



New Zealand Certificate in
Concrete Construction
(Commercial and Civil Infrastructure)
Level 4



Specifications

September 2020

Foreword

Welcome to the Specifications that set out the technical content of the New Zealand Certificate in Concrete Construction (Commercial and Civil Infrastructure) (Level 4) [Ref: 4188].

These *Specifications* are, collectively, a prescription for achieving the requirements of the qualification. Together they describe what a person must know and be capable of to become a qualified concrete construction trade professional.

They are intended to support tertiary education organisations to develop programmes that detail how learning and assessment will occur.

Programmes must encompass these Specifications and support the development of the knowledge, skills, and attributes that reflect the technical competence, self-management, and professional standards.

Assessment related to these Specifications

The individual skill sets included in these *Specifications* are designed to be read, interpreted and assessed together. This means the information contained in one skill set that is relevant to any other skill sets is stated only once, in the most appropriate place. The expectation is that assessment will look for links across skills sets. This avoids duplicating information and allows the candidate to be assessed holistically. Where the knowledge and skills included in one skill set are essential to achieving other skill sets, the candidate must be capable of applying them to the level, scope and complexity required.

The context of the qualification is commercial and civil infrastructure construction settings.

The New Zealand Certificate in Concrete Construction (Commercial and Civil Infrastructure) (Level 4) [Ref: 4188] is achieved by completing the Fundamentals Specification, the Concrete Construction Specification and the Professional Standards Specification.

Candidates can further enhance their qualification through the addition of either or both optional strands:

- Premanufactured elements
- Post-tension concrete.

To achieve the qualification a candidate must demonstrate commercial competence as a concrete construction tradesperson. Commercial competence requires a candidate to be capable of consistently performing the requirements of each skill set, and the *Specifications* as a whole:

- to current regulatory, industry, best practice and commercial standards
- to the ethical and professional expectations of industry and consumers
- working under limited supervision
- in varied and dynamic contexts.

Professional standards are reflected in:

- employment agreements, codes of conduct and standard operating procedures
- training and education agreements
- standards of ethics and professionalism produced by industry membership organisations
- best practice and technical guidance produced by suppliers, regulators, education and industry organisations.

Qualification: **Concrete Construction (Commercial and Civil Infrastructure)**

This qualification consists of three compulsory specifications including:

- **Fundamentals**
- **Concrete construction**
- **Professional standards**

Optional strand specifications:

- **Premanufactured elements**
- **Post-tension concrete**

Within each specification there are a number of skill sets covering the knowledge and practical skills required to be a qualified concrete construction tradesperson for a commercial or civil infrastructure context.

Compulsory

Specification: Fundamentals		40 credits
Skill Sets:	Covering:	
Tools, plant and equipment	Hand tools, power tools and equipment (mechanical and non-mechanical)	
Legislation	Building, health and safety, and environmental frameworks as they apply to concrete construction	
Drawings and specifications	Interpreting and applying drawings and specifications to concrete construction	
Construction mathematics	Measurement, area, volume, angles, percentages and calculations	
Construction science	Physics relating to structures and loads, water movement and subterranean conditions	
Planning and communication	Communication, planning and relationships with those involved in the construction process ²	
Concrete science	Physical and chemical properties and composition of concrete	

Specification: Professional Standards		10 credits
Skill Set:	Covering:	
Commercial competence and professional standards	Performance standard required of a trade professional	

Specification: Concrete Construction		70 credits
Skill Sets:	Covering:	
Site establishment and maintenance	Clearing and setting up the site, storing materials and equipment, maintaining the work environment, and disestablishment of the site	
Set-out	Taking levels, marking set-out, erecting profiles or establishing gridlines	
Site preparation	Groundworks, waterproofing and preparation of the base for concrete	
Falsework (temporary work) and formwork	Falsework/formwork types, properties and construction	
Reinforcing	Reinforcing types, materials, properties and installation	
Placing and finishing	Pre-pour checks, placing and finishing concrete, remedial work	

Optional strands

Specification:	Premanufactured Elements	10 credits
Skill Set:	Covering:	
Premanufactured elements	Lifting, handling, positioning and fixing premanufactured elements	

Specification:	Post-tension Concrete	10 credits
Skill Set:	Covering:	
Post-tension Concrete	Post-tensioned concrete operations	

To achieve this Fundamentals specification the candidate must understand the underpinning principles and apply them to all areas of work in concrete construction.

