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City & Guilds

The City & Guilds textbook

Painting and Decorating

LEVEL 1 DIPLOMA (6707)
LEVEL 2 TECHNICAL CERTIFICATE (7907)
LEVEL 2 DIPLOMA (6707)

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Contents

PRINCIPLES OF CONSTRUCTION

INTRODUCTION

Construction is a vital part of the economy and plays an important role in all our lives. Working in this sector can be very rewarding and there are many opportunities for career progression. This chapter introduces the construction industry and gives a wider context to the decorating trade. This chapter will give you an understanding of the principles of construction, building technology and terminology. This includes legislation, such as health and safety, planning and building control.

By the end of this chapter, you will have an understanding of:

- how to work in the construction industry
- construction information
- how to set up and secure work areas
- building substructure
- building superstructure.

The table below shows how the main headings in this chapter cover the learning outcomes for each qualification specification.

Chapter section	Level 1 Diploma in Painting and Decorating (6707-13) Unit 101, 201	Level 2 Diploma in Painting and Decorating (6707-22/23) Unit 201, 202	Level 2 Technical Certificate in Painting and Decorating (7907-20) Unit 201	Level 3 Advanced Technical Diploma in Painting and Decorating (7907-30) Unit 301	Level 2 City & Guilds NVQ Diploma in Decorative Finishing and Industrial Painting Occupations (6572-20) Unit 101, 218, 608
1. Understand how to work in the construction industry	**101**: 7.1–7.5	**202**: 16.1–16.7	1.1–1.3	1.1–1.3	
2. Understand construction information	**201**: 1.1–1.5, 2.1–2.6, 3.1–3.5, 4.1–4.3, 5.1–5.3, 6.1–6.4, 7.1–7.4, 8.1–8.5, 9.1–9.4	**201**: 1.1–1.5, 2.1–2.6, 3.1–3.5, 4.1–4.3, 5.1–5.3, 6.1–6.4, 7.1–7.4, 8.1–8.5, 9.1–9.4 **202**: 10.1–10.2, 13.1–13.2	2.1–2.4	1.1–1.2, 4.1–4.2, 5.1–5.2, 6.1–6.3	**101**: 1.1–1.8, 2.1–2.6, 3.1–3.8, 4.1–4.3, 5.1–5.2 **218**: 1.1–1.3, 2.1–2.4, 3.1–3.3, 4.1–4.6 **608**: 1.1–1.4, 2.1–2.5, 3.1–3.6, 6.1–6.2, 7.1
3. Understand how to set up and secure work areas			3.1–3.3		
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5. Know building superstructure	**101**: 4.1–4.3, 4.6, 6.1–6.3	**202**: 15.1	5.1–5.5		

1 UNDERSTAND HOW TO WORK IN THE CONSTRUCTION INDUSTRY

This section provides an overview of the range of construction activities. It includes the roles of members of a building team, communication methods used to share information and career progression within the industry.

▲ Figure 1.1 Members of the building team

Types of construction work

Construction work covers many types of projects, and each one will require different types of planning, numbers of building operatives, tools, equipment, materials and processes. The size and location of the project, together with various planning and environmental constraints will also have an impact.

The following should be considered for all building processes:

- **Sustainability** and environmental protection in relation to the design, planning and delivery stages of project development, across different types and scales of construction project. In construction, sustainability is a broad term that describes how buildings can be constructed in a way that has less impact on the environment. For example, the concept of reduce, recycle and reuse makes better use of natural resources and leads to fewer natural resources being used or wasted. The reuse of bricks, concrete, etc., for hardcore is one example of making construction work more sustainable.
- Local sourcing, resource protection, reuse and refurbishment of materials and waste management should be built into the process from design to completion.

KEY TERM

Sustainability: ensuring the world's natural resources are not used up today, thereby leaving nothing for future generations. Oil and gas reserves are limited, and alternative sources of energy must be found before they are all gone. Trees cut down for wood must be replaced with new trees so that sources of wood do not run out.

The range of constructions projects includes new builds, renovations, maintenance and restoration.

New build

This type of project involves the construction of new buildings using new materials. It is typically associated with domestic housing, but can be other new buildings, such as hospitals, factories and leisure complexes.

