safety levels across a range of sectors.

Industry professionals have to know what these standards are. They also need to make sure they are using the most up to date standards.

Standards for BCATS industries are in NZS publications.

WorkSafe New Zealand (WorkSafe)

WorkSafe is the work health and safety regulator and is responsible for implementing the Health and Safety at Work Act 2015. WorkSafe's functions include:

- monitoring and enforcing compliance with work health and safety legislation
- providing guidance, advice and information on work health and safety
- promoting a co-operative and consultative relationship between the people who have health and safety duties and the persons to whom they owe those duties and their representatives
- collecting, analysing and publishing statistics and other information relating to work health and safety.

Examples of safety issues that WorkSafe provides information about – and investigates if accidents occur - include:

- manual material handling (safe lifting)
- safe use of plant, equipment and tools
- working at heights (i.e. above ground level, ladders and scaffolds)
- chemical hazards (adhesives and sealants)
- noise.

Building Consent Authorities (BCA)

BCAs are responsible for checking that building work meets the Building Code. A BCA is most commonly a Territorial Authority (local authorities or councils).

They have to check the work before it starts, while it is underway and when it is finished. This is shown in the table below.

What the BCA does	When	What they are checking
Issue building consents	Before any building work starts	Checking that the details shown on drawings meet the Building Code
Perform inspections	As building progresses	Checking that construction, insulation, lining, bracing, weather tightness, plumbing, and electrical work complies with the Building Code
Issue Code Compliance Certificates	When the building is completed	Checking that all the requirements of the Building Code are met.

Building Research Association of New Zealand (BRANZ)

BRANZ is an independent and impartial research, testing, consulting and information company providing services and resources for the building industry.

Their two main areas of activity are to:

- research and investigate the construction and design of buildings in New Zealand
- enable the transfer of knowledge from the research community into the commercial building and construction industry.

Their core purpose is to improve people's lives through research and to inform, educate and motivate those who shape the built environment.

BRANZ produce a wide range of publications that translate building-related research into practical, usable information about trends and best practice, making it accessible to the wider construction industry.

Industry Training Organisations/Workforce Development Councils

Industry training organisations (ITOs) have since 1992 set the skill standards and arranged training for people employed in the industries the ITO is responsible for. Almost all building and construction industry apprentices in New Zealand since 1992 were enrolled with the Building and Construction ITO (BCITO).

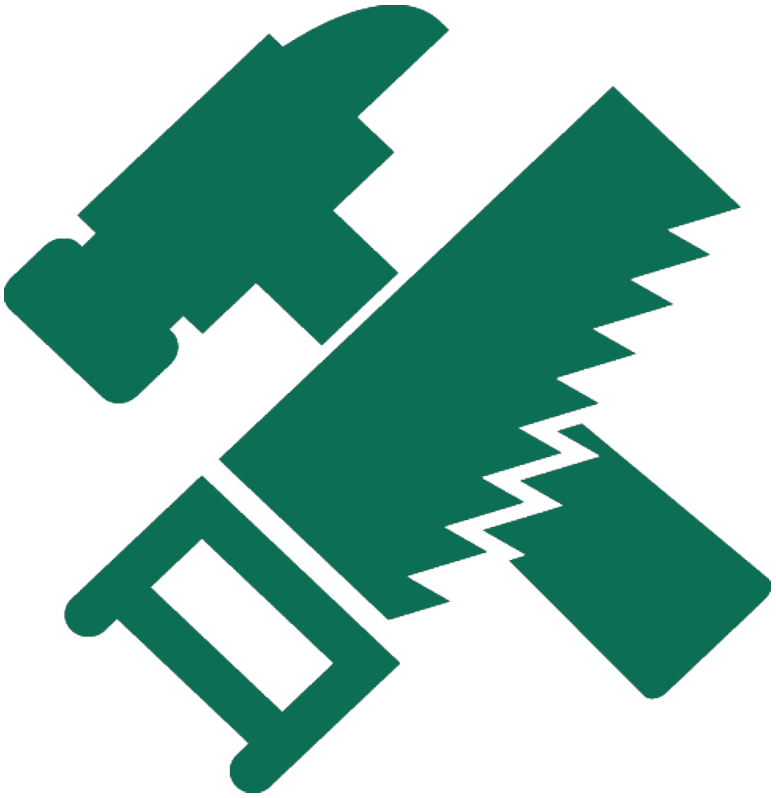
Recent changes to the vocational education sector means that setting skill standards and developing qualifications will soon be done instead by Workforce Development Councils (WDC). The WDC for building and construction industries will be the Construction and Infrastructure Workforce Development Council (CIWDC).

The responsibility for arranging training of apprentices will mostly move from ITOs to Te Pūkenga (the New Zealand Institute of Skills and Technology (NZIST). Wānanga and Private Training Establishments (PTEs) are able to continue to support apprentices training through them

To print just the **Carpentry** section, print pages 11 to 28

This box does not have to be printed

Carpentry
(Te Mahi Kāmura)



Carpentry (Te Mahi Kāmura)

The carpentry industry covers many different construction methods and occupations. Carpenters can construct, erect, install, repair and maintain structures and fixtures made from timber, steel and other materials.

Carpenters must also be able to read and interpret information from plans, specifications and technical information and to communicate it clearly.

In New Zealand the building industry has three major sectors:

- residential
- commercial
- maintenance.

Residential building

The residential trade sector is primarily centred on the construction of single and multi-storey houses, flats, low rise apartments, and additions to existing buildings. These can be built in a wide range of shapes and sizes.

In New Zealand houses are usually built using the light timber frame construction method, reflecting the availability of plantation grown timber. Steel framed houses are another option.

The light timber frame construction method is a building technique based on a stable structural timber frame - or alternatively using a light gauge steel frame - to which a range of exterior, interior wall and roof coverings are attached.

Some other residential construction methods include:

Solid timber This is a system which usually consists of a single or double layer of solid timber.

Straw bale This method uses baled straw as the main material for the walls.

Rammed earth This method involves compacting a mixture of cement and moist earth into formwork to produce solid walls.

Straw bale house being constructed.

Commercial building

The commercial building sector is made up of all non-residential type construction including:

- high-rise apartment and office buildings
- schools and hospitals.

Commercial building in New Zealand provides particular design and structural challenges for designers and builders due to the danger of major earthquakes.

Building maintenance

The on-going maintenance of a building requires carpenters to do many different tasks. The principles of good building practice that apply to the construction of new buildings also apply to the maintenance of buildings.

Older houses, in particular, may be constructed quite differently from modern homes and the materials and construction techniques used then are often not those used today. Maintenance work will often include carpenters bringing them up to compliance with the current Building Code.

Checking plans and specifications on site.

Carpentry glossary of terms

Below are a few of the many terms carpenters must know. Remember to also refer to the glossary of terms in the introduction section.

Term	Meaning
Building Code	Prescribes the functional and performance criteria requirements which buildings must comply with.
Building Consent	The formal document issued by a Building Consent Authority, confirming that a proposed construction project complies with the building code and allows the specific project to proceed.
Building work	All work relating to the construction, alteration, demolition or removal of a building.
CGL (cleared ground level)	The height of the ground after the clearance of all vegetation etc.
Code Compliance Certificate	A certificate issued by a Building Consent Authority confirming that the completed building complies with the Building Consent.
Datum	A permanent and defined point from which can be used as a reference to establish levels on a building site.
DPC (damp proof course)	A horizontal moisture barrier which prevents moisture rising into a structure through capillary action.
Licensed Building Practitioner (LBP)	A person who has demonstrated that they have met the standards for licensing and registered to carry out restricted building work.
Restricted work	Any building work that is critical to the integrity of the building and the health and safety of its occupants and requires a Building Consent.

Overall roles and responsibilities of carpenters

The overall role and responsibilities of carpenters is to construct buildings that are safe and watertight.

They follow each building's plans and specifications once the local Building Consent Authority has approved them. All work must comply with the:

- Building Act 2004
- Building Regulations (which includes the Building Code)
- relevant New Zealand Standards, the most important of which is NZS 3604.

In addition to these, manufacturers of systems such as interior linings provide instructions for their products' installation that must be followed for the product to meet required performance standards.

There are many aspects to carpenters work that is considered to be 'restricted building work'. Only Licensed Building Practitioners (LBPs) can carry out or supervise this work and they are held personally responsible for its quality.

Some examples of the consequences of carpenters not fulfilling their required obligations are below.

- Buildings not constructed where they must be due to not reading the site plans and/or setting out correctly.
- Incorrect levelling of foundations causing structural risks to the building.
- Using materials not designed for the job, such as timber that will rot because it is not treated for being in contact with the ground and incorrect pile foundations causing the building to fall off them during high winds or an earthquake.
- Water destroying frames, interior linings, floors, and furnishings due to external cladding not being installed according to manufacturer's instructions and best practice, resulting in unsafe, mouldy homes and significant repairs/demolition being required.
- Roofs collapsing during heavy snow due to not checking that the trusses delivered were the ones specified in the plans and specifications before installing them.
- Cold and energy-inefficient homes due to removing insulation after building inspection.
- Code compliance certificate not being issued due to not having required building inspections before, for example, cladding the building, which could result in significant and expensive rework before the building can be assessed as meeting Building Code requirements and a certificate issued.

Think: Why else is it important for carpenters to take care to fulfil their overall role and responsibilities?

Despite best efforts, there are times when things go wrong. Under New Zealand law, the client is covered for:

- buildings and building materials, under the Building Act's implied warranties
- services provided by tradespeople, under the Consumer Guarantees Act
- misleading claims, under the Fair Trading Act.

Home building insurance is also offered by organisations such as New Zealand Certified Builders and the Registered Master Builders Association.

Carpenters must ensure their work complies with the New Zealand Building Code and its associated NZ/AUS standards.

Quality assurance

Below are some other ways the industry works to provide confidence in the quality of their buildings.

Manufacturers guarantee systems

A guarantee is a written assurance by a manufacturer or vendor that their goods or services meet a certain standard of quality and durability.

- Sometimes the manufacturer guarantees only their products/systems to be manufactured to a specific quality level.
- Sometimes the manufacturer also guarantees the use of their products/systems in their installed state by a contractor whose work they are prepared to stand behind.

Accredited supply networks

Many manufacturers and suppliers to the construction industry have accredited supply networks. These are how a manufacturer or supplier of products and systems shows they are prepared to stand by certain contractors' work provided they satisfy the manufacturer's accreditation criteria. An accredited supply network will ensure that transportation, storage and installation of their products will comply with the manufacturers specific quality control systems.

There are no set criteria when it comes to the various accredited supply networks. Mostly they are due to the manufacturers' development of long-term relationships with contractors who have a good standing in the industry and are known for the quality of their work.

Product training

Construction methods and products have become more complex and increasingly require specialist knowledge and skills in order to ensure that the finished job meets the required quality standard.

Many larger companies offer technical training (often free) on the use of their products and systems to ensure that they are used and installed the way they were designed to be.

This training is often delivered by the manufacturer's specialist technical

training team or by sales representatives who provide training as a part of their role. In some larger projects, in-house engineers and designers will also be involved in training, although this is generally limited to designers and specifiers within the construction industry who want to incorporate the manufacturer's products and systems in the buildings they are creating.

Summary of carpenters' work

Site preparation

Site preparation needs to be done before the building is set out.

The first step is to ensure that it is to be built on the correct land or section. To do this the pegs defining the actual land area will need to be located using the information on the site plan. These pegs, usually called boundary or survey pegs, are accurately surveyed and positioned where there is any change in direction in the boundary lines.

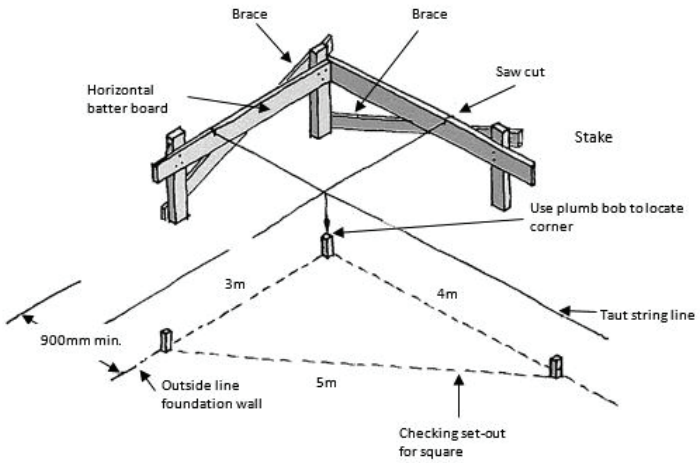
Once the boundary lines have all been found the carpenter arranges the area where the building is to be constructed to be cleared of all vegetation.

Setting out

Carpenters find the information about what is needed to set out the building in the working drawings and specifications.

When setting out any building a carpenter will use four main processes.

- positioning a line representing the front or longest side of the building
- locating the exact position of the corners at each end of that line
- setting out the two adjacent lines at right angles to the first line
- finding the location of all other lines usually at right angles or parallel to the first line.



Carpenters then erect temporary structures or profiles. The purpose of these is to support the building lines once the required levels have been established.

Levelling

Levelling is the process which determines the vertical heights of the building foundation. These are established from a permanent mark called a 'datum'.

Carpenters must take care to ensure that the levelling process is carried out accurately. Any inconsistencies in the level of a building foundation can produce serious construction issues and financial consequences. For small jobs, such as a garden shed, the levels can be determined with a spirit level and a straight edge. A telescope level or a laser level is used for larger jobs.

Foundations

The foundation is one of the most important structural elements of a building. It is the substructure which supports the building and transmits static structural loads and external environmental forces from the building into solid ground.

It is common, especially when sub-divisions are being built, for carpenters to sub-contract the construction of foundations to a specialist foundations company. However, all carpenters must be competent in constructing them themselves.

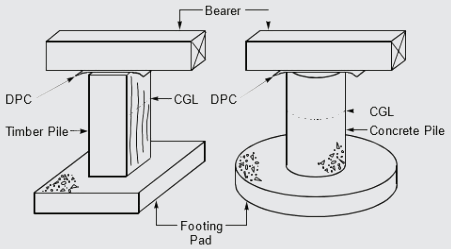
The type of foundation needed for a particular building will depend on a range of economic, environmental and design factors. There are four common types:

- pile only
- continuous reinforced concrete external walls with internal piles
- reinforced concrete corner walls with both internal and intermediate external piles
- concrete slab floors.

Brief descriptions of the first two are below.

Pile foundations

A pile foundation consists of a series of concrete or timber columns set firmly in the ground. They are designed to resist both static and environmental loadings that may be applied to it. There is a range of different piles designed to meet specific bracing requirements. Carpenters are responsible for ensuring they use the type of pile specified in the plans and specifications and setting them in place correctly.



Reinforced concrete external walls

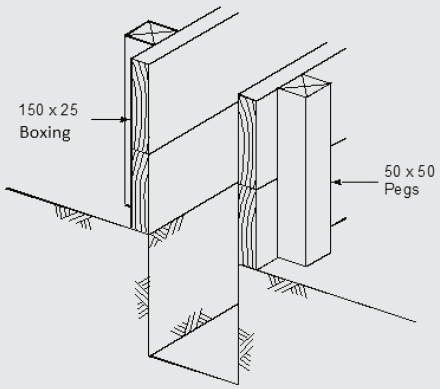
A reinforced concrete foundation usually consists of two separate parts - the footing and the foundation wall.

- The footing is the lower and wider part of the foundation wall which transfers the loads and forces imposed on a building into the ground below.
- The foundation wall is the narrower section on which the building is constructed.

The footings are excavated either manually or using mechanical means. Excavated material can either be stockpiled on site for future use or transported to a suitable disposal area.

A carpenter is responsible for the construction of the formwork which will contain the wet concrete so that it will:

- support the expected loading placed on it
- be easy to erect and dismantle
- remain rigid and straight during and after the concrete is placed.



Concrete in its plastic state can be moulded into almost any shape. It is important that any temporary formwork is strong enough to support the combined weight of the steel reinforcing and wet concrete and any other loadings that may be applied to it.

Floor framing

Sub floor timber framing can be built once the foundations are constructed. The sub floor framing is the timber members above the foundation which will support timber flooring.

Carpenters are responsible for the construction of the sub floor framing to the requirements identified in the plans and specifications. The specifications will take into account a range of environmental and design factors including:

→ the layout of the structure above the floor and the predicted loading

→ potential environmental loads such as wind, snow and earthquakes

→ the sub floor bracing requirements

→ the minimum sub floor clearance, access and ventilation requirements.

It is important to ensure that:

→ there is adequate cross floor ventilation to allow moisture to escape. Dampness can distort and lead to the failure of flooring supports and damage to floor coverings.

→ the finished floor is level, clean, dry and as smooth as possible because any imperfections will be visible once the floor coverings have been laid.

Wall framing

Wall framing is the basic skeleton of the building and performs a number of important roles including:

- providing support for the roof structure
- transferring both the vertical and horizontal forces through to the foundations
- providing a true surface to fix both the external cladding and internal lining materials
- providing a cavity to support the wall insulation
- allowing concealed access for services such as electrical, plumbing, telephone, etc
- providing support for doors and windows.

Any failure or imperfections in the framing components can be difficult and extremely costly to repair. This is because wall framing is almost inaccessible once the building has been completed. Carpenters must follow the plans and specifications to ensure they select the correct materials, use the specified construction methods, and to check that the walls bracing requirements are of the required standard.

It is increasingly common for wall frames to be prefabricated off-site but all carpenters must be competent in constructing them themselves.

Roof framing

It is common, especially when sub-divisions are being built, for carpenters to sub-contract the construction of roof trusses. However, once again, all qualified carpenters must be competent in constructing them themselves.

There are two main methods of roof construction:

- roof truss construction
- pitched roof construction.

All roofs are designed to precise engineering standards to meet the requirements of the specific building and expected environmental loads such as:

- Wind
- Snow
- Roof cladding loading.
- Rain
- Earthquakes

Exterior cladding

Exterior wall claddings provide a weathertight shield that protects the structural components and the interior of a building from outside elements. They also provide security and comfort for the people living inside and have a major influence on the final appearance of the building.

The Building Act 2004 requires that all buildings must be designed and constructed to prevent the penetration or accumulation of moisture. Methods of construction and the durability of the cladding materials must meet the requirements of the Building Code.