This specification contains the following seven skill sets:

- Tools, plant and equipment
- Legislation
- Drawings and specifications
- Construction mathematics
- Construction science
- Planning and communication
- Concrete Science

Each skill set comprises:

Know

(the theory that underpins the practical skills)

Do

(the practical skills the candidate needs to have)

Comments

(explanatory notes to clarify specific aspects of knowledge and skill)

Concrete construction is undertaken in residential, commercial and civil infrastructure environments.

Commercial construction focuses on single and multi-story structures intended for multi dwelling residential, commercial, light industrial and civic uses.

Civil infrastructure construction focuses on core infrastructure and public works structures like pipelines, telecommunications, sewers, water treatment systems, highways, roads, bridges, subway tunnels and light rail transit lines. The assets that support economic growth and development, public health and safety and systems for communication and transport.

Skill Set 1:	Tools, plant and equipment	8 credits
Know:	How to operate hand tools used in concrete construction	
	How to operate power tools used in concrete construction	
	How to operate items of plant and equipment used in concrete construction	
	How to care for and maintain different tools, plant, equipment used in concrete construction	
Do:	Operate a range of hand tools	
	Operate a range of power tools	
	Operate a range of plant and equipment	
	Maintain tools, plant and equipment	
Comments:	Tools, plant and equipment, and technology include those typically used in concrete construction on a regular basis	
	Maintenance required is limited to routine checks, inspections, cleaning and basic servicing and repair	

Skill Set 2:	Legislation	8 credits
Know:	The health and safety legislative framework as it applies to concrete construction operations	
	The environmental legislative framework as it applies to concrete construction operations	
	The building legislative framework as it applies to concrete construction operations	
Do:	Apply the health and safety legislative frameworks in everyday contexts within concrete construction operations	
	Apply the environmental legislative framework in everyday contexts within concrete construction operations	
	Apply the building legislative framework in everyday contexts within concrete construction operations	
Comments:	The legislative framework refers to the hierarchy of Acts of Parliament, regulations, rules, local by-laws, codes, standards, approved codes of practice, and best practice guidelines	
	The building legislative framework encompasses residential, commercial and civil infrastructure construction contexts.	
	The level of legislative knowledge required is that of a qualified concrete construction tradesperson rather than that of an expert in legislation	

Skill Set 3:	Drawings and specifications	6 credits
---------------------	------------------------------------	------------------

Know:	The key components that make up working drawings and specifications How to interpret working drawings and specifications for concrete construction work
Do:	Apply information obtained from working drawings and specifications to complete concrete construction work
Comments:	Interpreting a set of working drawings and specifications includes understanding drawing conventions including drawing types, scales, symbols, dimensions, abbreviations and terminology Categories of specification may include performance, prescriptive and proprietary

Skill Set 4:	Construction mathematics	4 credits
---------------------	---------------------------------	------------------

Know:	The different units of measurement and how they are used in concrete construction Conventions around the use of centres and spacing How to calculate area and volume Pythagoras' theorem and its practical application in concrete construction How to use and apply fractions, ratios and percentages to concrete construction calculations
Do:	Undertake measurements and calculations in one, two and three dimensions Use the mathematical principles associated with right angled triangles Calculate material quantities and make the appropriate allowances
Comments:	Units of measurement include length, area, volume, weight, time, temperature and distance Calculations for area and volume include a variety of different shapes including rectangular, triangular and circular

Skill Set 5:	Construction science	4 credits
---------------------	-----------------------------	------------------

Know:	How loads work on and within concrete structures
	The impact of subterranean conditions on on-site concrete construction work requirements
	The effects of dewatering on subterranean conditions
	The principles of water movement and the methods applied to manage it in concrete construction

Comments:	Subterranean conditions include sub-strata and soil composition and compaction, the proximity of the water table, and the potential for earthquake and geothermal activity
	Loads include gravity, buoyancy, wind and seismic activity (earthquakes)
	Water movement principles are capillary forces, hydrostatic pressure, gravity, wind pressure and surface tension
	Methods applied to manage water movement include dewatering, deflection, drainage, drying and durability of materials
	The level of construction science knowledge required is that of a qualified concrete construction tradesperson rather than that of an engineer, designer or scientist

Skill Set 6:	Planning and communication	6 credits
---------------------	-----------------------------------	------------------

Know:	The roles and responsibilities of the parties involved in a construction process
	How to plan and coordinate work to fit with a construction programme and other parties

Do:	Work effectively with own team and the parties involved in the construction process
	Communicate effectively with own team and the parties involved in the concrete construction processes

