

National Certificate in Building, Construction, and Allied Trades Skills (BCATS)

**Demonstrate knowledge of the
civil infrastructure industry within
a BCATS environment**

Unit Standard – 25320

Level 2, Credit 2

Name: _____



What you need to do

By the end of this module, you should be able to demonstrate knowledge of the interior systems industry covering:

- major industry sectors
- industry work processes
- industry clients, supply and inter-trade relationships
- the impact of regulatory and trade bodies on the industry and
- industry jobs and their training requirements.

How you will be assessed

Your teacher/tutor will give you a worksheet that you need to complete, which your teacher/tutor will mark.

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Glossary of terms

Term	Meaning
Construct	To build, create.
Crown entity	A government organisation.
Excavate	Dig out.
Infrastructure	The basic services needed to make a country work, move things and communicate. This includes such things as transportation and communications systems, water and power lines, telecommunications.
Maintain	Keep things in order and up to standard.
Maintenance	Keeping things in good working condition.
Occupation	Job or career.
Primary customer	The main or most important customer for an industry.
Sector	A part of something.
Standard	A level of quality that has to be reached.
Regulation	An official rule, law or order stating what may or may not be done or the way something must be done.



Introduction

The New Zealand civil infrastructure industry builds and looks after roads, pavements, highways, bridges and drainage.

This infrastructure allows people and goods to be moved throughout the country for work and everyday living.

The civil infrastructure industry is made up of different areas, or sectors. Each sector has a number of jobs.



The NZ infrastructure industry

The infrastructure industry gets its work from three types of client: the private sector, central government and local government.

1. Private sector

The private sector has two parts: domestic clients (individual people) and business clients (companies).

A domestic customer may, for example, be building a new house. They will need to have the earthworks for the building completed, drainage and sewerage works carried out and paths, fences and retaining walls built. This type of work is labelled as 'small scale' by the infrastructure companies.

Medium or large-scale work projects are more often needed by business clients. For example, a land developer building a subdivision may want all the services a domestic client needs to build their house, but for all the houses they are putting on the subdivision. This would be a medium or large project for companies.

The land developer will also need to create all the roading, drainage, service installation, kerb and channel and all the other infrastructure needed in a subdivision. This work would be labelled medium or large scale depending on the land area involved and the infrastructure needed.

2. Central government

Central government means the decisions made in Parliament in Wellington. Central government is the client that needs large infrastructure built and maintained such as bridges, airports, dams and road bypasses.

An example of central government is the New Zealand Transport Agency (NZTA). This is the organisation that authorises the maintenance contracts of motorways for central government.

3. Local government

Local government in New Zealand includes regional councils and territorial authorities (city and district councils). Local government requires small, medium and large scale work carried out. For example a city council wants footpaths installed or a regional council wants its stormwater system maintained.

Contracting and sub-contracting

Sometimes a client will contract all the infrastructure companies who will work on a project one by one.

Often, however, the client will contract just one company for the whole project (called a contractor) and then that company will sub-contract (hire other contractors or companies) and pay other organisations to complete work on the project in areas that they do not have the knowledge, skills or equipment for.

For example, Company A is contracted by the government agency NZTA to build a large bridge. Company A then goes and sub-contracts other companies to supply specialist machinery, steelwork, concrete and so on.



Common work processes

An infrastructure project is made up of a lot of processes.

- demolition
- site clearing
- earthworks
- site preparation
- excavation
- foundations
- erection and construction of structures
- installation of services
- pavements and surfacing
- road marking
- erection of signs.

All the activities happen in a logical order on a project; for example, you need to clear a site of debris and vegetation before earthworks can begin to reshape the site. You need to have the foundations of a bridge completed before you can start constructing it.

Before any project begins, the activities to be carried out are identified along with all the other planning you need to complete the project on time, safely and to the standard expected by the client, the workers and the company.

Read below to learn about what is involved in each activity.

Demolition

Demolition is the destruction of buildings or other structures. There are many demolition methods, the main ones being by hand or using machines.

Before demolition takes place, a building needs to be prepared. You might need to do such things as:

- removing asbestos
- disconnecting services
- putting up safety barriers
- completing all permit and notification procedures.

Demolition material needs to be removed regularly because overloading can cause floors and walls below to collapse. To prevent walls collapsing before schedule, props or cables need to be secured between the building and the surrounding stable ground. The structure also needs to be

secured against collapse if it is only partly knocked down and there is a break in work, such as the end of a day's work.

Site Clearing

Before clearing sites, it is important to protect any trees or vegetation which are to remain. The site can then be cleared of demolition material, vegetation, trees, fences, paving and rubbish. Tree stumps and roots may need to be grubbed out. The site should be cleared of waste as the work progresses, followed by a final clean of the site and adjacent areas.