All cladding materials have the potential to leak. It is vital that the manufacturer's installation instructions are followed carefully to ensure long term weather-tightness of the building. Any failure of the building envelope to prevent water penetrating can have serious and costly consequences to the structure of the building and can cause serious long term health problems to the occupants.

There is a wide range of external wall claddings available in New Zealand, including:

- timber
- fibre cement
- vinyl
- metal
- plaster.

Before the cladding is fixed a breather type building paper or synthetic wrap is always fixed to the wall framing. This underlay reduces air movement and the risk of moisture passing into the wall framing and internal linings.

Interior linings

Interior wall linings provide a backdrop to everyday living where surfaces can be decorated to look attractive but also kept clean and hygienic.

Building Consent Authorities must conduct a pre-lining inspection before giving approval to install the linings. Some of the things they will check are that:

- all framing members are straight and true, both horizontally and vertically
- the building is weathertight
- all internal wiring is installed (electrical, telecommunications cabling, etc)
- all plumbing within the walls is completed and tested

- insulation is correctly installed
- the moisture content of the wall framing meets the manufacturer's requirements.

The project plans and specifications will identify the product type, structural requirements, fixing methods and surface finish. There are significant differences between the types of material and their specific installation requirements. It is important to use and follow the manufacturers' instructions and recommendations.

Finishing

Once the lining material has been fixed the joins are filled to provide a flat surface ready for decorating. This is normally carried out by a specialist tradesperson to the requirements and standard identified in the project plans and specifications.

Joinery installation

Interior joinery is usually prefabricated by professional joiners and cabinet makers from the details in the project plans and specifications. It is installed either by the on-site carpenter or the manufacturer of the units.

Space created for the window to be installed.

Exterior joinery (external doors and windows) provides protection from the weather and security from unwanted visitors while allowing adequate light, access and ventilation for the people who live in or use the building. Most exterior joinery is assembled, fitted with the correct amount of clearance, squared, and hinged before leaving the joinery factory.

After checking that the opening size is correct, carpenters insert the prefabricated doors and windows. . Frames must be positioned level and flush with the interior linings. The window is then fixed permanently with nails and with packing blocks between the jamb and the opening studs.

Training requirements

There is a suite of New Zealand qualifications for those in the carpentry industry. They are:

- New Zealand Certificate in Carpentry (Level 4)
- New Certificate in Construction Related Trades (Supervisor) (Level 4)
- New Zealand Diploma in Construction (Level 6) with strands in Construction Management, and Quantity Surveying

Career paths

Labourer

A labourer is usually the least qualified person in the construction trade. They do most of the general basic unskilled manual work around a building site such as digging, lifting, loading and unloading.

There is no formal qualification for labourers. However a person with a good record of on-site experience can be a valuable asset to a construction company. It may also lead to an opportunity to do a carpentry apprenticeship.

Apprentice

An apprentice is a person who has signed into a Training Agreement with an employer to learn the range of knowledge, skills, and competencies that are required for a career in the construction industry. Apprentices receive on the job training and are assessed on a range of theory and practical construction work. Apprenticeships are "competency based" which is all about demonstrating the ability (both in terms of knowledge and skill) to complete a range of tasks to a recognised industry standard.

Qualified carpenters have completed a carpentry apprenticeship and been awarded a National or New Zealand Certificate in Carpentry (Level 4). This is a comprehensive qualification that recognises apprentices' experience and competence in all aspects of the industry.

It usually takes between three and four years to complete a carpentry apprenticeship. Once qualified there are a variety of career paths to choose from, including:

- specialising in residential (housing) or commercial construction
- working for a large construction company
- starting up in business as a sole trader.

Construction foreman/Supervisor

A construction supervisor is usually a carpenter with many years of experience and specialist knowledge who is in charged with the day to day organisation of a team of carpenters and labourers.

The New Zealand Certificate in Construction Related Trades (Supervisor) (Level 4) is designed to recognise the skills and knowledge required to be a supervisor in the construction industry. This qualification is for people already working as a construction supervisor or for people who want to move into the role.

Construction project manager

On larger constructions, the project manager (also known as the main contract supervisor) is the person responsible for planning, coordinating all work on site, and completing the project on time and within budget. They are responsible for negotiating and liaising with a wide range of people and agencies involved in the construction of the project including clients, architects and engineers, Building Consent Authorities, and all the sub-contractors.

The New Zealand Certificate in Construction Related Trades (Main Contract Supervision) (Level 5) is designed to recognise their skills and knowledge. It is for people already working as a main contract supervisor or for those who want to move into the role.

Construction manager

The New Zealand Diploma in Construction (Level 6) with strands in Construction Management and Quantity Surveying is designed to provide people with the skills and knowledge of a successful construction manager. It is a theory-based qualification. The qualification must be completed through a tertiary education provider accredited to deliver the programme.

Potential clients

There are two types of potential clients for carpenters. They supply their services:

- directly to the client
- by sub-contracting to other builders or building companies.

Direct to client

Many carpenters have clients who choose to manage the building process themselves and engage directly with the trades or professions whose skills they need to hire. In this situation, they are working directly for the client and will take instructions from, be paid by, and be responsible to them.

For example, a homeowner is renovating their kitchen and employs a local carpenter to coordinate the work. The two parties agree on the supply of materials, the method of payment, the timing of the job and any sub-contractors that may be required. From the beginning of the project through to its completion, the carpenter will continue to work directly with the homeowner as the client on all matters relating to the renovation.

Sub-contracting

A sub-contractor is a tradesperson, company or business contracted by the main contractor. The sub-contractor takes instructions from, is paid by, and is responsible to the main contractor.

Sub-contractors often work for one or two larger companies rather than with a number of different ones. This not only provides a continuity of work for the sub-contractor but also establishes relationships of trust between both parties based on the quality of work.

The main reasons the main contractor will engage sub-contractors is:

- to reduce costs by using the tendering process to obtain the best price to complete the work
- because the main contractor is working on a larger project than usual and does not employ enough people to carry out the required work.

Relationships with other trades

The successful completion of any construction project relies on bringing together people with a wide range skills and expertise, good organisation, quality control, and coordination, and clear lines of communication. All trades have a duty of care to respect and avoid damage to the work of other trades that have preceded them.

For example, in a typical residential project the carpenter must complete all the set out and boxing for the concrete placer to pour the concrete foundation (pad). Once the wall and roof frames are erected and exterior cladding fixed, joiners install exterior joinery into them. Plumbers and electricians install pipes and wiring before interior systems specialists install interior linings. Carpenters work throughout making any adjustments needed.

There are many other trades that come onto site once carpenters have prepared for them, and carpenters need to do more work on once they have completed theirs. Carpenters may also be required to provide their construction skills to assist sub trades with the installation of solid fixing for their product, materials or services.

Activities and responsibilities for other trades (sub-contractors) on a construction site will vary from project to project. The main contractor/ carpenter will do regular quality checks throughout the building programme to ensure the required quality is maintained. The findings from these checks must be communicated in writing to the respective contractor so that any non-compliance issues can be promptly remedied.

Construction sites can be extremely dangerous places, so a carpenter's role may also include responsibility for the development, management and coordination of Health and Safety procedures for all trades on site.

Industry bodies

The Ministry of Business, Innovation and Employment (MBIE) is responsible for administering many Acts of Parliament that relate to the construction industry, such as:

- Building Act 2004
- Construction Contracts Act 2002
- Fencing of Swimming Pools Act 1987
- Plumbers, Gasfitters, and Drainlayers Act 2006
- Weathertight Homes Resolution Services Act 2006
- Consumer Guarantees Act 1993
- Employment Relations Act 2000
- Health and Safety at Work Act 2015

Remember to also read the 'Industry bodies' section of this booklet's 'Introduction'. Information there is not repeated here unless it is especially vital for carpenters.

MBIE is also responsible for occupational licencing. Occupational licensing aims to ensure that people in the building industry who are responsible for the work done are competent and accountable so that homes and buildings are designed and built right the first time. The main occupational licensing that impacts on the carpentry industry is the Licensed Building Practitioners scheme.

The **Licensed Building Practitioners Scheme** was introduced in November 2007. There are a range of license classes covering carpenters, site supervisors, construction managers, designers and architects. There are also a number of specialist license classes for other trade areas including external plastering, roofing, brick and block laying.

Carpenters need to be a licensed building practitioner to carry out or supervise certain restricted building work on homes and buildings. Restricted building work is work that by its nature is important to the building, is complex to do, needs to be done right, and must therefore be done by an approved, competent person.

LBPs are held personally responsible for ensuring all work on the project complies with the Building Code and are required to sign-off each stage as it is completed.

Standards New Zealand specialises in the development of standards to enhance products and services, improve safety and quality, meet industry best practice, and support trade into existing and new markets.

The most important NZS for carpenters is NZS3604.

Trade and professional associations are also set up to support members. There are two major trade associations which represent builders in New Zealand. They are:

- **Registered Master Builders Association** is a long-standing membership organisation representing a significant part of New Zealand's building and construction community. Member builders must meet a broad range of criteria around qualifications, period of service, references and the financial stability of the business. You can find out more about them here: www.masterbuilder.org.nz.
- **New Zealand Certified Builders** was established in 1998 to recognise and promote qualified builders. Its aim is to promote the skills of its members, establishing a clearly identifiable level of competence, consistency and excellence for the building public and the profession. You can find out more about them here: www.nzcb.nz

To print just the **Concrete** section, print pages 29 to 46

This box does not have to be printed

Concrete
(Te Mahi Rāima)

Concrete (Te Mahi Rāima)

Concrete is the most widely used construction material in the world. It's used in everything – motorways, hospitals, schools, houses, garden sheds, skyscrapers, aircraft hangers, foundations, floors, walls, bridges, driveways, paths, patios, and storm water pipes.

Overall, concrete professionals use a range of tools and machinery to:

- establish levels and heights, prepare/ construct formwork and falsework, cut, bend, tie, and lay reinforcing steel
- pour, finish and sometimes cut concrete for building footings, foundations, walls, beams, and concrete floor slabs, driveways, etc
- make/prefabricate pre-cast concrete items and install them on site/in a building project (as in the photo above).

There is a lot of specialisation in the concrete industry, including those who only or mainly:

- mix, dispatch and test concrete
- pump, pour and finish concrete to form driveways and paths, foundations and slabs
- install the pre-cast concrete elements
- cut, saw and grind concrete for construction joints, demolition or decorative finishes.

Concrete professionals often come onto a building project at the beginning to build footings and retaining walls and to lay the foundations and floor slabs. Depending on its design, they may install pre-cast (or 'pre-formed') concrete panels after the heavy foundations or concrete block walls have been built. Concrete driveways, paths and patios are excavated and laid once the house is completed.

Concrete glossary of terms

Below are some of the many words commonly used in the concrete industry. Remember to also refer to the glossary of terms in the introduction section.

Term	Meaning
Aggregate	A combination of sand and gravel or crushed rock used to make concrete.
Boxing/ formwork	Temporary materials put in place to contain wet concrete until the concrete has set.
Builders mix	A proportional mixture of aggregate and sand available from a builder's supply merchant.
Cement	A grey powder made up of limestone and clay, heated to a high temperature and then ground to a fine powder.
Compaction	A hand or mechanical process used to consolidate and pack down the materials that will support the concrete slab.
Concrete	A combination of cement, water, sand and course aggregate which hardens due to a series of chemical reactions between the cement and water.
Curing	Curing takes place immediately after concrete placing and finishing, and involves maintenance of desired moisture and temperature conditions, both at depth and near the surface, for extended periods of time.
Damp proof course	A layer of durable vapour barrier to prevent the passage of moisture.
Falsework	Falsework consists of temporary structures used in construction to support a permanent structure until its construction is sufficiently advanced to support itself.
Hardening state	After concrete has set it begins to gain strength and harden. The properties of hardened concrete are strength and durability. Hardened concrete can also be referred to as 'cured'.
Hardfill	Compacted medium-sized aggregate, used to support the concrete slab or foundation.
Hydration	The chemical reaction that takes place between hydraulic cement and water during concrete curing.
Initial set	The first stiffening of fresh concrete.
Levelling sand	A layer of medium-grade sand placed over the hardfill and compacted down to provide a firm base to support the concrete slab.
Perimeter	The distance around the edge.
Plant	Equipment.

Concrete

Term	Meaning
Plastic state	The term for when concrete is first mixed and it is soft and can be worked or moulded into different shapes. Concrete must be plastic during placing and compaction.
Screed	Straight edge used to level off concrete.
Setting state	This is when concrete begins to stiffen. The stiffening of concrete, when it moves from the plastic state, is called setting. Setting takes place after compaction and during finishing.
Slab	A specific area of specially laid concrete such as a garage or house floor.
Subsoil	The underlying ground that supports the concrete.
Testing	Planned checks that are carried out to measure the quality of the concrete mix or product.

Falsework supporting the structure before concrete is poured to form the floor.

Overall roles and responsibilities

Concrete must be produced, manufactured, processed, and placed and cured correctly so that it can do the job it is meant to.

- Concrete not mixed in the correct proportions will not be able to achieve its intended strength. This could cause it to split and collapse, with dire consequences if it is, for example, pre-cast concrete flooring or bridge beams.
- Concrete reinforced with steel rods, bars and/or heavy wire sheets that are in contact with the ground or air will lose the reinforcing because the will metal rust due to the concrete not sealing it from moisture.
- Too much water mixed into the concrete will reduce the concrete product's strength and durability and increase the risk of cracking due to shrinkage as it dries.
- Pre-cast concrete products not made and installed correctly can cause structures/buildings to collapse and water and wastewater systems to leak and to create sinkholes if they collapse.
- Excavating properly and using the correct type and depth of hardfill and specified concrete will support heavy traffic.
- Mixing, placing, finishing, and curing concrete correctly provides strong and durable products that meet the needs of clients and other users.

There are a lot of New Zealand Standards that give information about how quality concrete should be produced and used. Clients may specify additional requirements.

> Concrete and its products must comply with the New Zealand Building Code and its associated NZ/AUS standards.

Below are some other ways the industry works to provide confidence concrete products will meet requirements.

Manufacturer guarantee systems

Manufacturer guarantee systems are written assurances from manufacturers that their goods or services meet a certain standard of quality and durability.

Sometimes the manufacturer guarantees only their products/systems to be manufactured to a specific quality level.

Sometimes the manufacturer also guarantees the use of their products/systems in their installed state by a contractor whose work they are prepared to stand behind.

Accredited supply networks

Many manufacturers and suppliers to the construction industry have accredited supply networks whereby a manufacturer or supplier of products and systems is prepared to stand by certain contractors' work provided they satisfy the manufacturer's accreditation criteria.

There are no set criteria when it comes to the various accredited supply networks of the different manufacturers associated with the construction industry They mostly develop long-term relationships with those contractors who have a good standing in the industry and are known for the quality of their workmanship.

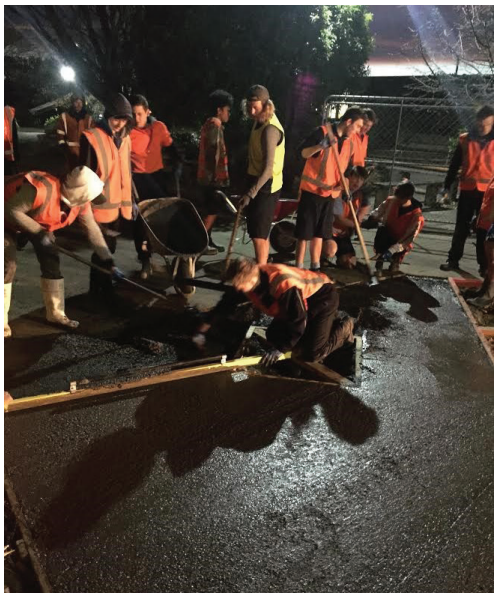
An accredited supply network will ensure that transportation, storage and installation of their products will comply with the manufacturers' specific quality control systems.

Product training

Modern construction methods and products have become more complex and require specialist knowledge and skills in order to ensure that the finished job meets the required quality standard.

Most manufacturers will have a vested interest to ensure their products and systems are installed correctly. Many larger companies will offer technical training (often free) on the use of their products and systems to ensure that they are used and installed the way they were designed to be.

This training is often delivered by the manufacturers specialist technical training team or alternatively by sales representatives who provide training as a part of their job description.



Kaiapoi High School students working Ready Mix concrete for their outdoor teaching area project.

Parts of the concrete industry

The concrete industry is divided into three main areas of speciality.

Speciality	What it does
Concrete production	Produces ready mixed concrete for use by the product manufacture, construction and precast sectors.
Concrete product manufacture	Produces masonry, pipe, tank and precast (and pre-stressed) products, e.g. pre-cast building panels.
Concrete construction	Undertakes civil and commercial construction, placing and finishing, sawing (cutting) and drilling. Residential In residential property a concreter will concrete driveways, piles, footings, floors, stairs and walls. Concrete is increasingly used as a finish for areas, such as floors, that can be seen and used by the client. Spray applied concrete is used to build swimming pools. Commercial In a commercial property a concreter will block fill for building foundations and retaining walls. They will lay concrete floors and polish and seal concrete floors. They will also put in place pre-cast concrete elements/slabs such as concrete walls and floors in multi-story buildings. Maintenance A concreter will be expected to clean, patch, repair, and reseal concrete. Concrete is relatively maintenance free. Concrete that has been sealed will need to be resealed to maintain the quality of the finish especially if a corrosive substance has been spilt on it or frost has damaged the surface.

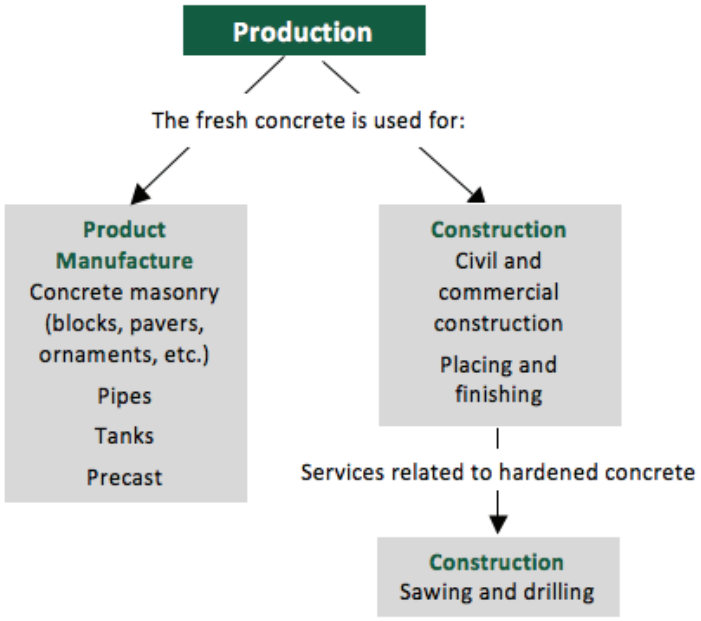
Specialisations

This section provides an introduction to work processes and associated job roles in the concrete industry. You can find more information about concrete product manufacture on the Concrete NZ website. (If you check in the 'Industry' tab there is more information about Masonry and Precast concrete).