▲ Figure 1.2 A new build construction site

Renovation

Renovation is the process of improving or modernising an old building, so it is returned to a good state of repair. The process typically involves replacing old with new.

▲ Figure 1.3 Renovation work in progress

Maintenance

Maintenance refers to the process of ensuring that buildings remain in good order, free from decay, and function as they were intended. The most effective form of maintenance is to have a planned programme throughout the life of a building. This could involve weekly, monthly or annual maintenance routines that can extend the life of the building.

▲ Figure 1.4 Decorating is a form of maintenance

Restoration

Restoration is the process of returning a building to its former state but may also improve it. This type of work is normally undertaken on buildings of historic interest. Restoration involves using materials and processes to authentically match the existing building structures, or as they appeared originally. Some structures of architectural interest or historic significance may be protected as **listed buildings**.

Listing indicates a building's special architectural and historic interest and brings it under the consideration of the planning system, so that it can be protected for future generations. The older a building is, and the fewer the surviving examples of its kind, the more likely it is to be listed. Listed buildings are graded as follows:

- Grade I buildings are of exceptional interest, only 2.5 per cent of listed buildings are Grade I.
- Grade II* buildings are particularly important buildings of more than special interest; 5.8 per cent of listed buildings are Grade II*.
- Grade II buildings are of special interest; 91.7 per cent of all listed buildings are in this class and it is the most likely grade of listing for a homeowner.

▲ Figure 1.5 You may be required to work on buildings of historical interest

KEY TERM

Listed building: a building that can only be restored, altered or extended if consent is given under government planning guidance. A listed building is given a grade which indicates its level of special interest or significance.

Types of construction work

Construction projects will usually fall into one of three categories – domestic/residential, commercial or industrial.

Domestic or residential

Domestic or residential construction typically refers to buildings that will be occupied as a person's home. This category includes houses, flats, bungalows, terraced properties and other types of residential building that are built for the purpose of living in. This also includes housing of multiple occupancy and high-rise flats.

▲ Figure 1.6 Residential housing

Commercial

Commercial typically refers to all types of land or building premises that are used for business purposes and are non-residential. Commercial properties include:

- schools, colleges and universities that are built for the purpose of providing spaces for education
- health centres, chemists and doctors' surgeries that are built to provide healthcare
- offices, which may be of high-rise or low-level construction and are typically used for business purposes
- entertainment areas, including cinemas, theatres, sports grounds and other buildings used for leisure and entertainment purposes
- light industrial units for small businesses
- vehicle showrooms
- shops including high-street shops and out-of-town stores.

Some commercial properties have a residential element to them, for example hospitals, care homes, prisons, hotels, hostels and student halls of residence. These partly fit within the residential context, but they are likely to be considered commercial projects due to their size.

▲ Figure 1.7 Commercial offices

Industrial

Industrial buildings are those that are used by an industry to manufacture or process articles as well as those concerned with transport infrastructure. Bridges and tunnels may also be classed as industrial structures.

This type of building includes:

- factories, for example vehicle, domestic appliance or food production buildings used for manufacturing processes
- quarry processing plants for cement, sand, gravel or other building products that have been extracted from the ground
- factories where steel and timber are produced, which among other uses may be used in the construction of buildings
- power stations using gas, electricity, oil or nuclear fuel, as well as wind farms and other constructions used for this purpose
- petrol stations
- bridges and tunnels – structures that provide access from one part of land to another and may involve tunnelling under or building over land or water, for example the Channel Tunnel and the Dartford Crossing Bridge
- rail and other transport constructions, such as railway stations, bus stations, airports and other buildings associated with travel.

▲ Figure 1.8 Industrial building

Organisations that contribute to the construction process

Building contractors

A building contractor is a person or firm that undertakes a contract to provide materials and/or labour to perform a service or do a job. In the case of the construction industry, building contractors carry out construction work and erect buildings. Building companies may be small, medium or large and comprise the principal or main contractor and various subcontractors. Small companies may range from a single person (sometimes referred to as a jobbing builder) up to those employing 50 workers. A medium-sized contractor typically directly employs between 50 and 250 employees, and a large contractor will directly employ over 250 people.