Earthworks

Machinery is used to move quantities, sometimes massive amounts, of soil and rock to establish roadway, trench and foundation sites. 'Earthworks' is a process of cutting away soil and rock and removing it to another location for fill.

Site Preparation

This involves clearing and levelling the site so that the work can be carried out.



Bulldozers are used in site clearing and bulk earthworks

Excavation

Excavation is the digging out of soil and rock. How the excavation is carried out depends on the project plans.

Small excavations may be done by hand with tools such as shovels, picks and jack hammers. Larger excavations may need tonnes of earth and rock dug out, which is done by earthmoving and digging machinery.

The two main types of excavation are:

- **trench excavations** where the horizontal width at ground level is less than the vertical depth of the deeper side. This is the most hazardous type of excavation.
- **open excavations** are wider than trenches and is the type used for foundations and building sites.

Foundations

The correct laying of foundations of any structure is very important. If foundations are not properly laid, the whole structure could be unstable. Once excavation has created the base area, the supporting areas of the structure are boxed, the reinforcement steel is placed and the concrete is poured.

Erection and construction of structures

A structure is a civil construction term that includes buildings, bridges, walls, towers, and so on. Some structures are built entirely on site; while others have parts assembled off-site and are transported to the construction site when required.

Trenching

Trenching is the digging of ditches so that drainage pipes and pipes providing services such as electricity, gas, water and telecommunications can be installed.

The positions of the trenches will be shown on the site plan. These positions are marked out on the actual site and then trenches are dug and the pipes installed.

The trenches are then backfilled, compacted and signage attached. Signage gives information about the services positions, depth of installation and provider contact details.



Trench excavation with steel shoring

Pavements and surfacing

Specialist crews are employed to complete pavements and surfacing on a project. This activity is done with hand tools and machinery.

Once the sub-base mixture has been laid and compacted, the basecourse is placed on top and compacted. A surfacing material such as asphalt or chipseal is then spread and stuck to the basecourse.



Surfacing with asphalt

Culverts

These are the structures that drain excess water away from earthworks, roads and structures such as bridges so flooding or ponding of water does not happen.

The water is channelled under roads or railway lines by pipes or tunnels called culverts.

Kerb and channelling

Roads have kerbs built on the sides to collect the excess water that flows off the road during wet weather. Those kerbs have a slope on them so the water is then channelled into drains.

Road marking

Road marking is carried out using a machine, which sprays the paint onto the road surface.

Erection of signs

The last activity of any project is usually the erection of signage such as street names, traffic signs and business signage.

Industry bodies

There are various organisations (called bodies) that have an effect on the infrastructure industry. This section introduces those bodies and tells you a little about them.

Regulatory Bodies

Regulatory bodies are the government organisations that make the regulations and check they are being followed. The main regulatory bodies that affect the infrastructure are:

- WorkSafe New Zealand
- Land Transport New Zealand
- Local and territorial authorities
- Standards NZ.

WorkSafe New Zealand (WorkSafe NZ)

This regulatory body helps New Zealand businesses with information and advice to make their workplaces safe and healthy. WorkSafe NZ also inspects workplaces to check health and safety assistance is in place and employers and employees are following health and safety laws. WorkSafe NZ also investigates work accidents.

New Zealand Transport Agency

This is the body that:

- Promotes transport safety.
- Advises the government which land transport projects to fund.
- Is responsible for state highways. These are the main national roads, motorways (for example State Highway 1) and bridges in New Zealand.

Local and Territorial Authorities

Local and Territorial Authorities are responsible for most of New Zealand's roads not controlled by the New Zealand Transport Agency.

Standards NZ

Standards NZ is a government agency that produces the national Standards. A standard is a document that sets rules for ensuring quality. It contains information such as specifications, dimensions, tolerances and materials that have to be used or processes that need to be followed.

Work that is done within infrastructure projects will often have to be carried out and completed so that meets a NZ Standard.

Trade and professional associations

Infrastructure companies will often belong to a national association such as Civil Contractors New Zealand, Road Transport Association NZ or the NZ Asset Management Support Group, so they can

gain and share information about their sector with others who do the same type of work, and the association can take the association's members' opinions or concerns to the Government.

Individual people may belong to a trade or professional association for the same purpose. Often that trade or professional association will supply the person with a practise license to permit them to work in their trade or profession.

Examples of trades are gasfitters or plumbers.

Examples of professional associations are the NZ Institute of Surveyors, IPENZ (Institute of Professional Engineers of New Zealand) and the Plumbers, Gasfitters and Drainlayers Board.

Training organisations

Sometimes training organisations are called education providers. These organisations combine with the companies involved in the sector to supply education and/or training so that workers are skilled and trained to do their jobs.