There are also good videos on YouTube, such as:
www.youtube.com/watch?v=YOw8rW5_8tc).

Concrete production

Aside from sawing and drilling, all sectors within the industry use fresh mix concrete to produce their product or construction. This makes the production sector a very important part of the quality management process for ensuring that the final product turns out as it should



Concrete is made of water, cement, sand and coarse aggregate. The different proportions of these ingredients (and any chemical additives) will have a huge impact on the workability and strength of the final product. This is why large quantities of concrete are usually made by specialised mixing (batching) plants.

Batching plants have laboratories and testing facilities to ensure their products meet strict production requirements that are set out in New Zealand Standards.

Batching concrete

Batching is probably one of the most critical phases in achieving the correct quality of concrete for a particular job. The concrete batcher is responsible for ensuring that:

- the prescribed design mix is interpreted correctly from job specifications
- the concrete mix components are selected and dispensed into the mixing bowl
- the equipment required for the task is available and operating safely
- hazard control procedures for the task are applied
- the mixing equipment is cleaned and operated in accordance with site safety procedures .

Transporting concrete

Concrete delivered by the drivers of ready mixed trucks provides contractors with the advantages of a good quality product together with the speed of pouring and laying.

The concrete is mixed in a rotating bowl mounted on a truck chassis. It is usually mixed before leaving the plant and during the delivery to a construction site. Before leaving the ready mix plant, the mixers receive accurately batched materials together with any required additives that may be required.

Once at the site, the concrete is discharged by reversing the direction of the bowl rotation. It is important that when transporting freshly mixed concrete that the mix is maintained in a stable and uniform condition. Ready mix trucks must also discharge the wet concrete within a specified time-frame beginning from the time that the mixing started.

Concrete construction

Placing concrete

The handling of concrete on construction sites starts when the concrete is being poured from the on-site mixer or the Ready Mix truck. Wet concrete needs to be moved quickly and efficiently to where it is to be placed to keep it in a workable condition. There is a variety of methods for distributing it ranging from wheelbarrows to mobile concrete pumps.

Compacting concrete

Freshly placed concrete needs to be thoroughly compacted to remove any trapped air. This also ensures that the formwork is filled to the correct level and that reinforcing steel is completely covered.

There are a number of ways to compact concrete including:

- a stick or steel rod to compact the concrete. For small jobs, such as concrete paths, this may be all that is needed
- compacting concrete in formwork and on larger projects using an immersion vibrator which transfers vibrations through the wet concrete
- a surface vibrator transfers the vibrations downwards and is useful for compacting concrete floors and other flat surfaces.

Finishing concrete

The finishing of concrete surfaces involves a combination of one or more of:

- levelling
- floating
- trowelling
- adding any other specified surface treatment

These are carried out while the concrete is still plastic. They help to ensure that the final surface finish of the concrete is level and of the required surface density and texture.

Levelling	Levelling (or screeding) is the initial operation carried out on a concrete slab after the concrete has been placed. This is carried out using a straight length of timber or steel and working it backwards and forwards across the concrete to create a level surface.
Floating	Floating prepares the surface of concrete for other finishing operations. Bull floating For larger pours the initial surface preparation is carried out with a larger hand or mechanical float which is worked backwards and forwards over the concrete parallel to the ridges formed during the screeding process. Hand floating A wooden hand float is held flat on the surface of the concrete and moved in sweeping arcs across the surface to embed any exposed aggregate into the mortar and compact the concrete.
Trowelling	Trowelling is carried out after floating and when the concrete has stiffened enough that the aggregate particles are not torn out of the surface of the mixture.

Curing concrete

Curing is the process which controls the loss of moisture from concrete after it has been placed in position, surface finishing completed, and the concrete has sufficiently hardened.

The setting and hardening of concrete is the result of a series of chemical reactions between the cement and water in the concrete mix. The reaction with water is called hydration. The longer and slower this reaction, the better the strength of the concrete. This is because the chemical reactions can continue for longer.

Three methods used to cure concrete are:

- minimising the moisture loss by covering the concrete with a relatively waterproof membrane
- keeping the surface of the concrete wet for a specific period of time
- using chemicals which are brushed or sprayed directly on to the concrete surfaces.

The curing process should begin as soon as possible after the concrete has been compacted and finished.

Concrete being poured for a floor.

Note the screed on the right side of the photo.

Masonry block walls being constructed.

Manufacturing and pre-cast concrete products

Precast concrete is when products are manufactured using a reusable mould or "form" and then cured in a controlled environment. It is then transported to the construction site and lifted into place.

Producing concrete products in a controlled environment (typically referred to as a precast plant) allows the manufacturing processes to be closely monitored by plant employees.

There are many different types of precast concrete forming systems for construction applications. They vary in size, function and cost.

Masonry or concrete blocks

A concrete block is a rectangular hollow block used in a lot of construction work. Masonry blocks are available in a wide range of sizes, shapes, textures and colours and provide an economical alternative to traditional methods of construction. The hollow block serves as a permanent formwork for concrete and reinforcing steel. This adds structural strength to a building.

Concrete blocks are precast in moulds at a factory and made from a mixture of cement, sand, and fine aggregate.

Concrete pipes and tanks

These products are made from various types of ready mixed concrete supplied from a production plant or from site batched fresh mix. These products also often use moulds or formwork.

Common uses for concrete pipes include					
→	water systems	→	fire hydrants	→	water meters
→	storm water treatment	→	sewer systems	→	manholes

Common uses for concrete tanks include					
→	septic tanks and filter	→	water tanks	→	grease traps
→	dangerous goods sheds	→	oil traps	→	well liners

Training requirements

Several New Zealand Certificates make up the suite of qualifications for those in the concrete industry. They are:

- New Zealand Certificate in Concrete Construction Skills (Level 3) with strands in
  - Formwork
  - Reinforcing
  - Placing and Finishing
  - Specified Concrete Finishes
  - Concrete Product Manufacture
  - Precast Concrete Manufacture
  - Concrete Sawing and Drilling
- New Zealand Certificate in Concrete Construction (Commercial and Civil Infrastructure) (Level 4) with optional strands in Premanufactured Elements and Post-tensioned Concrete
- New Zealand Certificate in Concrete (Specialist) (Level 4) with strands in Concrete Sawing and Drilling and Prestressed Concrete
- New Zealand Certificate in Concrete Production (Level 4) with strands in
  - Batching
  - Dispatching
  - Concrete Testing (with an optional strand in Tensile Testing)

It usually takes one to three years to qualify, which depends on which additional strands are chosen. It would take longer - maybe four years - if you are building concrete commercial/infrastructure projects or multi-story buildings.

Career paths

The concrete industry offers a range of jobs and a progressive career structure so you can grow and develop from on-job experience. There are opportunities to specialise in these areas:

Ready-Mixed Concrete - maintaining equipment and materials; producing, batching, delivering, transporting and testing ready-mixed concrete.

Sitework - producing and testing concrete, preparation, placing, finishing and curing and erecting pre-cast components.

Concrete

Precast Concrete - preparing placement with reinforcing and moulds, placing, finishing and curing, application and repairing of specialist finishes; and handling, dispatching and loading pre-cast units.

Placing and Finishing - understanding how concrete hardens, its strengths and weaknesses; correctly placing and finishing, colouring the surface and curing, creating an exposed aggregate finish, patterning the surface of coloured and uncoloured concrete.

Below is a list of occupations in the concrete industry, starting with the least qualified jobs and working upwards towards those that require higher qualifications and experience but as a result have subsequently greater financial rewards.

Labourer

Construction labourers clean and prepare construction sites. They remove trees and debris, tend pumps, compressors and generators. They load, unload, identify, and distribute building materials to the appropriate location according to project plans and specifications and will often help other workers, including carpenters, plasterers, operating engineers, and masons.

Labourers are employed on almost all construction sites. While many labouring jobs require a variety of basic skills, there are others that need more specialised training and experience. Most labourers learn as they do their work, but for some construction work (such as forklift driving), a more formal training programme will be required.

They can be employed building highways, on heavy construction sites, residential and commercial sites and on demolition sites. Labourers may specialise in one type of construction, such as highway or commercial construction, while others are generalists. Labourers who work in demolition are more likely to specialise only in demolition.

Apprentice

An apprentice is a person who has signed into a Training Agreement with an employer to learn the range of knowledge, skills and competencies that are required for a career in the concreting industry. During this period an apprentice will receive on the job training and be assessed for a range of theory and practical construction work. Apprenticeships are “competency based” which is all about demonstrating the ability (both in terms of knowledge and skill) to complete a range of tasks to a recognised industry standard.

Qualified concreters have completed an apprenticeship and have a relevant qualification. Qualifications recognise their knowledge and experience in their chosen part of the industry. There are choices for those that wish to specialise, such as producing concrete products, placing and finishing, and producing and testing concrete.

It is a good idea for apprentices to take the opportunity to get a heavy vehicle licence.

Foundations constructor

Specialist foundations constructors construct foundations for building projects. They need to read and interpret plans and specifications and do preliminary work and site establishment. They then construct the base for the building. They need to know and be competent in such things as constructing footings and slabs, pile foundations and walls, installing reinforcing, and placing and finishing concrete.

Concreter

A concreter is a skilled person who performs a wide range of work operations involved in the construction of buildings. The work generally involves a significant amount of manual labour and outdoor work. It can also involve working at heights, working in confined spaces, working with cranes and slinging loads.

There are many different specialities within concreting. For example, precast concreters make precast concrete products like pipes, tanks, cement blocks, panels and beams. They may do this in a factory environment or on site.

This could lead to being a concreting leading hand or supervisor.

Concreting foreman or supervisor

A concreting foreman or supervisor is usually a concreter with many years of experience and specialist knowledge who is charged with the day to day organisation of the work team. A qualification which supports this position is the New Zealand Certificate in Construction Related Trades (Supervisor) (Level 4).

Potential clients

There are two types of potential clients that those in the concrete industry supply services for. They supply their services:

- directly to the client
- by sub-contracting to builders or building companies.

Direct to client

Concrete producers always supply ready mix concrete directly to clients.

Many concrete contractors (sole traders), companies or businesses also have clients who choose to manage the building process themselves and engage directly with the trades or professions whose skills they need to hire. In this situation, the concreter is working direct for the client and will take instructions from, be paid by, and be responsible to them.

For example, a homeowner requires a new concrete path. They negotiate with local concreter to do the work and agree on the supply of materials, the method of payment and the timing of the job. The concreter works directly with the homeowner as the client on all matters relating to the job.

Sub-contracting

A concrete sub-contractor is a tradesperson, company or business contracted by a main contractor to work in their specialised trade as part of an overall project. The sub-contractor will take instructions from, is paid by, and is responsible to the main contractor or their on-site representative.

For example, a builder is erecting a new house and engages a concrete contractor to supply and place the concrete for the slab foundation. The builder is acting as the main contractor and is managing the different relationships with a number of sub-contractors who are contributing to the successful completion of the project. The concreter is responsible to the main contractor on all matters relating to the job.

Relationship with other trades

The successful completion of construction projects relies on bringing together people with a wide range skills and expertise along with good organisation, quality control, coordination and clear lines of communication. All trades have a duty of care to respect and avoid damage to the work of other trades.

The responsibility for organising and coordinating a project is usually the responsibility of the main contractor (generally the builder). For a large project the main contractor may also have a team of people working for them in overseeing roles.

The concrete production part of the concrete industry makes, tests, and transports ready mix concrete for pouring once carpenters have prepared the site and constructed formwork and any pipes or conduits needed have been laid by electricians and plumbers.

Depending on the size and design of a particular project, other parts of the concrete industry may be involved at various stages of the construction, such as handling and placing the delivered concrete, compacting and finishing concrete floors, pumping concrete into formwork, curing and testing concrete, delivering water tanks and masonry blocks, installing pre-cast floors and walls...and so the list goes on. Check back through the descriptions of the different specialisations for more ideas about what work needs to be done before and after concrete specialists' work.

Industry bodies

Remember to also read the 'Industry bodies' section of the introduction. Information there is not repeated here unless it is specific to the concrete industry.

The Ministry of Business, Innovation and Employment (MBIE) manages the regulations relating to all building. The regulations that affect the concrete industry are contained within the Building Code.

MBIE is also responsible for occupational licencing. Occupational licensing aims to ensure that people in the building industry who are responsible for the work done are competent and accountable so that homes and buildings are designed and built right the first time. The main occupational licensing that impacts on the concrete trade is the Licensed Building Practitioners scheme. The Building Practitioners Board has delegated authority to oversee the scheme.

Concreters need to be a Licensed Building Practitioners (LBP) to carry out or supervise building foundations, which are restricted building work. Restricted building work is work that by its nature is important to the building, is complex to do, needs to be done right, and must therefore be done by a competent person.

LBPs are held responsible for ensuring all work on the project complies with the Building Code and must sign-off each stage as it is completed.

Standards New Zealand specialises in the development of standards to enhance products and services, improve safety and quality, meet industry best practice, and support trade into existing and new markets. Examples of those for the concrete industry are:

- NZS 3104, *Specification for concrete production.*
- NZS 3109, *Concrete Construction*.
- NZS 3121, *Water and aggregate for concrete.*
- NZS 3112, *Methods of test for concrete – Tests relating to fresh concrete.*
- NZS 4206, *Concrete interlocking roofing tiles.*

Remember to also read the 'Industry bodies' section of this booklet's 'Introduction'. Information there is not repeated here unless it is specific to the concrete industry

Concrete

Trade and professional associations are also set up to support members. Examples of associations in the concrete industry are:

- **Concrete NZ** represents and advocates for almost all the specialist concrete sub-sectors in New Zealand. Its overarching aim is to promote excellence in all things concrete. They offer ongoing professional development and share knowledge and industry best practice through their Learned Society. Their website, concretenz.org.nz, is well worth taking the time to explore – there is a wealth of information on it.
- **New Zealand Concrete Contractors Association (NZCCA)** is a membership-based organisation. Members are required to have high work standards, good business acumen, and keep to the Code of Ethics. In return, members are provided with leadership, advocacy, professional development, and partnering. You can find out more about this association here: www.nzconcretecontractors.org.nz.
- **New Zealand Concrete Sawing and Drilling Association (NZCSDA)** represents concrete cutting and drilling industry suppliers, contracting companies and associated companies. They work to develop and promote professional concrete cutting and drilling companies. NZCSDA also contributes to the development of national standards, the development and promotion of safe practices, and collaboration. You can find more about what they do here: nzcsda.co.nz.

To print just the Exterior Plastering section, print pages 47 to 62

This box does not have to be printed

Exterior plastering

(Te Whakapiri Ukutea ki Pakitara Whakawaho)

Exterior plastering (Te Whakapiri Ukutea ki Pakitara Whakawaho)

Exterior plasterers are sometimes simply known as plasterers. They mix and apply plaster to form the exterior cladding of a building or to form smooth or textured surfaces for pools and walls. Exterior plasterers also apply decorative finishes and mouldings to buildings.

There are two exterior plastering specialities in New Zealand, though some choose to specialise in both:

- Solid plaster. These plasterers apply protective and decorative coats of sand and cement-based plaster.
- PPCS (Proprietary Plaster Cladding System). These plasterers install a variety of exterior cladding substrates and finish them with coats of plaster modified to form a 'system' with the particular substrate.

All exterior plasterers need to be able to interpret building plans and specifications to select and measure the right materials to apply and create the required finish.

The quality of their work has to be high to ensure water-tightness. Plaster applied to a high standard also makes for a good base for the painters to work on and so can affect how the finished house looks.

Exterior plasterers come on site once the house structure is built to apply the backing panels or materials that form the substrate for the plaster coating. It is important they install the specified system to the manufacturer's instructions as this forms the house's protective barrier against the weather and affects the system's guarantee.

All the necessary flashings and cavities must be installed before a council inspection can take place. Once the council has confirmed it is satisfied with the backing and flashing system, the exterior plaster can be applied.

The plasterer finishes off the external cladding once the joinery is installed.

Plastering glossary of terms

Below are a couple of the many terms exterior plasters must know. Remember to also refer to the glossary of terms in the introduction section.

Term	Meaning
PPCS	Proprietary Plaster Cladding Systems are the modern form of exterior plastering that use modified plasters to coat the exterior of buildings
Solid plastering	Solid plastering is the traditional form of exterior plastering that uses sand and cement plasters to coat the exterior of buildings

Overall roles and responsibilities

The overall roles and responsibilities of exterior plasterers are to ensure the building envelope is waterproof by applying solid plaster or PPCS to the required standard and specifications.

- Applying solid plaster or PPCS to substrates that haven't been installed or prepared properly can affect how the plaster seals the exterior cladding and require expensive rework for the building to meet the Building Code and Building Consent requirements.
- Selecting the correct PPCS for the job and using every product of the selected PPCS in accordance with the manufacturer's instructions will help ensure the cladding system will perform as it has been designed.
- Quality application and finishing of each coat will provide a good surface for painters that will, in turn, enable the painted surface to look as it was intended to look and to complete the waterproofing process.

Exterior plastering is 'restricted building work'. Only Licenced Building Practitioners (LBPs) can carry out or supervise this work and they are held personally responsible for its quality.

> Plasterers must ensure their work complies with the New Zealand Building Code and its associated NZ/AUS standards.

Below are some other ways the industry works to provide confidence its work will meet requirements.

Manufacturer guarantee systems

Manufacturer guarantee systems are written assurances from manufacturers that their goods or services meet a certain standard of quality and durability.

- Sometimes the manufacturer guarantees only their products/systems to be manufactured to a specific quality level.
- Sometimes the manufacturer also guarantees the use of their products/systems in their installed state by a contractor whose work they are prepared to stand behind.