Comments:	The parties involved in a construction process may include the main contractor, other subcontractors/trades, clients, suppliers, architects, engineers, designers, neighbours, members of the public and compliance bodies
	Working effectively involves everyday contact with other parties and the ability to discuss and reach conclusions about work requirements and integration of activities
	Communicating effectively involves written, oral and visual communications

Skill Set 7:	Concrete science	4 credits
Know:	<p>The physical and chemical properties of concrete</p> <p>How concrete is used in the built environments and water based environments</p> <p>The ingredients and composition of fresh concrete</p> <p>The impacts of concrete on human health and the environment</p> <p>The types, properties and purposes of additives used with concrete</p>	
Comments:	<p>The physical properties of concrete include strength, deflection and expansion, and how it performs under compression and tension or when subject to friction, wear or environmental factors (temperature, wind, seismic, climatic, sub-thermal forces)</p> <p>The chemical properties of concrete includes factors that influence the appearance, workability, hardening and durability of concrete</p> <p>Ingredients for concrete include fine and coarse aggregate, cement and water.</p> <p>Additives are those solutions and materials used to modify the properties, workability or appearance of concrete</p> <p>The level of knowledge required is that of a qualified concrete construction tradesperson rather than that of an engineer, designer or scientist</p>	

To achieve this concrete construction specification the candidate must understand and apply the knowledge and skills required for concrete construction.

This specification contains the following six skill sets:

- Site establishment and maintenance
- Set-out
- Site preparation
- Falsework (temporary works) and formwork
- Reinforcing
- Placing and finishing

Strands:

- Premanufactured elements
- Post-tensioned concrete

Each skill set comprises one or more of the following:

Know

(the theory that underpins the practical skills)

Do

(the practical skills the candidate needs to have)

Comments

(explanatory notes to clarify specific aspects of knowledge and skill)

Skill Set 1:	Site establishment and maintenance	10 credits
---------------------	---	-------------------

Know:	How to identify the site from survey information
	The site facilities required to allow work to start and progress
	Access and delivery requirements
	Temporary storage and protection requirements for materials, tools, plant and equipment
	Requirements for managing and disposal of on-site waste
	Traffic management requirements

Do:	Identify the site boundaries, the position of proposed and/or existing structures on site and any features or physical attributes requiring specific consideration
	Organise and set up necessary site facilities
	Co-ordinate deliveries and maintain a site
	Disestablish the site and make good at the end of the construction programme

Comments:	Site facilities include power and water supply, sheds, toilets, storage, fences, hoardings and any other necessary provisions
	Disposal of waste includes on-going clean up and management of on-site waste materials, as well as wash down and correct treatment of hazardous materials
	The level of complexity for site establishment and maintenance is that required of a concrete construction tradesperson and does not include those elements of site management that would be undertaken by a main contract manager or construction manager

Skill Set 2:	Set-out	10 credits
---------------------	----------------	-------------------

Know:	How to interpret surveying information provided for the set-out process
	How to set out construction lines and profiles, and mark set-out points for in-ground and above-ground concrete constructions

Do:	Set out for in-ground and above-ground concrete constructions
------------	---

Comments:	The level of set-out must meet or exceed that required to form grids and levels over a site and control line, level and gradient
	The level of complexity of set-out is that required of a concrete construction tradesperson rather than that of an engineer or main contract manager.

Skill Set 3: Site preparation 8 credits

Know:	The methods used for ground work excavation for preparing the base for concrete construction
	The methods used to manage on-site ground water
	The effects of excavation on volume of ground works materials or spoil
	The types, properties and purposes of materials used to prepare the base for concrete construction
	The types, properties and uses of damp proof membranes
Do:	Prepare a base for concrete construction
Comments:	Methods applied to manage water movement include dewatering, deflection, drainage, drying and durability of materials
	Types of damp proof membranes include emulsion, polythene sheet and self-adhesive membrane

Skill Set 4: Falsework (temporary works) and formwork 15 credits

Know:	The types and purposes of falsework (temporary work) and formwork
	The systems, materials, accessories and construction methods used to construct and dismantle formwork for concrete structures
	The loading factors on formwork
	The types, purpose and details of construction joints in concrete
	The types and purposes of cast-in elements
	The types, materials, accessories and construction methods used to fabricate, assemble and dismantle falsework and propping systems for concrete structures
	The time requirements for stripping formwork
	The release agents and cleaning agents used with formwork
Do:	Fabricate, assemble and dismantle formwork for foundations and structural and non-structural concrete elements
	Position and align block out and cast-in elements
	Construct formwork detail to allow for concrete joints
	Fabricate, assemble and dismantle, falsework and propping systems
Comments:	Formwork includes modular, gang, table, jump/climb, slipform, permanent systems, in-situ or custom made and in-ground
	Loading factors on formwork include those present during erection and concrete placing, and curing
	Fabrication of falsework and formwork includes making from scratch and incorporating pre-made components
	Cast-in elements include reinforcing chairs, brackets, ties, waffle slab components, and conduits for services, bolts, plates, rods, pipes, penetrations, and ducting.
	Stripping times refer to the time specified by the designer to allow for sufficient strengthening of concrete and to achieve desired finish where specified