For the civil infrastructure industry there are three main types of training provider:

- The Industry Training Organisation (ITO), Connexis.
- Private and Government training providers.
- Civil infrastructure companies.



This is the ITO for the infrastructure industry. It sets national standards for qualifications, checks the quality of training and assessment, plus it gives support to employers and trainees.

Connexis offers the opportunity to gain national certificates and diplomas related to the infrastructure sector.

Private and Government training providers

Private training establishments (PTEs), polytechnics and universities offer a range of qualifications that are related to the infrastructure sector. For example, the New Zealand Diploma in Engineering Practice (with strands in Civil Engineering, Electrical Engineering and Mechanical Engineering), the New Zealand Certificate in Drainlaying, or a surveying degree.

Civil infrastructure companies

Many of the larger civil infrastructure companies have their own training departments. Often the company training department collaborates with the ITO and other training providers mentioned above.



Job Roles

Each sector in the industry employs people who are trained for a variety of jobs or occupations. A lot of these occupations fit into the different sectors. For example, occupations like supervisors, managers and operators are needed in most sectors.

By training and gaining qualifications a worker can become more proficient at their own job and then move on to lead teams involved in the work, manage small or large parts of projects and work in different sectors.

A **labourer** works with basic tools and equipment. They do not need a special certificate or training to do their work.

An **equipment operator** needs special skills to work with their equipment. Equipment operators have to be certified (licensed) to operate the equipment they use. For example, earthmoving machine operators need to be licensed to operate machines such as excavators, bulldozers and graders to dig out, shape or level the ground.

A **pipelayer** is a qualified person who is responsible for following the project plans. Their work includes setting out and jointing pipes such as sanitary sewage and storm water pipes and fittings. Their job may include laying pipes or ducting for other services such as water, gas, electricity, or telecommunications.

A **leading hand** is a person who is very experienced and has an understanding of many of the tasks involved in their sector. In some work situations a leading hand will lead a small team of workers.

A **foreperson** oversees and is responsible for the work of a team of workers. A team of workers may contain leading hands and operators. A foreperson tells his team what management wants done on a job and reports to management how his team has carried out the job.

A **supervisor** is in control of a number of work teams. Sometimes the position of supervisor and foreperson can be expected to do both jobs.

A **plant manager**. Plant is the word for large machinery and equipment used in the infrastructure industry. The plant manager is responsible for the distribution, upkeep and maintenance of things such as gravel crushers, bulldozers and graders.



Plant maintenance and checks are important

A **contract manager** is a senior member of staff who is often in charge of all contracts his company is working on. Sometimes a manager is put in charge of just one contract because it is very large or it involves a special client.

A **project manager** organises and supervises all parts of a project.



An **engineering supervisor** has civil engineering qualifications and is responsible for supervising technical engineering works to make sure the works meet the expected standards.

A **quantity surveyor** manages construction project finances. They work out a budget based on their client's plans for the project. A detailed estimate of costs is prepared for all parts of the project such as labour costs, material costs and machinery hire. It is very important that the

budget is detailed and correct as a lot of money and time can be lost if a project runs out of money before it is complete.

A **land surveyor** carries out surveys of land and land formations. They also do set-out surveys which fix positions of boundaries, land features like hills and rivers and man-made structures such as bridges and houses.

A **geotechnical engineer** is involved in planning the foundations for large structures such as dams, tunnels, retaining walls or jetties.

The geotechnical engineers inspect and test the soil and rock on which the foundations are to be built. They can then decide what type of construction methods need to be used to make the foundations stable and long-lasting.

A **civil engineer** designs and supervises the construction and repair of infrastructure such as buildings, tunnels, dams, water systems, waste water treatment plants, airports and wharves. They work with the clients who are paying for the construction, and other professionals such as surveyors and government officials.

A **laboratory technician** carries out laboratory testing of materials used in civil engineering to see if they will do the job expected. Materials tested might be things such as gravel, concrete or steel.

A **draughtsperson** makes plans and drawings for structures such as buildings, bridges and machines like water turbines.

A **quality manager** is a qualified person who is responsible for making sure the company does their work to the quality standards expected of the company by the client and the law. A quality manager uses reporting, surveys, maintenance data, health and safety checks and so on to test that quality standards have been met.

Specialist qualifications

The job roles described above will often involve infrastructure workers who have specialist qualifications and knowledge gained through study at a polytechnic or university. For example, engineers, drainlayers, surveyors, laboratory technicians, mechanics.

These workers have qualifications that mean they could also work in other sectors, but they have decided to cross over and work in the infrastructure sector because their skills and knowledge are just as useful on those types of projects.