Manufacturer guarantee systems are particularly relevant in the PPCS sector of exterior plastering. In order for a PPCS to be specified and used on a building, it must:

- go through a BRANZ Appraisal (which is a strict testing regime undertaken by the Building Research Association of New Zealand)
- be signed-off by the Territorial Authority issuing the Building Consent for the work being undertaken.

Both of these requirements mean that manufacturers are extremely concerned about standing behind their systems and working closely in partnership with:

- the manufacturers of the substrates on which their products are being applied
- a network of applicators who apply their specified systems.

Product training

Because PPCS manufacturers have a vested interest in ensuring that their products and systems are installed and applied correctly, PPCS manufacturers often offer technical training on the use of their products and systems to ensure that they are used the way they were designed to be used.

Specialisations within the exterior plastering industry

Solid plastering

Solid plastering is the traditional form of exterior plastering that uses sand and cement plasters to coat the exterior of buildings. In New Zealand, solid plaster is often referred to as stucco. In reality, applying stucco is only one part of the work a solid plasterer does.

Solid plasterers work on two types of substrates.

- **Solid substrates.** These include concrete, concrete block, stone, brick or any other material that is considered "solid" in form.
- **Light timber framed substrates.** These include timber framed buildings with some sort of exterior lining to which the plaster layers are applied.

Proprietary Plaster Cladding Systems (PPCS)

Proprietary Plaster Cladding Systems (PPCS) use modified plasters to coat the exterior of buildings. Each plaster system is designed for specific use on a specific material in a specific way.

People who work within the PPCS sector are often referred to as applicators because they 'apply' a specific manufacturer's system in order to achieve the finished plastered surface.

There are a number of different manufacturers of PPCS within New Zealand. They either alone or in conjunction with manufacturers of other products develop their own specific plasters, coatings, flashings, beads, trims, accessories and paints that together form a particular PPCS. Even when the individual products that form a particular system are available as separate items, it can be called a PPCS only when they are assembled, constructed, applied and finished as specified by the system's manufacturer.

There is not a single plaster that makes up a PPCS. Each manufacturer has different types of plasters for different uses and each plaster will be a composition of different ingredients combined together in specific quantities. In a similar way to how KFC will only tell you that their chicken is coated in the Colonel's secret herbs and spices, so too is a PPCS manufacturer protective about their plasters.

PPCS applicators work on a number of different types of substrates:

- solid substrates – which include concrete, concrete block, aerated concrete or any other material that is considered "solid" in form
- lightweight fibre cement sheets fixed to a timber frame
- rebated fibre cement sheets fixed to a timber frame

- polystyrene sheets fixed to a timber frame
- polystyrene blocks, which are a lightweight alternative to concrete blocks. They are filled with reinforcing and mortar in a similar way to masonry blocks.

Summary of plasterers' work

The work of those in the exterior plastering industry depends on:

- the sector they are working in (solid plastering or PPCS)
- the substrate they are working on (solid, light timber framed, fibre cement sheet, polystyrene, etc)
- the manufacturers system they are working with (if applying a PPCS)
- the extent of the work they are required to undertake as part of their contract.

Preparation of surfaces

Surface preparation is crucial to exterior plastering. It is often the quality of the base surface that determines the quality of the finished job. All surfaces need to be clean and free of dust, oils, and not have any loose bits flaking, peeling, or falling off it.

The amount and type of surface preparation depends on whether the type of plaster is a solid plaster (sand and cement) or a PPCS (modified plaster) and what type of substrate the plaster is being applied to.

Some examples of how surfaces are prepared for solid plastering are:

Solid surfaces	Water blasting, sand blasting, or scabbling (a process that chips and roughens the surface).
Light timber framed buildings	Checking the lining material has been installed properly, fixing reinforcing mesh, mouldings and flashings, and ensuring construction joints are formed.

Some examples of how surfaces are prepared for PPCS are:

Fibre cement sheets	Checking that the fibre cement sheets and accessories have been installed properly, masking adjoining areas, installing proprietary beads and flashings, and priming joints.
Polystyrene	Checking that the polystyrene sheets and accessories have been installed properly, masking adjoining areas, and installing proprietary beads and flashings.
Solid surfaces	Washing, water blasting, sand blasting, or chemical cleaning.

Another important thing to know is that once a plasterer or applicator accepts the surface for plastering, they are accepting responsibility for that surface. If the surface has been installed by someone else incorrectly, the exterior plasterer needs to ensure that the installer fixes it before they apply any plaster.

Plastering solid surfaces

Plastering solid surfaces is a work process undertaken by both solid plasterers and PPCS applicators. The difference is the types of plasters used and the number and types of coats applied.

Solid plasterers apply three types of sand and cement plaster coats to solid surfaces. These are called:

- bond coat
- flanking coat
- finish coat.

The bond and flanking coats are "keyed" or "scratched" to help the next coat stick to it properly.

PPCS applicators apply modified plaster coats as specified by the PPCS manufacturer. The plasters used often have different additives and serve different purposes in the overall composition of the completed plastered surface. As a general rule, though, a PPCS applicator will apply a levelling base coat and finish coat(s) to solid surfaces.

Solid plastering light timber framed substrates

Solid plastering light timber framed substrates is referred to as stucco work. It is undertaken in a similar way to how a solid substrate is plastered. The main difference is that there is a reinforcing mesh attached to the surface of the sheet lining material that is fixed to the timber framing.

Once the reinforcing mesh is attached, there is again the application of three coats of sand and cement plaster – those three coats being:

- scratch coat (the first coat to bed-in the reinforcing mesh)
- flanking coat (the middle coat)
- finish coat (sometimes textured in some way to provide a distinctive pattern to the finished surface).

To prevent cracking, sand and cement plasters require careful curing to ensure that the surface does not dry too quickly or unevenly. Apart from the paint, the finished plastered surface is the surface that is seen by all and much care and skill goes into making sure it looks exactly as it is supposed to.

Applying modified plasters (PPCS) to fibre cement substrates

There are two types of fibre cement sheet that can be attached to timber frames and plastered.

Lightweight fibre cement sheets	Usually only 4.5mm thick. Coated all over the surface with several thick layers of modified plasters, the first being a base coat and the second a mesh coat which has fibreglass reinforcing mesh bedded into it. Subsequent modified plaster coats are then applied according to the PPCS manufacturer's specifications.
Rebated fibre cement sheets	Usually 7.5 or 9mm thick with rebated edges. Sheet joins (along the rebated edges) are primed and plastered (jointed) with a fibreglass reinforcing tape bedded into a jointing compound to make the surface of all the joined sheets look like one, large monolithic surface. Modified plaster coats are then applied to the whole surface according to the PPCS manufacturer's specifications.

Applying modified plasters (PPCS) to polystyrene substrates

Polystyrene substrates that are coated with a proprietary plaster system are known as an Exterior Insulation and Finishing System (EIFS).

There are a number of different thicknesses of polystyrene sheets that provide the substrate for plastering, with the most common thicknesses being 40mm and 60mm.

The polystyrene substrate is coated all over the surface with a thick layer of modified plaster. The first layer is a base coat into which a fibreglass reinforcing mesh has been bedded in. Remaining modified plaster coats are then applied according to the PPCS manufacturer's specifications.

Note: Polystyrene substrates are usually fixed in position by the applicator or another member of their exterior plastering crew. This is an important difference to note because fibre cement substrates are usually fixed by the carpenter/builder.

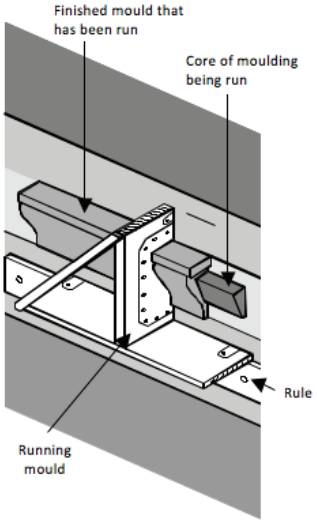
Applying decorative mouldings

Decorative mouldings can help to bring out the architectural features of buildings. How they are made is completely different for the Solid Plastering and PPCS sectors.

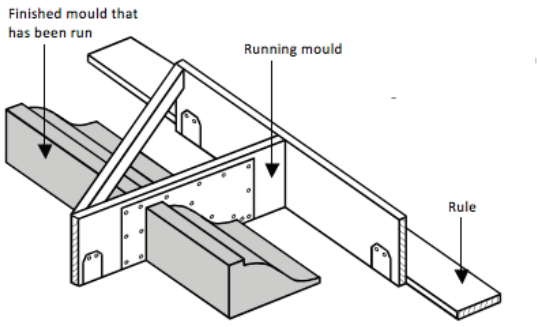
Solid plastering decorative mouldings

While plastering flat surfaces is the bread and butter work of the solid plasterer, the application of mouldings is the artisan side of the trade. This process is most often done as part of historical restoration work.

Decorative mouldings are formed by a process called “running”. Running a moulding is done by building up layers of plaster then running a specially shaped profile mould along a to form the shape of the mould on the surface of the building. Mouldings can be run on the building in its designated position or on a bench. If they are run on a rule temporarily fixed to the face of the building they are formed directly onto the building. If they are run on a bench they are lifted and fixed to the building once they’re dry.



Running a moulding in situ



Running a moulding on a bench

PPCS decorative mouldings

When there is the need for some sort of decorative moulding to be applied to a PPCS, they tend to be pieces of pre-formed polystyrene that are stuck onto the building and then plastered over. Often these decorative mouldings come “pre-meshed” so that all that needs to be done is applying the finishing coat of plaster.

Training requirements

The qualification for exterior plasterers is the New Zealand Certificate in Trowel Trades (Level 4) with strands in:

- Brick and Block Laying
- Floor and Wall Tiling
- Proprietary Plaster Cladding Systems
- Ferro-cement Tank Manufacture
- Refractory Installation
- Solid Plastering

It also has optional strands in Fixing Cavities and Substrates, and Decorative Mouldings.

It usually takes two to three years to qualify.

The New Zealand Certificate in Construction Related Trades (Supervisor) (Level 4) is available for those working for larger companies as supervisors of a team of plasterers.

Career paths

The exterior plastering industry offers a range of jobs and a progressive career structure so you can grow and develop with experience.

We list most of them below, starting from the more junior roles and working upwards towards those that require more qualifications and experience but have subsequently greater rewards.

Labourer

This is the most junior position in the trade. The labourer does a lot of the general basic "lifting, carrying, loading and unloading" sort of jobs and is not expected to have a qualification. If they remain on the job long enough they can pick up good experience that can help if they decide to go on to do an apprenticeship.

Apprentice

Exterior plasterers complete a formal apprenticeship to become qualified. An apprentice is a person who has signed into a Training Agreement with an employer to learn the range of knowledge, skills, and competencies that are required for a career in the plastering industry.

People who gain a qualification will have a broad knowledge and skill base to work as a competent tradesperson whether they specialise in residential, industrial, commercial or multi-storey construction. Many apprentices qualify in both solid plastering and PPCS.

Exterior plastering tradesperson

An exterior plasterer tradesperson is a skilled person who performs a range of work operations involved in the exterior plastering trade in which they have been successfully trained.

Once qualified, there are a variety of career paths to choose from, including:

- specialising in the residential (housing) or commercial sector
- working for a large construction company
- starting up in business as a sole trader.

Supervisor

A supervisor is usually a tradesperson with years of experience and specialist knowledge who is charged with the day to day organisation of a gang/team generally made up of qualified tradespersons and labourers. They will probably spend a reasonable amount of time still doing exterior plastering tasks.

Supervisors report to the project manager on large sites or to the main contractor/ builder on smaller sites.

Potential clients

Exterior plasterers will usually do both sub-contracting and direct-to-client jobs.

Direct to client

Many exterior plasterers have clients who choose to manage the building process themselves and engage directly with the trades or professions. In this situation, they are working direct for the client and will take instructions from, be paid by, and be responsible to them.

As an example, a homeowner is extending their house to add another bedroom. They are doing some of the work themselves and contracting specialists when needed. Because exterior plastering is restricted building work, they hire a local exterior plasterer who is an LBP to plaster the external cladding.

Sub-contracting

An exterior plastering sub-contractor is a tradesperson, company or business contracted by a main contractor to work in their specialised trade as part of an overall project. The sub-contractor will take instructions from, is paid by, and is responsible to the main contractor or their on-site representative.

By way of example, a builder is building a new house and engages a local exterior plasterer to apply the PPCS that has been specified for the job by the architect. In this example, the builder is acting as the main contractor

and is managing all the different relationships with sub-contractors who are assisting them in completing the full scope of work.

Relationships with other trades

The successful completion of any construction project relies on bringing together people with a wide range skills and expertise along with good organisation, quality control, coordination and clear lines of communication. All trades have a duty of care to respect and avoid damage to the work of other trades that have preceded them.

Exterior plastering contractors are involved in projects once the exterior framing or substrate is complete, the roof is on, the exterior windows and doors are installed, and the building is ready to be made completely weatherproof.

Exterior plastering contractors need to know what trades come before them in their work and build relationships with them to ensure that, together, they are able to produce weathertight exterior surfaces. Here are some of the ones most important for plastering work.

- The carpenter who constructed the framing on which the substrate is fixed (if it is a light timber framed building).
- The block-layer (if it is a solid concrete block structure).
- The fixer of the substrate, which may or may not be the carpenter (remember that if the substrate is polystyrene, it will be fixed by the exterior plasterer themselves).
- Any trade that will 'penetrate' the substrate and plastered surface of the building (such as plumbers and electricians) as they need to have their pipes and cables in place before any plastering work is undertaken.
- The joiner who installs the exterior doors and windows.
- The scaffolder who provides the working platforms off which the exterior plasterer will work to reach all surfaces off the ground.

The trades that follow exterior plastering contractors tend to be also those that come before them (such as the plumbers, electricians, etc) to finish off the work that they started but can only complete once the surface is finished.

A trade that will always follow after the exterior plasterer is the painter. The quality of the plastering and painting must both be good if the finished surface is going to achieve what has been specified.

There are also other trades that follow, many of whom have not been on the site to date. These trades can affect the weather-tightness of the plastered surface if they do not take care. Below are a couple of examples.

- Cable installers or other trades that "fix to" the finished plastered surface can create weaknesses in the surface or allow water to penetrate if they do not install their products properly. All penetrations to the plastered surface must be properly flashed and sealed and there must be sufficient support in the structure behind to take the fixings.
- Landscape gardeners must not build-up the gardens up to or over the line of the plastered surface or the system will deteriorate and moisture could enter the structure.

Industry bodies

Remember to also read the 'Industry bodies' section of this booklet's 'Introduction'. Information there is not repeated here unless it is specific to the exterior plastering industry

The Ministry of Business, Innovation and Employment (MBIE) manages the regulations relating to all building. The regulations that affect the exterior plastering industry are contained within the Building Code.

MBIE is also responsible for occupational licencing. Occupational licensing aims to ensure that people in the building industry who are responsible for the work done are competent and accountable so that homes and buildings are designed and built right the first time. The main occupational licensing that impacts on the exterior plastering industry is the Licensed Building Practitioners scheme.

The **Licensed Building Practitioners Scheme** was introduced in November 2007. There are a range of license classes, including specialist license classes for external plastering. Plasterers need to be a licensed building practitioner (LBP) to carry out or supervise certain restricted building work on homes and buildings. Restricted building work, such as that required to ensure the building envelope is waterproof, is work that by its nature is important to the building, is complex to do, needs to be done right, and must therefore be done by an approved, competent person.

LBPs are held personally responsible for ensuring all work on the project complies with the Building Code and are required to sign-off each stage as it is completed.

Exterior plastering

Standards New Zealand specialises in the development of standards to enhance products and services, improve safety and quality, meet industry best practice, and support trade into existing and new markets. Examples of those for the exterior plastering industry are:

- NZS 4251, *Code of practice for solid plastering*
- NZS 3103, *Specification for sands for mortars and plasters*
- NZS 4251:1974, *Code of practice for solid plastering*
- NZS 4251.1:2007, *Solid plastering - Cement plasters for walls, ceilings and soffits.*

Trade and professional associations are also set up to support members. Examples of associations in the plastering industry include:

- **The Canterbury Master Plasterers and Tilers Employers Association** is an invitation-only membership organisation that supports members to maintain high professional standards. It has been supporting Canterbury members for over 120 years but also has members from the upper South Island area and the West Coast. You can find out more about them at: cmpt.co.nz.

Floor and Wall Tiling
(Te Horapa Papariki)

Floor and Wall Tiling (Te Horapa Papariki)

Tilers use materials like ceramics, stone, glass, marble and terracotta. They cover walls, floors and surfaces in entrance ways, bathrooms, kitchens, living areas, patios, fireplaces and swimming pools. Tilers may also do restorative or repair work on historic buildings.

Tiling can be very creative. Even the same shaped and coloured tiles can be laid in different patterns for different effects. Add in different sizes and colours and tiling become a true art form even when the purpose of the tiles is to be functional. Some jobs require mosaic patterns that are purely decorative.

Attention to detail is important. It is obvious even in a small tiled area if care hasn't been taken to keep the tiles correctly spaced and lined up.

Tilers have to interpret specifications and plans to calculate what materials and quantities are needed. Materials need to be handled with care and are heavy.

Tilers come onto building projects after interior linings and finishing are completed. Depending on the house design, they will also be on site once the flooring substrate is ready for the floor tiles and again once kitchen and bathroom cabinetry has been installed.

The placing, fixing and finishing of tiles is done in a similar way regardless of whether the tiles are used for walls or for floors. This is also true of whether the tiles are installed in commercial or residential buildings.

Commercial versus residential

The biggest difference between the commercial and residential sectors of the floor and wall tiling industry is the scale (or size) of projects. The jobs are done in a similar way but a bathroom in a private house is going to take fewer and different tiles than needed for a public swimming pool.

Because they have to tile larger areas:

- commercial jobs may use tiles larger than those used in residential jobs
- commercial tilers may have to have more expensive machines and equipment to deal with the much larger quantities of tiles they use
- the tiles used may need to be more durable because they are in public places and could be more susceptible to damage.

Preparing a waterproof base and installing a waterproofing system for tiles must be done to the same standard for both residential and commercial installations.

Waterproofing

Tiles are often used as a hard wearing, moisture-repellent covering because they are durable and easy to keep clean. This is why they are often used in residential bathrooms and where hygienic surfaces are vital. (Such hygienic commercial application areas could include operating theatres in hospitals, commercial kitchens, and public toilets and showers.)