Skill Set 5:	Reinforcing	15 credits
---------------------	--------------------	-------------------

Know:	The types, properties, sizes and uses of reinforcing steel in concrete construction
	Methods for calculating material lengths and quantities of reinforcing steel
	The different methods for storing reinforcing steel to prevent damage or deterioration
	The different methods for cutting, and tying reinforcing steel

Do:	Calculate and order reinforcing steel materials and products
	Receive and store reinforcing steel materials and products
	Select, cut and tie reinforcing steel for slab, footings, foundations, ground beams and walls

Comments:	Types of reinforcing steel include formed and fabricated mild, ductile and high-yield steel components, round bars, deformed bars, mesh and fibre
	The level of reinforcing materials knowledge required is that of a concrete construction tradesperson rather than that of an engineer or designer.

Skill Set 6: Placing and finishing 12 credits

Know:

- The pre-pour work requirements for concrete placement
- The procedures for reviewing concrete on-site prior to placing
- How to transport, place and finish concrete
- The finishes applied to and formed on the surface of concrete
- How to form concrete joints in fresh concrete
- The different methods for curing concrete
- The types of defects encountered in finished concrete and the associated remedial actions

Do:

- Review concrete supplied prior to placing
- Check pre-pour work for suitability prior to concrete placing
- Transport, place and finish concrete
- Form joints in fresh concrete
- Cure concrete
- Complete remedial work on finished concrete

Comments:

- Reviewing concrete on-site involves checking that documentation for the supplied concrete matches the designer or engineer’s specifications
- Transporting concrete includes methods used to move it on-site
- Methods of curing concrete vary depending on the site and environmental factors
- Pre-pour work requirements includes preparation of site, lighting requirements, traffic control, positioning of truck, installation of damp proof membrane, and placement and securing of cast-ins and reinforcing
- Pre-pour checking includes confirming lines, levels, falls, integrity and stability of formwork, falsework and propping
- The level of finishing does not require achieving decorative finishes or high specifications for flatness and levelness.

Optional strand

Specification: **Premanufactured elements**

(10 credits)

To achieve this concrete construction specification the candidate must understand and apply the knowledge and skills required for premanufactured elements.

This specification contains the following skill set:

- Erect premanufactured elements

The skill set comprises one or more of the following:

Know

(the theory that underpins the practical skills)

Do

(the practical skills the candidate needs to have)

Comments

(explanatory notes to clarify specific aspects of knowledge and skill)

Skill Set:	Position and fix premanufactured elements	10 credits
Know:	The safe lifting methods and procedures for handling and storage of pre-manufactured elements How to position, secure and integrate premanufactured elements into a structure The types, compositions and purposes of premanufactured elements	
Do:	Position, secure and integrate premanufactured elements into a concrete construction	
Comments:	Premanufactured elements include precast, prestressed and posttensioned concrete structures, steel and composite structures that form structural and secondary structural elements within a building or structure. Positioning premanufactured elements includes the use of temporary support systems Integration of premanufactured elements into a structure includes forming any necessary joints and preparing for post-tensioning.	

Optional strand

Specification: **Post-tensioned concrete**

(10 credits)

To achieve this concrete construction specification the candidate must understand and apply the knowledge and skills required for post-tensioned concrete.

This specification contains the following skill set:

- Post-tensioned concrete

The skill set comprises one or more of the following:

Know

(the theory that underpins the practical skills)

Do

(the practical skills the candidate needs to have)

Comments

(explanatory notes to clarify specific aspects of knowledge and skill)

Skill Set:	Post-tension concrete	10 credits
Know:	The techniques used to post-tension concrete in-situ	
	The purpose of post-tensioning concrete in-situ	
	The safety procedures applied during post-tensioning operations	
Do:	Post-tension concrete	
	Apply safety procedures when carrying out post-tensioning operations	
Comments:	Post-tensioning concrete occurs in a range of on site in-situ contexts including slab on-ground foundations, vertical construction and civil infrastructure construction.	
	Post-tensioning operations must be in accordance with specifications	

This specification reflects the performance standard required of a commercially competent concrete construction tradesperson. It contains the following skill set:

- Commercial competence and professional standards

Candidates must be capable of demonstrating the knowledge and skills included in this skill set to be awarded the New Zealand Certificate in Concrete Construction (Commercial and Civil Infrastructure) (Level 4) [Ref: 4188].