Installing a waterproof membrane prior to tile installation requires a high level of skill. The extra skill comes in the preparation and checking of the surface that is to go under the tiles (called the substrate), installing a waterproofing system designed to have tiles adhered to its surface, and keeping waterproof any places where services must pass through the tiles (drains, pipes etc.).

Tiling glossary of terms

Below are some of the many terms that are commonly used in the tiling industry. Remember to also refer to the glossary of terms in the introduction section.

Term	Meaning
Adhesive	A material that is used to fasten one surface to another.
Curing time	The time taken for the adhesive to reach its full strength.
Grout	A thin mixture of fine sand, cement and water.
Solvent	A liquid that dissolves another material producing a solution.
Substrate	A term used in building to describe the base material onto which another construction material is to be fixed.

Double-checking the tile was cut to the correct size.

Overall roles and responsibilities

The overall roles and responsibilities of floor and wall tilers are to produce high quality work that meets the performance expectations of the area they are tiling.

- Substrates and surfaces not prepared properly can cause tiles to lift or not lie flat, reducing the durability of the finished project and causing a tripping hazard on floor tiles.
- Using the wrong adhesive causes tiles to fall off and will require the whole job to have to be done again after removing all the laid tiles and adhesive.
- Preparing substrates and installing waterproof tiled surfaces correctly will prevent water from rotting floors and supporting structures of wet areas such as bathrooms and toilets.
- Using non-porous epoxy grout to correctly install tiles in operating theatres and commercial kitchens reduces the chances of illnesses by providing easily cleaned hygienic surfaces.

There are a number of standards that Standards New Zealand has adopted that give information about minimum standards and Codes of Practice for tiling.

Laid tiles must comply with the New Zealand Building Code and its associated Standards and Codes of Practice.

Below are some other ways the industry works to provide confidence tiling products will meet requirements.

Manufacturer guarantee systems

Manufacturer guarantee systems are written assurances from manufacturers that their goods or services meet a certain standard of quality and durability.

- Sometimes the manufacturer guarantees only their products/systems to be manufactured to a specific quality level.
- Sometimes the manufacturer also guarantees the use of their products/systems in their installed state by a contractor whose work they are prepared to stand behind.

Example – Product performance warranty. This is where a tile manufacturer will guarantee that when the tile was made and sold to you that it was a certain size and thickness, could withstand certain weight or pressure, and was suitable for a certain purpose (e.g. as a decorative tile). It wouldn't apply if any of the tiles changed colour due to incorrect grout being used or if the tiles cracked because they were not used for their intended purpose (such a laid on a floor instead of a wall).

Example – Workmanship warranty. This is in addition to the example above. For example, a manufacturer might guarantee certain tiles will last 10 years if the approved adhesive and grout were used and they were installed by a qualified tiler they were confident was skilled and knew how to work with their products.

Accredited supply networks

Many manufacturers and suppliers have accredited supply networks whereby a manufacturer or supplier of products and systems is prepared to stand by certain contractors work provided they satisfy the manufacturer's accreditation criteria.

An example is a large tiling supplier with a network of tilers they recommend to the customers who purchase their tiles directly from them.

Another example is a manufacturer of tile waterproofing systems with an accredited network of installers they have personally trained in the use of their products and systems.

Product training

Many tiling products and systems have become more complex over time and require specialist knowledge and skills in order to ensure that the finished job meets the required quality standard.

Because manufacturers have a vested interest in ensuring that their products and systems are installed correctly, the larger companies offer technical training (often free) on the use of their products and systems to ensure that they are used and installed the way they were designed to be.

Sometimes this training is delivered by a specialist technical training team and sometimes the manufacturer's sales representatives lead the training as a part of their role. Depending on the size of the manufacturer, in-house engineers and designers can also be involved in training – although this type of training is generally limited to designers and specifiers within the industry who want to incorporate the manufacturer's products and systems in the buildings they are creating.

Fixing wall tiles

Summary of tilers' work

Floor and wall tiling has three main steps.

1. Surface inspection and preparation.
2. Setting out the tiles.
3. Fixing or laying the tiles.

Careful planning and preparation helps produce a quality finished tiling project that meets the requirements of the plans and specifications.

Surface preparation

A clean, stable and rigid surface is essential. Poor surface preparation will affect the quality of the finished tiled areas.

The underlying supporting structure needs to provide a solid and rigid backing that supports:

- the weight of the tiles
- the weight of the bedding material
- the loads that will be applied to the finished tiled surface.

Working drawings, specifications, and tile manufacturer's installation instructions must be carefully read and fully understood. These will specify the method of surface preparation that that will be required for the project. The best way for the surface to be prepared depends on a number of factors, including:

- location – floor, wall, internal, external
- use – residential, commercial, light or heavy traffic
- environment – wet, dry, commercial or residential
- substrate – concrete, cement board, plasterboard
- any contamination such as grease, paint etc that needs to be removed
- unsuitable surface conditions including uneven or out of level surfaces that may need to have a levelling compound applied to them.

Good surface preparation is especially critical where tiles are to be installed in wet areas (such as bathrooms and showers) or where tiles could be subject to water splash. The Building Code has specific requirements about tiles in these areas.

As part of the preparation process, tilers consult with other trades to ensure that any services that need to be installed or any work that needs to be done

first is completed before the tiling process is started. This helps to avoid any damage to the tiles after they have been laid.

Tilers also needs to take care that any work completed by other trades is protected from damage before they start their work.

Setting out the tiles

Each tiling project is set out in a different way depending on factors such as:

- the size and shape of room or area
- the position of doors and major fixtures such as benches
- the chosen pattern and design.

The working drawings and specifications, tile manufacturer's installation instructions, and discussions with the client – along with the experience of the tiler - will provide all the information to complete the set-out correctly.

There are a number of other checks that need to be carried out before tiles are laid. These include:

- the correct type and quantity of tiles have been delivered
- the correct adhesive is available
- all preparation work done by other trades is checked for completion to the required standard
- the tiling specifications and manufacturer's instructions are re-read and confirmed
- the area to be tiled is clean and dry.

Getting tiles ready to set out

Calculations will determine exactly where the tiling will start and end and also where tiles need to be cut. For an attractive and symmetrical finish, it is important that all measurements are double-checked before fixing tiles.

Any special features, patterns and borders also need to be carefully placed at the set-out stage.

Fixing or laying the tiles

The laying process can start once the checks are done. The laying process will generally follow these steps.

Applying grout

- From the starting point, the adhesive is spread evenly over a small area using a notched trowel.
- The first row of tiles are then laid on the adhesive and separated from each other with spacers.
- The process is repeated until the row has been completed.
- Continue with the row next to the starting line and then complete all the full tiles required for the area.
- Where a tile needs to be cut, this can be done using a manual tile cutter or a wet saw.
- After 24 hours, the spacers between the tiles can be removed and grout applied to fill the joints.
- Leave for a further 24 hours to allow the grout to harden before use.

Training requirements

The qualification for tilers is the New Zealand Certificate in Trowel Trades (Level 4) with strands in:

- Brick and Block Laying
- Floor and Wall Tiling
- Proprietary Plaster Cladding Systems
- Ferro-cement Tank Manufacture
- Refractory Installation
- Solid Plastering

It also has with optional strands in Fixing Cavities and Substrates, and Decorative Mouldings.

It usually takes between two and three years to qualify.

Career paths

The floor and wall tiling industry offers a range of jobs and a progressive career structure so you can grow and develop with experience.

We list most of them below, starting from the more junior roles and working upwards towards those that require more qualifications and experience but have subsequently greater rewards.

Unskilled labourer

This is the most junior position in the trade. The labourer does a lot of the general basic "lifting, carrying, loading and unloading" sort of jobs and is not expected to have a qualification. If they remain on the job long enough they can pick up good experience that can help if they decide to go on to do an apprenticeship.

Apprentice

Floor and wall tilers complete a formal apprenticeship to become qualified. An apprentice is a person who has signed into a Training Agreement with an employer to learn the range of knowledge, skills, and competencies that are required for their career in the tiling industry.

Apprentices receive on the job training and are assessed for a range of theory and practical plastering work. Apprenticeships are "competency based" which is all about demonstrating the ability (both in terms of knowledge and skill) to complete a range of tasks to industry standards.

Floor and wall tiling tradesperson

Qualified tradespeople are successfully able to complete, without supervision, all work involved in floor and wall tiling in the workplace to a professional standard. There are a variety of career paths to choose from, including:

- specialising in the residential (housing) or commercial sector
- working for a large construction company
- starting up in business as a sole trader.

A tradesperson may report to different people depending on the area they've chosen to work. For example, they will generally report to the construction foreman (supervisor) if working on a large commercial site.

Qualified tradespeople with their own businesses are responsible for ensuring their own work performance meets the expectations of the client and the Building Code and any applicable standards.

Potential clients

In the floor and wall tiling industry, tiler will usually do both sub-contracting and direct-to-client jobs.

Direct to client

Many tilers have clients who choose to manage the building process themselves and engage directly with the trades or professions whose skills they need to hire. In this situation, they are working direct for the client and will take instructions from, be paid by, and be responsible to them.

Example: A homeowner is re-furbishing the kitchen in their house and wants to have the floor and the walls around the stove tiled. They get a local tiler to do the work and agree on the provision of materials and the timing of the job. The tiler will work directly with the client on all matters of the job.

Sub-contracting

A tiling sub-contractor is a tradesperson, company or business contracted by a main contractor to do the tiling work that is part of an overall project. The sub-contractor will take instructions from, is paid by, and is responsible to the main contractor or their on-site representative.

Example: A builder is building a new house and engages a tiler to do all the tiling work for the bathroom, kitchen and patio floors. In this example, the builder is acting as the main contractor and is managing all the different relationships with sub-contractors.

Another example: A tiler bids for the installation of tiles for a new shopping mall. The tiler and main contractor must agree on the correct quantity of tiles needed. Once delivered, the tiler has the responsibility of laying them according to the working drawings and specifications. The tiler will work with (and around) other tradespeople and will report to whoever is managing the project for the large construction company who are the main contractors. The tiler will be paid for their work by the large construction company.

Relationships with other trades

Floor and wall tiling contractors tend to be involved in projects towards the end of a construction project. For example, tilers will come onto a commercial construction site once the floors and walls are ready for their final surface covering. They start their work on residential sites once the linings and flooring are completed and the main contractor is getting ready for the decorators, kitchen installers and carpet layers.

Along with a good relationship with the main contractor (generally the builder), floor and wall tilers have a duty of care to the trades that come immediately before them and those that follow immediately after them.

Tilers need to make sure that all services are in place before they start tiling and that the surfaces to tile are in a suitable condition. This means having a relationship with the fixers (and stoppers, if appropriate) of lined areas, plumbers, and electricians. Some jobs may have variations to this.

For example, if the job is to install tiles as an up-stand (or splash-back against a wall) on a bench, the bench will need to have been either installed or very accurately measured up. This could involve liaising with the joiner. Tilers also need the main contractor (the carpenter) to "make ready" for them – which may mean some additional carpentry work needs to be done so that they can do their job. This is especially important for getting the substrate (the base) ready for surfaces that need to be watertight.

Industry bodies

The Ministry of Business, Innovation and Employment (MBIE) manages the regulations relating to all building. The regulations that affect the tiling industry are contained within the Building Code.

Standards New Zealand specialises in the development of standards to enhance products and services, improve safety and quality, meet industry best practice, and support trade into existing and new markets. Examples of those for the tiling industry are:

→ AS 3958.1, *Ceramic tiles - Guide to the installation of ceramic tiles.*

BRANZ produce a wide range of publications that translate building-related research into practical, usable information about trends and best practice, making it accessible to the wider construction industry. One essential to the tiling industry is:

→ Good practice guide to tiling.

Trade and professional associations are also set up to support members. Examples of associations in the tiling industry include:

→ **The Tiling Association of New Zealand (TANZ)** was established in 2017 to support, monitor and grow the tiling industry in New Zealand. Member accountability includes the tiler following all manufacture specifications and installation guidelines, and using only imported products (tiles, membranes and adhesives) that have a proven product performance history. You can find out more about them here: www.tanz.net.nz.

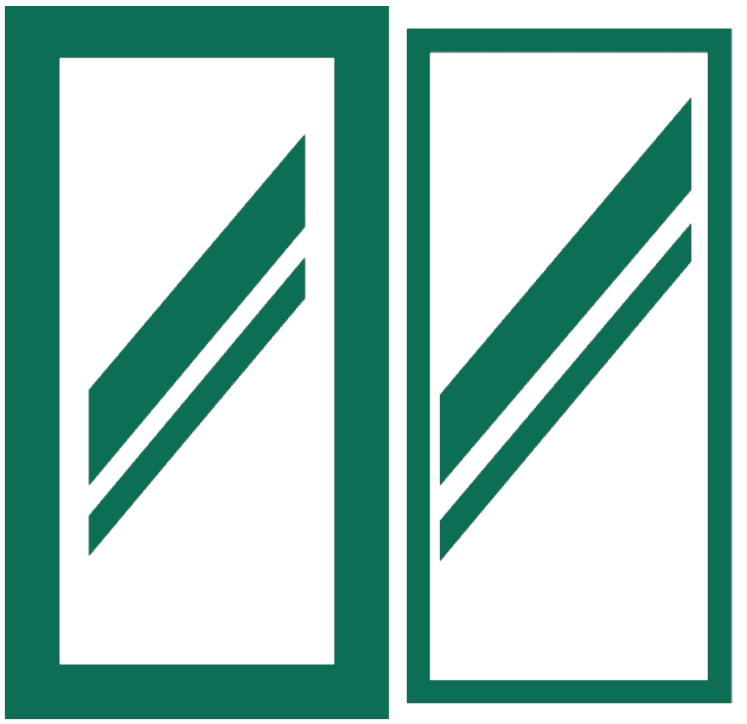
→ **The Canterbury Master Plasterers and Tilers Employers Association** is an invitation-only membership organisation that supports members to maintain high professional standards. It has been supporting Canterbury members for over 120 years but also has members from the upper South Island area and the West Coast. You can find out more about them at: cmpt.co.nz.

Remember to also read the 'Industry bodies' section of this booklet's 'Introduction'. Information there is not repeated here unless it is specific to the tiling industry

To print just the **Glass & Glazing** section, print pages 77 to 92

This box does not have to be printed

Glass and glazing (Te Karāhe Whare)



Glass and Glazing (Te Karāhe Whare)

There are three specialities within the glass and glazing industry:

- glass manufacturing and processing
- glazing
- automotive reglazing.

Glass manufacturing and processing. This involves the making of glass and its preparation for delivery to a site for installation. Those working in this part of the industry need to know how to make different types of glass, as well as how to:

- cut
- process Insulating Glass Units (IGUs) (also known as 'double glazing units')
- notch glass to regular and irregular shapes
- edgework
- manually process toughened and heat strengthened glass
- safely load glass for transportation.

Glass processors normally hand their finished product to glaziers for installation.

Glazing. Glaziers cut and install glass products and related structures. They need to know how to handle and install different types of glass, like toughened glass, solar controlled, and specially-coated glass and insulation systems.

Glaziers install glass in timber, metal and PVC frames. Aside from windows, they install shower cubicles, glass walls, floors, and canopies.

They also need to master the techniques needed to manually cut irregular glass shapes on-site from working drawings and plans. Attention to detail to measure and cut to exact requirements is essential. Installed glass needs to fit tightly to be waterproof.

Glaziers install their glass products once its framing has been constructed.

Automotive reglazing. Automotive reglazers are glaziers who specialise in cutting glass, repairing glass and removing and replacing old glass in vehicles. As part of the repairing and replacing glass process, automotive reglazers also remove, refit and test electrical and electronic components to facilitate automotive reglazing.

Glass and glazing glossary of terms

Below are some words that are commonly used in the glass industry. Remember to also refer to the glossary of terms in the introduction section.

Term	Meaning
Aluminium profiles	Special shapes of aluminium that is cut up to form the frames for windows and doors.
Annealed glass	Standard non-safety glass.
Desiccant	Desiccants are used in IGU's to prevent the inside glass surfaces from fogging because of condensation of moisture vapour or organic vapours.
Curtain walling	Big thick strong panes of glass on buildings that form a wall as well as a window. They are said to form a "curtain wall" on the building.
Float glass	The process for making glass into stock sheets.
Glazier	A person who installs glass.
Glazing	Installing glass.
IGU (or DGU)	Abbreviations for double glazing, which is two or more panes of glass separated by trapped air. An Insulating Glass Panel is called an IGU and a Double Glazed Unit is a DGU, but they both mean the same thing.
Primary seal/butyl	The interior seal of an IGU. Very important component in the makeup of an IGU in order for it to pass auditing procedures.
Quenching	A high-pressure cooling procedure, which lasts just seconds. High-pressure air blasts the surface of the glass from an array of nozzles in varying positions. It is used in conjunction with a furnace during the toughening process.
Secondary seal	The outer seal on an IGU. It usually consists of a polysulphide or silicon product.
Stock sheet	Size of glass cut to size by float glass manufacturer for shipment around the world. There are various sizes stock sheets e.g. 5100 x 3210mm, 3660 x 2440mm, 2440 x 1830mm, and 2440 x 1220mm.

IGU panels made to size are ready to be assembled into joinery units.

Overall roles and responsibilities

Glass must be manufactured, processed, and installed correctly so that it can do the job it is meant to.

- Faults in glass can cause it to break into large shards and cause serious injuries to the glazier when cutting and installing it or to people living or working where it has been installed. Faults in glass include chips, runs, vents, and seeds.
- Stock sheets being used where toughened glass was specified could cause serious injuries and deaths by glass falling from height.
- Glass not tinted correctly will not meet client expectations of reducing heat, UV light, and glare.
- Correctly manufactured obscure/patterned glass will protect clients' privacy while allowing light in.
- Laminated glass produced and installed correctly in cars can save lives in accidents. Laminated glass can also be used in areas with high foot traffic instead of using toughened glass.
- Manufacturers and suppliers of toughened glass having strict auditing processes to ensure it meets the minimum NZ/AUS standards provides confidence that the toughened glass will perform as required.
- IGUs/DGUs made and installed correctly reduces the risk of illnesses caused by damp and mouldy homes – and reduces heating costs - by helping to keep homes warm and dry.
- Fire rated glass can play a vital role in restricting fire damage to buildings along with providing rescuers visibility to find people during a fire.
- Any glass not installed exactly as it needs to be will produce issues with weather tightness. This can not only cause health and safety problems but can cause buildings to rot.

There are a lot of standards in New Zealand that give information about how certain types of glass need to be installed. The supplier and/or manufacturer of the glass will also have some installation instructions.

No matter which standard is used, glass must be produced and installed so that it complies with the New Zealand Building Code and its associated NZ/AUS standards.

Below are some ways to help provide clients with confidence the glass supplied and installed will meet requirements.

Manufacturer guarantee systems

Companies that provide glass materials give guarantees that the products they sell will be fit for the purpose they will be used for and free from defects.

This does not mean that the glass will not break if it is hit or exposed to really high winds. It means that it will not break in normal conditions and will not have defects such as fogging or internal scratches in IGUs.

Glass is usually installed in window and door frames (exterior joinery) by joinery companies. The joinery company uses the guaranteed glass to make the exterior joinery and provides their clients with a guarantee for the materials used and their workmanship.

For large contracts, there is often a maintenance period. This requires the glass installer to correct any unexpected problems discovered.

Product training

Product training is how industry professionals keep up to date with what new products can and cannot do and how to make and install them to meet their performance expectations.

We have already talked about IGU glass being required on all joinery now. Suppliers of this glass product do a lot of training of the companies they supply to and the people who will be using the product. Training sessions may involve the product manufacturer as well as the supplier.

Accredited supply networks

The glass that comes into New Zealand and that is used in New Zealand must meet New Zealand's standards. One way to make sure that this happens is to have accredited supply networks.

This basically means that suppliers are accredited as being able to supply certain glass products to meet certain specifications. Glass from accredited overseas companies will only be imported if the company's glass meets New Zealand requirements. Because different glass manufacturers often specialise in different types of glass, New Zealand glass processing companies normally have a network of suppliers that they use.

Joinery companies will only get glass from suppliers in New Zealand if they are accredited to supply glass of a certain standard. They will use certain suppliers, and these suppliers form a network or suppliers that a company will purchase glass from.

Several types of glass may be needed for one building

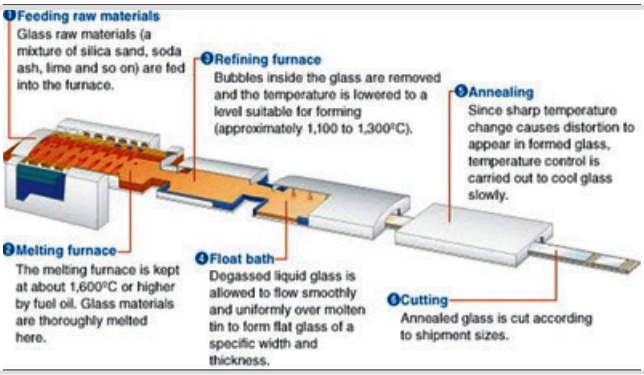
Glass manufacturing

Most glass used in construction is made using a method called the "float glass process". In the float glass method, glass is made from melting silicate (which is basically sand), lime, and soda in a large furnace. Other ingredients can be added depending on the requirements of the batch being made.

As you can see in the diagram below, this is followed by a refining furnace to try to remove imperfections. The melted glass is then floated onto a bed of red hot (molten) tin and finally goes into an annealing lehr (oven) where it is slowly cooled and turns into solid glass. It is then cut into stock sheets, ready for shipment.

The glass can be made as thin as 2mm and as thick as 19mm. Float glass is made overseas. It is shipped into New Zealand in large panels and then processed by companies like Metro Glass and Viridian.

The process for making plate glass



Types of glass

The float glass process can be changed to make many types of glass. Glass can also be processed after it has been made. This is normally done by glass suppliers in New Zealand.

It is not uncommon for different types of glass to be used in one building, especially commercial ones.

Some of the different types of glass are:

- tints, reflective and coated glass
- decorative glass
- wired glass
- mirrors
- laminated
- toughened
- heat treated
- screen printed
- cladding
- insulating.

Below are some common examples of types of glass and how the process can be changed to make them.

Tinted glass

Glass has a natural green tint to it caused by the iron in the sand. Manufactures can add less iron to make the glass less green. They can also add metal oxides to the mixture to tint glass grey, bronze, or blue.

While tinted glass looks nice, it is usually used because it stops inside areas heating up too much and cuts down UV light and glare inside buildings.

Decorative and obscure/patterned glass

There are a number of types of ways of making decorative glass.

- → Some is sandblasted once it is made.
- → Etchlite glass is treated with an acid to make a fine grainy finish.
- → A film can be added to the glass at the end of the process.

Obscure/patterned glass is made by manufacturers overseas for multiple reasons like privacy. Stippolite (Spotswood) has a prominent pattern which reduces visibility through the glass while still allowing light in.

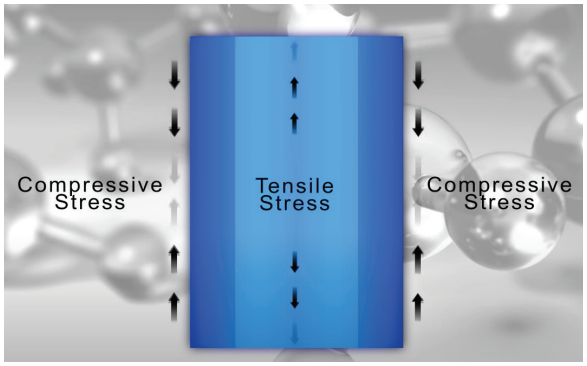
Laminated glass

Laminate glass is a Grade A safety glass product. It is made by joining two or more sheets of glass together with a plastic or resin. The advantage of laminated glass is that when it breaks all of the bits of glass stick to the plastic or resin. This is why it is used in vehicle windscreens.

Mirrored glass

Mirrored glass is another word for reflective glass. It is glass that has been treated with a metallic substance and offers mirror-like properties. The term 'mirrored glass' can apply to products made specifically to serve as mirrors as well as to glass that is reflective but made for architectural or decorative purposes, such as facades or table tops.

Toughened glass



Tempered glass is about four times stronger than "ordinary", or annealed, glass. Unlike annealed glass, which can shatter into jagged shards when broken, tempered glass fractures into small, relatively harmless pieces. Spontaneous Glass Breakage is usually caused by too much nickel sulphate added during the manufacturing process in the float glass method.

Toughened glass is made by heating up float glass

to above 600°C. It is then cooled quickly using a process called 'quenching'. Quenching cools the outer surfaces of the glass much more quickly than the centre. As the centre of the glass cools, it tries to pull back from the outer surfaces. As a result, the centre remains in tension, and the outer surfaces go into compression. It is this that gives tempered glass its strength and ability to cope with very high temperatures.

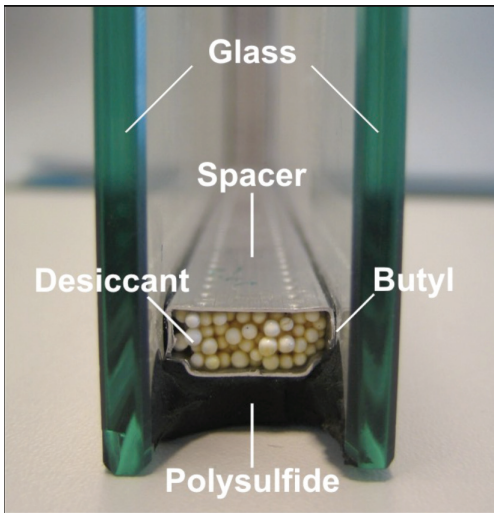
Glass manufacturers who supply toughened glass must have strenuous auditing processes because the product has to conform to NZ/AUS standards 2208 and 2080. All toughened glass is a Grade A safety product.

Insulating glass

An Insulating Glass Unit (IGU) or Double Glazing Unit (DGU) is basically two panes of glass with a layer of air trapped between them, fully sealed around external edges for weatherproofing. Double glazing is required on all new glass installations. This is because it stops buildings losing heat in the winter.

An IGU will always consist of:

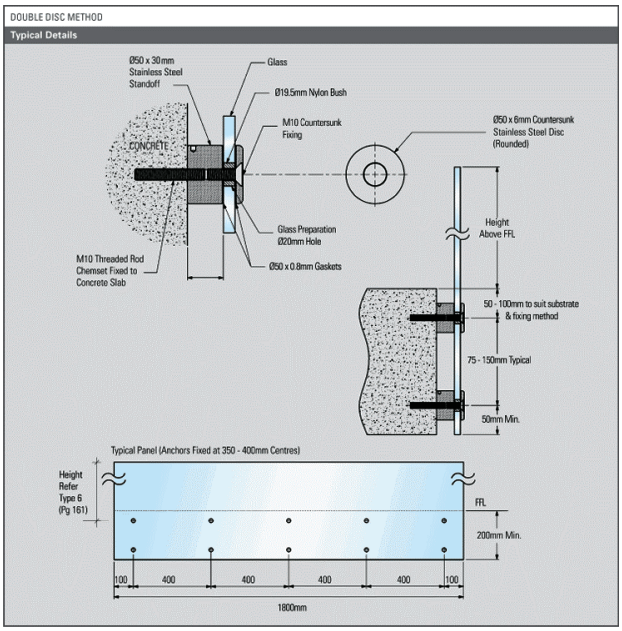
- the glass panels specified for the job
- a spacer bar to separate the panes of glass
- desiccant to adsorb moisture and prevent fogging up inside the unit
- a primary (or interior) seal, which is usually referred to as butyl
- a secondary (or outer) seal, which in New Zealand is usually made with polysulphide or structural silicone.



Argon gas can also be added to the inside of an IGU for extra insulation. This further helps prevents the loss of heat from buildings.

As with the toughening glass process, IGU's need to pass strenuous auditing criteria to meet building standards and to ensure the end customer receives a product which won't deteriorate over time.

Glass installation

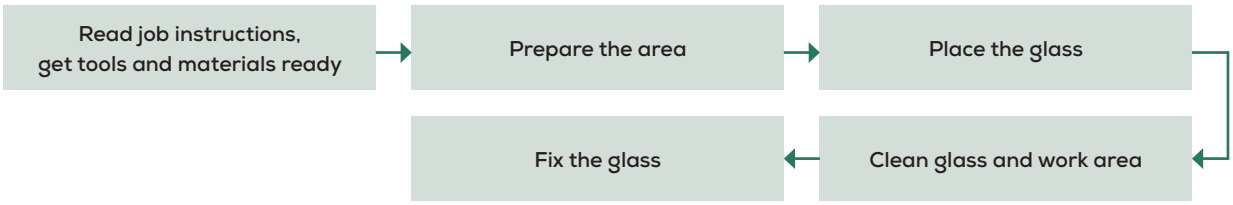


Example of installation details for balustrade

Glass installers are called glaziers. They have to be very aware of health and safety hazards when they are installing glass. They need to use the right tools to make sure glass is installed safely and is weatherproof.

Glass installation either happens in a workshop or on site. It is installed in a joinery shop when being used to make, for example, window and door units for installation on site. Glass is installed directly on site if it is a repair or replacement of a pane of glass. It will also be installed on site if it is not part of another unit (like a door or window).

The flowchart below summarises the basic process for installing glass.



Installation starts with reading the job instructions and making sure all the materials and tools for the job are correct and ready. The next step is preparing the area where the glass is being installed. This could involve cutting and preparing aluminium profiles, putting seals in place or attaching fixings. The glass must then be put into place.

Glass is often large, heavy and difficult to handle. Special suction handles called “glass suckers” are often used to handle large panels of glass. This reduces the risk of breaking the glass and makes it easier to install it correctly.

Mechanical fixing for glass.

Once in place, the glass needs to be fixed correctly. Depending on what is specified, this may be by seals or mechanical fixings or both.

Glass installation is only finished after the glazier has cleaned up. This means they need to clean the glass as well as pick up and remove any rubbish that they have made during their work. It is really important to clean up all broken glass so no one is cut by it.

Training requirements

Many apprentices start their careers by working in a glass processors or joinery shop after school hours or in the holidays, helping out with the cleaning, and possibly assembly work. If the person shows they are keen to learn, the joinery company may offer them a job and even an apprenticeship.

Qualifications available in the glass and glazing industry include:

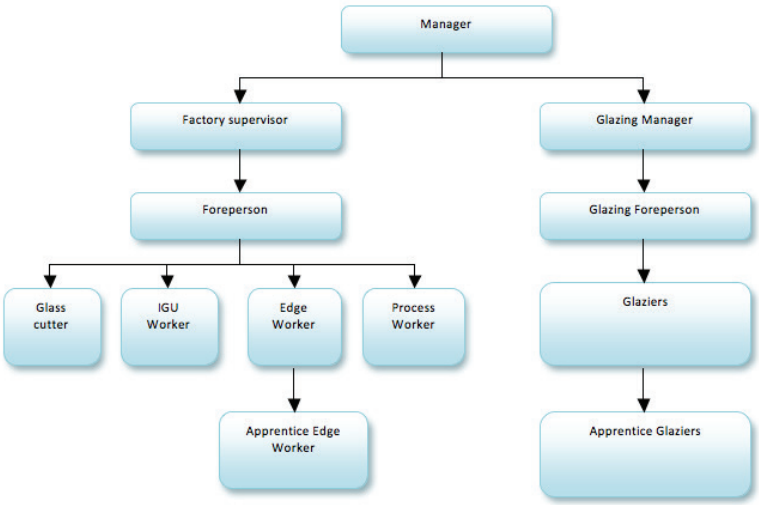
- New Zealand Certificate in Glass (Level 3)
- New Zealand Certificate in Automotive Reglazing (Level 3)
- New Zealand Certificate in Glazing (Level 4) with strands in:
  - Residential Glazing
  - Commercial Glazing
  - Frameless Glazing
- New Zealand Certificate in Glass Processing (Level 4) with optional strands in:
  - Manufacturing insulating glass units
  - Manufacturing toughened glass
  - Manufacturing screen printed glass
  - Manufacturing laminated glass
  - Computer numerical controlled machinery

Job roles

There are a lot of different jobs in the glass industry. A simplified team structure of a glass processor and supplier is shown right.

There are other roles like specialist installers for glass products like curtain walling.

Companies who repair or replace glass units usually employ glass installers.



Glass and glazing

Glass sub-contractors are normally joinery companies. The team structure will be set up in a similar way to the diagram above but the roles will be slightly different. Four of the main roles in glass joinery companies are summarised below.

Fabricators A fabricator starts with raw materials like aluminium profiles or timber. They then measure and machine it so that they can be put together to make windows and door frames. Fabricators learn how to use machines like saws and routers.

Glass cutters Glass cutters use special tools to cut glass panels to the right size. They need to be very accurate with their measurements. They also need to be careful that they do not damage the glass.
Very little glass cutting is done by joinery companies making IGUs because the units are cut and supplied ready to be installed into the timber or aluminium joinery framing.

Assemblers An assembler takes the framing components the fabricator has made, the glass the cutter has cut, (or that the IGU worker has made), and any seals and fittings and puts them together.
Assemblers use tools like drills to put the frame and glass together. They must make sure that they follow the plans carefully and work very accurately. It is very easy to put components on the wrong side or slightly out of shape if they are not careful with their work.
IGU workers are specialist assemblers. They have to be trained and follow assembly methods really closely. If they do not, the IGU panels may fail by allowing moisture in or having internal scratches on them.

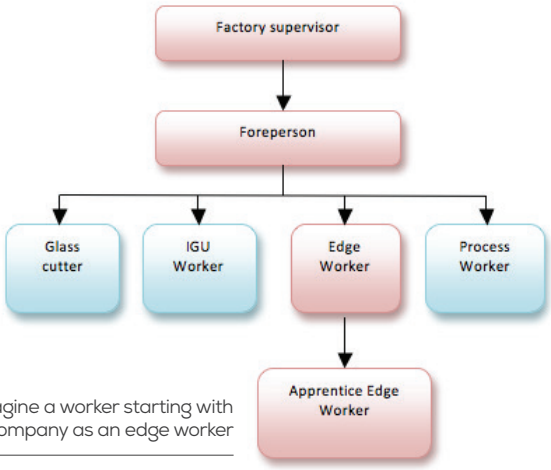
Installers Installation work involves working on construction sites. The items are delivered to the site and installed into position by an installer. They have to be careful that they follow the plans and put the correct fixings in the correct places.
Installers can also be people who repair or replace glass products on site. For example, an installer may remove an old glass pane from a frame to install a new one.
Installers need to know quite a bit about the assembly of glass joinery. This is so they can remove and reinstall glass correctly without damaging the frame or glass. They may also need to know how to cut glass

Career paths

Usually a person will start in the glass industry as an apprentice, factory hand or labourer. The career path that each person has will depend on things like:

- what training they have
- where they work
- what experience they have or can get
- their keenness to learn and be promoted.

You can get an idea of the possible career path from this diagram on the right for the glass processor and supplier industry.



Imagine a worker starting with the company as an edge worker

Potential clients

Manufacturers of float glass supply glass products to companies who process the glass in New Zealand.

From there, suppliers and glass process companies either supply:

- directly to the client
- to sub-contractors, like joinery companies, needing glass
- by sub-contracting to builders or building companies.

Direct to the client

This occurs where the client approaches the glass supplier to price and manufacture glass products and fittings. These could be from drawings that are done by the client or their architect. In other situations, the client may tell the supplier what they want and the supplier will work with them to determine the best products for their needs.

The client may work directly with the supplier.

The client contracts the glass supplier to process and supply the items. The glass supplier may install the items for the client or they may contract this out to a special installer.

The supplier has to process the glass and have it ready and installed for the client on schedule. The client pays the supplier direct for the items and installation.

Sub-contracting

Clients can approach sub-contractors for joinery products like doors with glass panels. The sub-contractor will then make up the joinery for the client.

Joinery companies that make products like aluminium and timber doors and windows still need to purchase their glass from a supplier. Their supplier will almost always cut the glass to size and do any processing needed before it's delivered.

The sub-contractor normally has their own glaziers who will install the glass into the joinery. However, glass for IGU units is usually suppled ready for installation into joinery.

Sub-contracting to builders

Sub-contracting occurs when a builder or building company invites joinery companies to provide quotations to supply (and possibly to install) a range of items. The builder then chooses a joinery company and offers them the work. Once the building company has chosen who will supply and process the items, the company then gives them a schedule detailing what items are required and when they are needed by. As with all construction work, the suppliers and installers of glass products need to make sure they can meet the client's requirements and deadlines.