The skill set comprises:

Know

the theory that underpins the practical skills

Do

the practical skills the candidate needs to have

Comments

explanatory notes to clarify specific aspects of knowledge and skill

Skill set:	Commercial competence and professional standards	10 credits
Know:	<p>The practical and conceptual interrelationships between the standards required to achieve the New Zealand Certificate in Concrete Construction (Commercial and Civil Infrastructure) (Level 4) [Ref:4188]</p> <hr/> <p>How to locate and interpret concrete construction industry professional standards</p> <hr/> <p>The quality assurance systems relevant to on-site concrete construction processes</p> <hr/> <p>The connection between professional standards and the sustainability of the concrete construction trade</p>	
Do:	<p>Perform all aspects of on-site concrete construction to a commercially competent standard</p> <hr/> <p>Demonstrate professional behaviour on a day-to-day basis</p> <hr/> <p>Fulfil responsibilities in the workplace under commercial contracts, employment and education agreements</p> <hr/> <p>Maintain quality assurance practices through all areas of concrete construction work</p> <hr/> <p>Self-manage on-going learning and development to maintain currency with concrete construction industry professional standards</p>	
Comments:	<p>A commercially competent standard means completing work to a commercial standard in a commercial environment without direct supervision</p> <hr/> <p>Demonstrating professional behaviour on a day-to-day basis is likely to include working constructively with clients, suppliers and people involved in the candidate's learning programme, being consistently reliable, responsible and accountable, acting with integrity, making and keeping commitments, and showing respect and consideration for people, property and the environment</p>	

References

The following is a list of nationally applicable legislation, standards and best practice guidance information relevant to the learning and assessment included in this *Specification* at the time of this publication.

This is not intended to be an exhaustive list. Programme developers are expected and encouraged to develop programmes that also reflect the requirements of their region, learners and industry stakeholders.

It is the responsibility of TEOs offering programmes leading to the qualification to ensure learning and assessment reflect current local and national legislative, regulatory and industry standards.

Acts of Parliament available from www.legislation.govt.nz

Building Act 2004

Construction Contracts Act 2002

Health and Safety at Work Act 2015

Fair Trading Act 1986

Fire and Emergency New Zealand Act 2017

Hazardous Substances and New Organisms Act 1996

Heritage New Zealand Pouhere Taonga Act 2014

Resource Management Act 1991

Regulations available from www.legislation.govt.nz

Building (Definition of Restricted Building Work) Order 2011

Building (Forms) Regulations 2004

Building (Pools) Regulations 2016

Building (Residential Consumer Rights and Remedies) Regulations 2014

Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005

Health and Safety at Work (Asbestos) Regulations 2016

Health and Safety at Work (General Risk and Workplace Management) Regulations 2016

Health and Safety at Work (Worker Engagement, Participation and Representation) Regulations 2016

Health and Safety at Work (Hazardous Substances) Regulations 2017

Codes available from www.building.govt.nz

The New Zealand Building Code

Standards available from www.standards.co.nz

NZS 3109 Concrete construction

NZS 3124 Specification for concrete construction for minor works

NZS 3602 Timber and wood based products for use in buildings

NZS 3604 Timber-framed buildings

NZS 3631 New Zealand timber grading rules

NZS 3640 Chemical preservation of timber and wood based products

NZS 4210 Masonry construction: Materials and workmanship

NZS 4218 Thermal insulation - Housing and small buildings

NZS 4243.1 Energy efficiency - Large buildings - Building thermal envelope

NZS 4246 Energy efficiency - Installing bulk thermal insulation in residential buildings

NZS 4230 Design of reinforced concrete masonry structures

Guidelines and Approved Codes of Practice available from www.worksafe.govt.nz for the following topics:

Cranes

Excavation and shafts for foundations

Load-lifting

Management and removal of asbestos

Manual handling

Management of substances hazardous to health

Management of noise

Powder-actuated, hand-held fastening tools

Power-operated elevating work platforms

The safe handling, transportation and erection of precast concrete elements

Best practice and good practice guidelines

Various BRANZ publications available at www.branz.co.nz

The Absolutely Essential Health and Safety Toolkit for Small Construction Sites and other Worksafe NZ publications available from www.worksafe.govt.nz