If the work has some difficult glass products and/or fixing methods, the building company may choose to use both a joinery company and a supplier to supply and install the different glass products. For example, if a building has curtain walls as well as standard joinery, the building company may give the joinery work to a joinery company and contract the curtain walling to a specialist glass company.

Relationships with other trades

Relationships between trades in the construction industry are really important. Trades need to be able to work together so that the finished building meets the client's as well as legislative requirements.

The main ones that must work together in the glass industry include:

- carpenters
- joinery
- gib fixers, stoppers and plasterers
- painters.

Before any glass products can be installed into a building, framing needs to be made to hold the glass units. Framing is normally prepared by a builder.

When the framing and external cladding is ready for the new joinery, the joiner delivers the units (such as windows) to the site. In residential buildings, the glass joinery is normally installed by the builder. However, on larger commercial sites, or if the work is complicated, a specialist installer may be subcontracted to do the work.

Special work like curtain walling will be installed by a specialist. The builder will never do this work themselves.

Once the glass units have been installed on a new building, the internal lining can be finished by gib fixers. These are then finished off by gib stoppers and plasterers, ready for the painters do their work.

Industry bodies

The Ministry of Business, Innovation and Employment (MBIE) manages the regulations relating to all building. The regulations that affect the glass industry are contained within the Building Code. Examples of these include:

- wind loadings that glass can cope with
- glass life
- weather tightness of windows and external glass doors
- energy efficiency (using IGU units).

Standards New Zealand specialises in the development of standards to enhance products and services, improve safety and quality, meet industry best practice, and support trade into existing and new markets. Two examples of those for the glass and glazing industry are:

- AS/NZS 2208, *Safety glazing materials in buildings*
- AS/NZS 2080, *Safety glazing for land vehicles*.

Remember to also read the 'Industry bodies' section of this booklet's 'Introduction'. Information there is not repeated here unless it is specific to the glass and glazing industry

Trade and professional associations are also set up to support members. Examples of associations in the glass industry include:

- **Window & Glass Association of New Zealand (WGANZ)** has members that provide products or services of a certain standard. For example, the Window & Glass Association of New Zealand conducts examinations in the practical understanding of the New Zealand Standard for glazing in Buildings. Graduates must attain a 100% pass mark in written examinations on the practical interpretation of NZS 4223:Part 3:1999.

Moving stock sheets

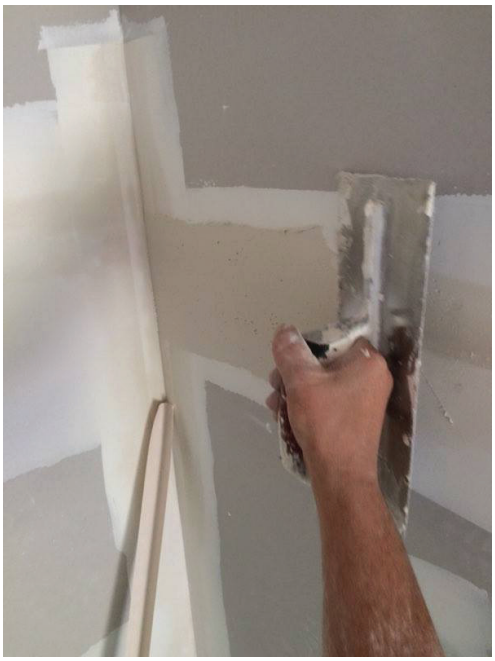
To print just the **Interior Systems** section, print pages 93 to 106

This box does not have to be printed

Interior systems

Ngā Pūnaha-ō-Rō-Whare)

Interior systems (Ngā Pūnaha-ō-Rō-Whare)



The interior systems industry manufactures, installs, and plasters interior walls and ceilings.

There are two distinct parts of the installation side of the industry. Within these are some further sub-parts.

Interior linings includes the fixing and finishing of:

- plaster board
- fibre cement linings
- fibrous plaster.

Proprietary systems includes the installation of:

- proprietary partitions
- suspended ceilings.

Depending on their speciality, interior systems specialists may be called gib-stoppers, plasterers, fibrous plasterers or ceiling fitters. All except proprietary partitions installers do their work once the carpenter has constructed the frames their material needs to be fixed to. Painters then seal the fixed material.

Interior systems specialists are officially known as:

- **Fibrous plaster manufacturer.** Fibrous plaster manufacturers work in a factory. They use moulds to make the fibrous plaster sheets, cornice and decorative mouldings for fixers and finishers to install.
- **Interior linings fixer.** Interior linings are those such as walls and ceilings. Interior linings fixers install plaster board, fibre cement, and fibrous plaster ready for stopping and finishing. They line the inside of the room on top of the framing structures constructed by carpenters.
- **Interior linings finisher.** Interior linings finishers stop (seal the lining's joins) and finish the linings ready for painting. They also install coves and cornices to provide decoration between walls and ceilings.
- **Suspended ceilings installer**. Suspended ceiling installers set out and install the suspended ceiling grids. They then either line or place ceiling tiles into the grids.
- **Proprietary partitions installers.** Proprietary partitions installers create partitions (or walls) from steel or aluminium to create rooms inside large interior spaces.

Interior systems glossary of terms

Below are some of the commonly used words used in the interior systems industry. Remember to also refer to the glossary of terms in the introduction section.

Term	Meaning
Casting	The process where a combination of gypsum plaster and fibreglass reinforcing is placed in a mould to create a product.
Fibre cement linings	Sheet material made of water, fine sand, cement and wood pulp.
Fibrous plaster	An interior lining material made up of gypsum plaster and fibreglass reinforcement.
Finishing	Plastering the surface of sheets, which finishes the installation process by making the surface smooth and ready for painting or papering.
Plaster board	A sheet material with a core of gypsum plaster between two sheets of heavy paper.
Stopping	Sealing joins between sheets.

Cornices and decorative mouldings, made by fibrous plaster manufacturer, and installed then finished in this ceiling by an interior linings finisher.

Overview of roles and responsibilities

The overall roles and responsibilities of interior systems specialists are to install interior linings and room partitions (such as walls and ceilings) according to manufacturers' specifications and finished to the quality standards the client requires.

- Suspended ceilings installed correctly using an approved manufacturer's system are designed to not collapse in earthquakes.
- Proprietary partitions installed correctly will not fall over when pressure is applied, such as when someone leans on it.
- Interior linings fixed and finished correctly will be smooth and ready for the type of paint and paint finish the client wants.
- Fibrous plaster decorative mouldings can add character and a point of difference to rooms.

Proprietary partitions have many components that need to be installed according to its manufacturer's specifications.

Interior systems specialists must ensure their work complies with the New Zealand Building Code and its associated NZ/AUS and BS standards.

Summary of interior systems specialists' work

Fibrous plaster manufacture

The oldest part of the interior systems industry in New Zealand is that of the fibrous plaster manufacturer. They cast:

- flat, curved and decorative sheets for use on walls and ceilings
- decorative mouldings (such as cornice, centres, domes, fire surrounds, archways and corbels) that are used to adorn interior spaces
- ceiling panels and tiles for use in suspended ceilings.

Concave sheets installed and ready for finishing.

They also make:

→ running moulds out of plaster

→ moulds out of plaster, timber, rubber and other substances for casting items of fibrous plaster.

Casting is the process where a combination of gypsum plaster and fibreglass reinforcing is placed in a mould to create a product.

Flat sheets are cast on a flat, glass-like surface to make them flat and have a glass-like face.

Curved sheets are cast on a purpose-built curved mould with the radius of the curve being the required radius of the finished sheet. Concave sheets are cast on convex moulds and convex sheets are cast on concave moulds. Decorative sheets are cast on a patterned surface.

While fibrous plaster factories have many moulds to cast their usual items, they also produce one-off products for clients who want something different. This is a specialist side of the trade that requires considerable skill and creativity.

Moulds can be made out of a number of different materials. They are sometimes made from a master (or model) that is provided by the client and sometimes constructed from scratch.

Fibrous plaster installation

Some fibrous plaster manufacturers offer an installation service to their clients. Their products are taken directly from the factory to the site and installed by their own fibrous plasterers.

There are also fibrous plaster installers who purchase from the manufacturer what is needed for a job. Because fibrous plaster is not the most common interior lining used, fibrous plaster installers often also install other types of interior linings.

Fibrous plaster installers offer the complete fix and finish service. This involves:

→ fixing fibrous plaster sheets to interior surfaces

→ finishing (plastering) the fibrous plaster to hide all the joins and fixings

→ fixing and finishing fibrous plaster cornice and other decorative mouldings.

Working together to install fibrous plaster sheets on a ceiling.

Joins between two fibrous plaster sheets are formed by building up layers of plaster and reinforcing tape and feathering the surface of the join into the body of the sheet. Joins between sheets are easier to disguise than other internal lining materials because the sheets have a plaster face and so the entire finished surface is plaster. This clean, seemingly join-free surface makes the use of fibrous plaster common in hi-spec designs.

Fibrous plaster cornice and decorative mouldings are fixed using a combination of mechanical fixings and a special plaster mix. The fixing and finishing of cornices requires internal and external mitred corners. Special care must be taken to match pattern designs with repetitive features.

Plaster board – fixing

Plaster board is sold as a system that includes the boards, framing, fixings, finishings and other materials that go into making it a complete product.

Plaster board is often installed by builders for small jobs. A team of professional fixers are common for large and/or complex jobs.

Plaster board fixers:

- fix different types of flat plaster board to interior surfaces
- form curves and other architectural shapes with plaster board.

Plaster board fixers fix the board according to the manufacturer's specifications and the job's working drawings and specifications.

Plaster board – finishing

Plasterers are responsible for 'finishing' or plastering the plaster board to make it ready for painting or papering.

Plaster board finishers:

- stop and finish the plaster board to hide all the joins and fixings
- stop and finish internal and external corners (including fixing trim that is bedded in the plaster)
- fix and finish paper-faced cove between walls and ceilings.

Joins between two plaster board sheets are formed by building up layers of plaster and paper reinforcing tape and feathering the surface of the join into the body of the sheet.

Paper-faced cove is fixed using a special plaster mix. The fixing and finishing of cove requires internal and external mitred corners.

Plaster board is finished to one of three specified levels of finish.

- **Level 3:** Used in areas that do not require decoration such as above ceiling level and inside service shafts.
- **Level 4:** The default level of finish for gypsum linings unless specified otherwise.
- **Level 5:** Used where gloss or semi-gloss paints are specified or where bright light will shine on the surface.

Plasterers check the quality of their work using high-powered lights that shine across the plastered surfaces. This shows any imperfections, such as joins and fixings, still visible under normal lighting conditions.

Fibre cement linings – fixing and finishing

Fibre cement linings are not used as widely as plaster board. It would be unlikely to find someone whose only job was fixing fibre cement linings to the interiors of buildings.

Fibre cement linings are often installed by builders for small jobs. A team of professional fixers are common for large and/or complex jobs.

Fibre cement linings fixers:

- fix different types of flat fibre cement linings to interior surfaces
- form curves and other architectural shapes with fibre cement linings.

Fibre cement lining fixers fix the linings according to the manufacturer's specifications and the job's working drawings and specifications. Fibre cement linings are generally fixed using mechanical fixings (nails or screws) and adhesive and can be fixed to timber or steel framing.

Some fibre cement linings require a plasterer to finish them. Others don't need plastering, either because the joins don't need plastering or because the linings have a pre-finished surface that can be joined together with a custom-made PVC jointer.

Proprietary partitions installation

Walls that are constructed from timber are usually built by carpenters, not proprietary partition installers. Proprietary partition installers create them from steel or aluminium in large interior spaces. Their job includes:

- constructing the framework for the partitions
- creating the openings in the partitions

- installing the linings onto the frames they have constructed
- installing doors and windows in the openings they have formed.

The framing for a proprietary partition uses a series of steel or aluminium studs that are fitted between a top and bottom track. The top track is generally fixed to the underside of a suspended ceiling and the bottom track fixed to the floor. The components that form a proprietary partition are fastened together using the method developed by the manufacturer of that partition system.

Each proprietary partition system manufacturer will have their own diagrams and tables to provide guidance for installers. It is important that manufacturers' specific installation methods and specifications are followed because the methods of installation for different systems are often unique.

Because proprietary partition installers fix the interior linings to the partitions, they also do the jobs of plaster board or fibre cement linings fixers.

Suspended ceilings installation

Suspended ceiling installers create ceilings that hang from the structure supporting the roof or the floor above. Their job includes:

- constructing a gridded framework into which the ceiling linings are either placed or fixed
- forming special details around the perimeter of the ceiling or at the junction between the ceiling and walls, columns or beams
- placing tiles into grid and tile ceilings
- fixing ceiling linings where the grid is concealed and a continuous flat surface is required.

Not all suspended ceilings installers fix linings to ceilings. Those that do mainly install plaster board linings and so must also be a plaster board fixer.

Suspended ceilings are usually made from a series of hangers that are fixed to the underside of the floor above that suspend the main tees (or strongbacks) and cross tees (or furring channels) that form the gridded framework of the ceiling. The ceiling is supported at the junction with the wall by either a wall angle or channel. The components that form a suspended ceiling are fastened together using the method specified by the manufacturer of the chosen ceiling system.

Each suspended ceiling manufacturer will have their own diagrams and tables to provide guidance for installers. Once again, it is important that manufacturers' specific installation methods and specifications are followed because the methods of installation for different systems are often unique.

Training requirements

There are three New Zealand Certificates that make up the suite of qualifications for those in the interior systems industry. They are:

- New Zealand Certificate in Fibrous Plaster Manufacture (Level 4) with optional strands in Specialist Models and Mould Making
- New Zealand Certificate in Interior Linings Installation (Level 4) with strands in Fixing, and Finishing (with an optional strand in Fibrous Plaster Installation)
- New Zealand Certificate in Proprietary Systems Installation (Level 4) with strands in Proprietary Partitions, and Suspended Ceilings

Those who go on to become supervisors can also do the:

- New Zealand Certificate in Construction Related Trades (Supervisor) (Level 4).

It normally takes two to three years to qualify as a tradesperson in interior systems.

Career paths

The interior systems industry offers a range of jobs and a progressive career structure so you can grow and develop with experience.

Most of the roles within the career path are listed below, starting from the more junior roles and working upwards towards those that require more qualifications and experience but have subsequently greater rewards.

Unskilled labourer

This is the most junior position in the trade. The labourer does a lot of the general basic "lifting, carrying, loading and unloading" sort of jobs and is not expected to have a qualification. If they remain on the job long enough they can pick up good experience that can help if they decide to go on to do an apprenticeship.

Apprentice

Interior systems specialists complete a formal apprenticeship to become qualified. An apprentice is a person who has signed into a Training Agreement with an employer to learn the range of knowledge, skills, and competencies that are required for a career in the interior systems industry.

The qualification the apprentice gains will depend on which specialty they're working in.

Apprentices receive on the job training and are assessed for a range of theory and practical plastering work. Apprenticeships are "competency based" which is all about demonstrating the ability (both in terms of knowledge and skill) to complete a range of tasks to recognised industry standards.

Interior systems tradesperson

An interior systems tradesperson is a skilled person who performs a range of work operations involved in the interior systems trade(s) they have specialised in.

Once qualified, there are a variety of career paths to choose from, including:

- specialising in the residential (housing) or commercial sector
- working for a large construction company
- starting up in business as a sole trader.

Supervisor

A supervisor, often called a 'foreman', is usually a tradesperson with years of experience and specialist knowledge who is charged with the day to day organisation of a gang/team generally made up of qualified tradespersons and labourers. They will probably spend a reasonable amount of time still doing interior systems tasks.

Supervisors report to the project manager of the company that they work for or, if an independent contractor, to the main contractor/builder on smaller sites.

Potential clients

Out of the various interior systems trades, those working with interior linings are likely to be both sub-contractors and work directly for clients. Those associated with the specialist interiors side of things are likely to only be sub-contractors.

Fibrous plaster manufacturers always supply directly to clients (usually via their architect or designer). Their clients also include individual home/building owners seeking a bespoke product, suppliers, and installers of their product systems.

Direct to client

Many interior systems tradespersons have clients who choose to manage the building process themselves and engage directly with the trades or professions whose skills they need to hire. In this situation, they are working directly for the client and will take instructions from, be paid by, and be responsible to them.

As an example, a homeowner is re-furbishing some rooms in their house and wants to have the walls and ceilings plastered and some cornice and mouldings attached. They get a local plasterer to do the work and agree on the provision of materials and the timing of the job. The plasterer works directly with the client on all matters relating to the job.

Sub-contracting

An interior systems sub-contractor is a tradesperson, company or business contracted by a main contractor to work in their specialised trade as part of an overall project. The sub-contractor takes instructions from, is paid by, and is responsible to the main contractor or their on-site representative.

As an example, a builder is building a new house and engages the local plasterer to do all the stopping and finishing of the interior walls and ceilings. The builder is the main contractor who manages all the different relationships with sub-contractors. The plasterer will work with (and around) other tradespeople and will report to the builder.

Relationships with other trades

Interior systems specialists tend to be involved in projects towards the end. In large commercial buildings, specialist interiors come into the job to get the ceilings installed and the partitions erected once the floors are ready. In smaller residential jobs, the interior linings are installed after the house is watertight, all the interior walls are constructed, and the carpenter is preparing for decorators, kitchen installers and carpet layers.

Along with a good relationship with the main contractor, interior systems contractors need to consider the trades that come immediately before them and those that follow immediately after them.

- Specialist interiors contractors need to work with air-conditioning contractors, plumbers, electricians, data cable technicians etc. While some services will be completely in place before they arrive on site, others will be installed at the same time (such as wiring and pipes inside partitions). The specialist interior contractor will also need assistance from the main contractor (the carpenter) to "make ready" for them, which may mean some additional carpentry work needs to be done.
- Interior linings fixers need to make sure that the walls, partitions and ceilings have been constructed and are ready for lining. They also need to ensure that all services have been installed before they're covered with the linings.
- Interior lining fixers are responsible for the quality of their lined surfaces. They must first check that the framing is up to standard before they start. When lining timber-framed buildings, this means doing a pre-line inspection to check that the timber is dry enough to take the linings. They must also check the standard of the carpenters' work because any framing members that stick out or are not in the correct position will have an impact on the finished product. This sometimes means carpenters must to do additional work to correct any misaligned timber.

Interior systems

The trades that follow the interior systems contractors tend to be those that also come before them (such as the plumbers, electricians, air-conditioning technicians etc) to finish off the work that they started and can only complete once the surface is finished.

The other trade that follows immediately after them is the painters and decorators. A hand-over with the painter is done to ensure that their finished surface meets the expectations of the client. In a similar way to how an interior linings fixer accepts the framing and an interior linings finisher accepts the lined surface, a painter needs to accept the plastered surface as it is the painter that is ultimately responsible for the final finish once they put their brush or roller on it.

Industry bodies

Remember to also read the 'Industry bodies' section of this booklet's 'Introduction'. Information there is not repeated here unless it is specific to the interior systems industry

The Ministry of Business, Innovation and Employment (MBIE) manages the regulations relating to all building. The regulations that affect the interior systems industry are contained within the Building Code.

Standards New Zealand specialises in the development of standards to enhance products and services, improve safety and quality, meet industry best practice, and support trade into existing and new markets. Examples of those for the interior systems industry are:

- AS/NZS 2589, *Gypsum linings - Application and finishing*
- AS/NZS 2785, *Suspended ceilings - Design and installation*
- BS EN 13815, *Fibrous gypsum plaster casts. Definitions, requirements and test methods*
- BS 8000-8, *Workmanship on building sites. Code of practice for plasterboard partitions and dry linings*

Trade and professional associations are also set up to support members. Examples of associations in the interior linings industry include:

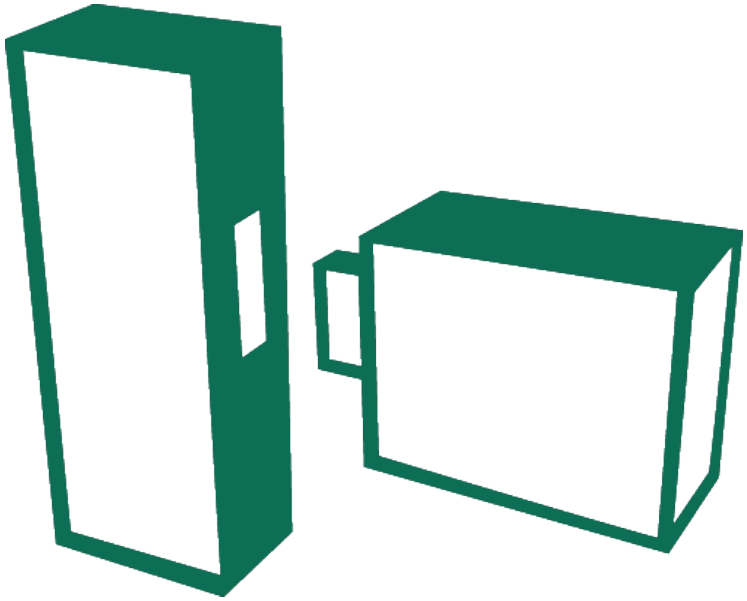
- **The Association of Wall and Ceiling Industries of New Zealand Inc (AWCI NZ)** covers every sector represented in this introduction to the Interior Systems industry. Members either employ trade qualified staff or others who have proven they have trade skills to perform and adhere to strict guidelines for achieving acceptable standards in both workmanship and business practices. You can find out more about them here: awci.org.nz.

Interior linings fixed to the wall and ceiling frames carpenters built. The surfaces were then finished to the standard painters and decorators need.

To print just the **Joinery** section, print pages 107 to 119

This box does not have to be printed

Joinery
(Te Hono Rākau)



Joinery (Te Hono Rākau)

The joinery industry is a very visual and rewarding trade with attention to detail being important. Joiners create several different types of products. These include:

- kitchen, laundry, and bathroom cabinets
- timber exterior and interior doors, windows, and frames
- timber stairs
- laminate components
- commercial bars and counters
- shop fit-outs.

Many joiners work in large workshops programming designs into multi-million dollar machines (called a CNC, or Computerised Numerical Control, machine). Other joiners use more traditional tools and equipment to craft timber into bespoke exterior doors and windows, kitchens, vanities, laundries, interior doors, stairs, bars and counters, shelving… and the list could go on.

Joiners need to be good at interpreting plans and specifications. The cabinetry and components (parts) have to be cut and constructed to exact dimensions. This involves the use of a combination of craftsmanship and technology.

Joiners also need a thorough understanding of the materials they work with and their properties. Different types of timber have their own strengths and weaknesses and looks. Other materials, such as laminates melamine, MDF, veneer, and plywood are also common.

Joiners normally start preparing cabinetry and other joinery items at the mid-stage of a build. They manufacture their products off-site, in a factory, and install them after the wall linings are in.

As with many trades, there is increasing specialisation in joinery. Apprentices can choose to specialise in one or more of Cabinetry, Timber Doors and Windows, Timber Stairs, and Laminate Fabrication. There are also those who focus solely on installing completed kitchen cabinetry.

Joinery glossary of terms

Below are some of the many words commonly used in the joinery industry. Remember to also refer to the glossary of terms in the introduction section.

Term	Meaning
BS	British Standard.
Bespoke/ custom	Items that are made to customised designs and sizes.
Hardware	Hinges, drawer runners, bins, bifold components, etc.
Laminate	The surface material applied to the substrate on benches, tables, and cabinetry.
Off the shelf	Items that are typically made to standard sizes and designs.
Stiles, top rail, bottom rail, glazing bars	These are names given to parts of a window sash.
Sill, jamb, head, transom, mullion	These are names given to different parts of window and door frames.
Muntin, glazing bars	These are names given to different parts of a door.
Stringers, treads (steps), risers	These are all parts of a stair.
Substrate	The base material that laminate is glued on to.

Oak saw tooth stairs.

Overview of roles and responsibilities

The overall roles and responsibilities of joiners is to create quality products that are fit for purpose and meet any applicable New Zealand Standards.

- Any joinery item not made correctly will not fit properly within the space allowed.
- Timber windows not sealed correctly will allow moisture into buildings and need to be repaired or remade to meet Building Code requirements.
- Stairs made correctly will stand the test of time, not cause accidents due to different riser heights, and not allow small children to fall between the treads.
- Kitchen and bathroom cabinetry will fit exactly into their allocated spaces and open and close properly.

Joinery with structural or weatherproofing requirements, such as stairs and windows, must comply with the New Zealand Building Code and its associated NZS and BS.

Below are some other ways the industry works to provide confidence joinery products will meet requirements.

Materials guarantees

Companies that provide materials to joiners' suppliers give guarantees that the products they purchase will be fit for the purpose they will be used for and free from defects.

The joiner, in turn, provides their clients with a guarantee for the materials used and workmanship in the joinery they sell.

There is often a maintenance period once joinery has been installed. This allows the joiner to make adjustments if necessary, such as when door hinges on cupboards need to be adjusted after they have been used a bit.

Product training

Suppliers will often provide product training for people who will be using their new products. This is done either within the joinery factory or at special product training sessions. Training sessions may involve the product manufacturer as well as the supplier and are a useful way for joiners to understand the capabilities and limitations of new products.

Summary of joiners' work

This section provides an introduction to some of the common products joiners manufacture.

Kitchen, laundry, and bathroom cabinets

Kitchen cabinets can be made from solid timber or from sheets of MDF (medium density fibre board), particle board, and plywood with low and high pressure laminates, acrylics, and timber veneers on each side. Solid timber cabinets are generally custom made to the customer's requirements. The timber panel components are often made from several strips of timber joined edge to edge to achieve the correct width. The components are glued together with wooden dowels or biscuits.

When making them with laminated boards, the sheets are first cut to size on a table saw or CNC router. Each piece is then edged to hide the board substrate. The main components of the cabinets behind door and drawer fronts are typically covered in white laminate, Doors and drawer fronts are made from coloured laminate, timber veneer, or other decorative materials.

Regardless of the material used, the components (parts) joiners make for cabinets include:

A joinery workshop with completed, bespoke cabinets to the left.

- haffits/ends or sides - the side components
- bottom/base – the bottom components
- top – the top component
- divisions/dividers – vertical components that divide the measurement between the two ends
- shelves (fixed or adjustable) – horizontal components that divide the internal height of the cupboard
- toe kick – the component between the bottom of the cupboard and the floor. Fixed on edge to hide the cavity under the cabinet
- doors – panels that open on hinges to hide the contents of the cupboard
- drawers – sliding boxes that slide in and out on runners.
- seen panels – panels that are seen when doors and drawers are closed.
- hardware – hinges, drawer sides and runners, flap door fittings, bifold and sliding components, handles, adjustable feet.
- inserts - cutlery and utensil trays, bins.

Components are generally screwed, biscuited, cam and doweled together. Some cabinets are supplied as kitsets especially when weight or access into final location are a factor.

Timber doors and window sashes

Timber doors and window sashes are made from solid timber. There is a range of styles available as 'off-the shelf' items that are typically made to standard sizes. These include solid doors made from tongue and groove (T&G) timber, framed doors with glass panels, framed doors with moulded timber panels, and framed doors with a combination of glass and timber panels. 'Custom made' items are made to customised designs and sizes.

The components in framed timber doors include:

- stiles – the side components
- rails – the top, mid, and bottom horizontal components
- muntin – internal vertical components
- panels – solid components with moulded edges fixed between the other components
- glazing bars (Astragals) – intermediate horizontal and vertical components that divide the glass portion of a window sash or door.

Doors are joined together using mortice and tenon or dowel joints. The door/sash components are machined to fit together and then glued and clamped together. Single or double glazed glass is added following assembly.

There are other doors called 'flush doors' that a made with a timber frame with plywood glued onto each side of the frame. These are usually only used for interior doors and are made by specialist manufacturers to specific sizes.

Timber door and window frames

Timber door and window frames are made from solid timber that has been treated against insects and rot. The timber components are machined to the correct profile and then glued and nailed together to form the frame.

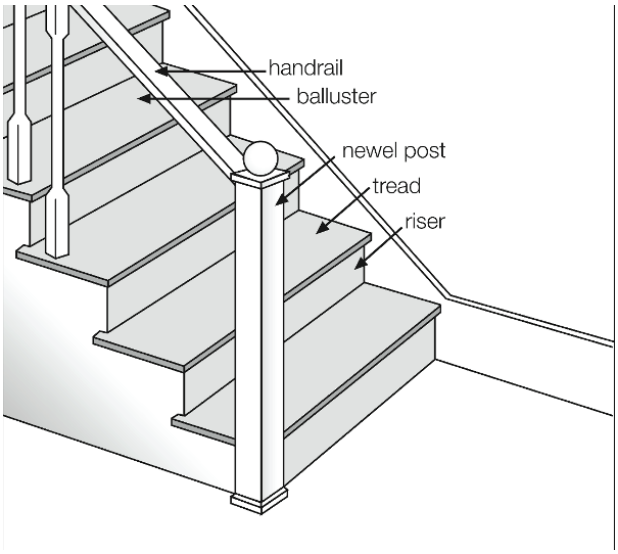
Rebating a timber window frame

The components in timber window frames include:

- sill – the bottom component
- jambs – the side components
- head – the top of the frame
- transom – horizontal intermediate part of the frame
- mullions - middle vertical components
- sash – open part of a window that is fitted into the frame with various hardware
- door leaf – opening part fitted into the frame to allow people to enter and exit buildings
- seals – rubber, foam, and mohair inserts that are fitted to reduce sound and drafts
- hardware – hinges, stays, bifold and sliding components

The rebates that take the glass are primed, left to dry, and then the glass is put in. Because windows need to be water tight, the joiner must make sure that the glass is bedded into the rebate. A good seal between the glass and the frame is essential.

Timber stairs



Timber stairs are made using solid timber for the sides and timber, triboard or MDF (types of manufactured sheet material) for the treads and risers.

The components of timber stairs include

- stringers – the side components
- treads/steps – the horizontal (flat) components
- risers – the vertical panels between each step.

The stringers have slots machined into the inside face to house the treads and risers. The stairs are assembled by placing components together. The stair is clamped and glue is then applied to wedges which are hammered into place to hold the tread and rise tightly in place.

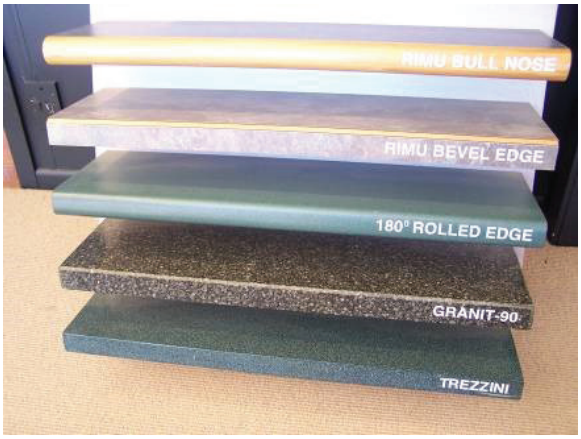
Laminate fabrication

Laminate fabrication generally creates hard wearing surfaces such as kitchen bench tops.

The components in laminate fabrications include:

- substrate – the sheet material to which the laminate is applied
- laminate – the surface material applied to the substrate.

These fabrications are made by cutting the substrate (base) material to size. The laminate is cut slightly oversize. Glue is applied to the substrate and the underside of the laminate. Packers are placed on the glued surface of the substrate, and starting at one end, the laminate is laid on to the substrate and then pressed in place.



Because the glue used is contact glue, fabricators must be careful to prevent the glued surfaces touching each other until the laminate is positioned correctly.

Training requirements

There are two qualification options for becoming a qualified joiner.

1. New Zealand Certificate in Joinery (Level 4) with strands in:
    - Cabinetry
    - Timber Door and Window
    - Stairs
    - Bench Top and Speciality Surfaces.
2. New Zealand Certificate in Kitchen Joinery (Level 4) with strands in:
    - Manufacture
    - Installation.

Joiners become qualified through completing a formal apprenticeship. An apprentice is a person who has signed into a Training Agreement with an employer to learn the range of knowledge, skills, and competencies that are required for a career in the joinery industry.

Joinery apprentices receive on the job training, supplemented with block courses at Te Pūkenga (NZIST/polytech). Throughout the apprenticeship a person is assessed for a range of theory and practical joinery work.

It usually takes two to four years to qualify as a joiner, depending on which strands are selected.

Career paths

Joiners are either apprentices or qualified tradespeople. Once qualified, joiners can continue working in the trade and move into roles such as CNC operators and programmers, supervisory and management, contract management, quantity surveying (pricing), joinery detailing (computer based CAD operators), kitchen and bathroom design, or start their own business.

Qualified tradespeople may also choose to specialise in one or more of cabinetry (usually in partnership with kitchen and bathroom designers), timber doors and windows, timber stairs, and/or laminate fabrication. There are some who focus on making and installing completed kitchen cabinetry and some who specialise in making bespoke pieces by hand. For commercial applications, factories use traditional machinery and high-tech CNC machinery.

Potential clients

Joinery firms tend to work both directly with clients and by sub-contracting.

Direct to the client

This occurs where the client approaches the joiner to price and manufacture products. These could be from drawings or where the joiner discusses the client's requirements, and provides ideas or advice. The client contracts the joiner to manufacture the items. Often the joiner will install the items for the client. The client pays the joiner directly for the items and, if applicable, installation.

Here, the joiner will fit the items required into their production schedule, and advise the client when they can expect to have the items delivered.

Sub-contracting

In this situation, a builder or building company will usually invite several joiners to provide quotations to supply (and often to install) a range of items.

The builder then chooses a joiner and offers them the job. If the job is large, the building company may choose more than one joiner, dividing the work between them. This also often occurs when there is a short timeframe to get the whole job completed.

Once the building company has chosen who will manufacture the items, the company then gives the joiner a schedule detailing when certain items are required. The joiner makes sure they can meet these requirements within their production schedule.

Relationships with other trades

The joinery trade has close relationships with other trades because of the product the joiner manufactures. Other trades the joiner needs to work with include:

- carpenters
- kitchen and bathroom designers
- electricians
- plumbers.

Joiners also use sub-contractors, which can include:

- furniture finishers (spray painters)
- stone fabricators, who manufacture benchtops
- steel fabricators, for structural and decorative steel components and stainless steel benchtops
- glaziers.

Imagine a kitchen being manufactured for a client who is replacing or altering their existing kitchen. The builder may have removed the existing cabinets and re-line the walls. Before the new wall linings were attached, the electrician and plumber installed new wiring and piping.

When the room is ready for the new joinery, the joiner delivers the new kitchen units to the site. The joiner may also install the new units. When the units are in place, the plumber comes back to connect up the pipes and waste and the electrician to connect new switches and power points. Tilers may also come in to lay splashbacks.

It is very important that each of these tradespeople coordinate their efforts so that the work remains on schedule and the client faces the least amount of disruption as possible.

Industry bodies

Remember to also read the 'Industry bodies' section of this booklet's 'Introduction'. Information there is not repeated here unless it is specific to the joinery industry

The Ministry of Business, Innovation and Employment (MBIE) manages the regulations relating to all building. Compared to other building and construction industries, there are few regulations that affect the joinery industry. These are contained within the Building Code.

Standards New Zealand specialises in the development of standards to enhance products and services, improve safety and quality, meet industry best practice, and support trade into existing and new markets. Examples of those for the joinery industry are:

- NZS 4211:2008, *Specification for performance of windows*
- NZS 4121:1985, *Design for access and mobility buildings and associated facilities*
- NZS 4223:2016, *Glazing in buildings part 3: human impact safety requirements*
- AS/NZS 4386.1:1996, *Domestic kitchen assemblies Part 1: Kitchen units*
- BS 5395-1:2010, *Stairs. Code of practice for the design of stairs with straight flights and winders*
- BS EN 15644:2008, *Traditionally designed prefabricated stairs made of solid wood. Specifications and requirements*
- BS EN 942:2007, *Timber in joinery. General requirements*
- BS 1186-2:1988, *Timber for and workmanship in joinery. Specification for workmanship*
- BS 644:2012, *Timber windows and doorsets. Fully finished factory-assembled windows and doorsets of various types. Specification*

Trade and professional associations are also set up to support members. Examples of associations in the joinery industry include:

- **NZ Master Joiners** has ten Associations throughout the country that collectively make up the **New Zealand Joinery Manufacturers' Federation**. They encourage excellence and work to keep members up to date with the latest trends both in craft practice and business developments. You can find more about them here: masterjoiners.nz.