Manufacturers

A manufacturer is a person or a registered company which makes finished products from raw materials. Manufacturers produce the materials and equipment used in construction, such as bricks, processing timber, plaster, sand and gravel from quarries, paints, toilets, baths, sinks, boilers, electrical sockets, cables and many other items used in the building process.

Suppliers

A supplier is a person or organisation that provides something needed during construction, such as a product or service. Suppliers, or builders' merchants, sell goods from a manufacturer to the end users, such as building contractors, who use them in construction projects.

Local authorities

A local authority is an administrative body in local government that is officially responsible for all the public services and facilities in an area of the country. They ensure that all building and construction projects in their area comply with legislation relating to planning and building control, are in line with the local development plan and conform to building regulations.

Legislative bodies

The government passes legislation that lays down the rights and responsibilities of individuals and authorities in all aspects of life. The government then instructs an institution, department or body to oversee and control the implementation of that law.

The Health and Safety at Work etc. Act 1974 is just one of many laws related to construction. This Act is administered by the Health and Safety Executive (HSE). The HSE is a UK government agency responsible for the encouragement, regulation and enforcement of workplace health, safety and welfare, and for research into occupational risks in the UK.

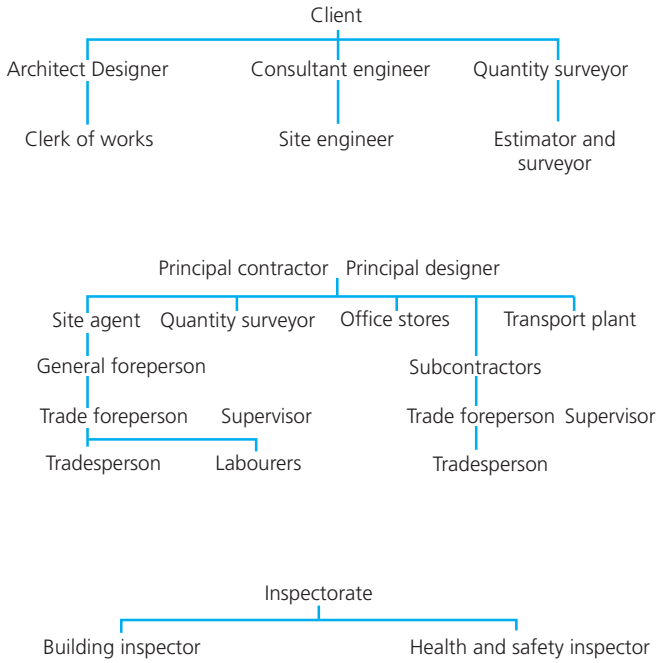
The Building Regulations (2010) is another example of legislation implemented by the government to enable buildings to be built safely and to certain approved standards. Building control officers are appointed by the local authority and are responsible for ensuring these standards are maintained.

ACTIVITY

Visit the Planning Portal at www.planningportal.co.uk and navigate to the building control section. In your own words describe the main purpose of the Building Regulations 2010 regarding materials and workmanship (further information on this topic can be found in the Approved Documents, Regulation 7).

Roles of construction team members

The construction of a building is a complex process that requires the involvement of many individuals. They make up the construction team and it is important that they work well together. Figure 1.9 shows a typical team involved in a large construction project.



▲ Figure 1.9 Members of the construction team and their roles

The members of the construction team are generally classified as professional, craft or operative.

Professional

Those members of the team classified as professional will generally have a management role, where they have a specific responsibility for the planning, design or management of the construction project. The table below describes some of the key roles of the professional team. Members of the legislative bodies, such as planners and inspectors, are also described as carrying out a professional role. There will also be technicians and many other support staff working with the various professional roles listed, as well as several specialist roles carried out in the construction process. For example, an architectural technician will typically work in support of the architect to carry out various duties in the construction design process. The Principal contractor and Principal designer will ensure that all aspects related to the Construction Design and Management Regulations are formulated and implemented. The full details of the CDM regulations are explained on page 9 and 26. They may appoint a single co-ordinator on contracts to oversee this role.

▲ Figure 1.10 Members of the professional construction team

Architect	Designs new buildings and the spaces around them; he or she also works on the restoration and conservation of existing buildings
Engineer	Civil engineer: designs and manages construction projects ranging from bridges and buildings to transport links and sports stadiums Building services engineer: designs, installs and services equipment and systems in buildings like offices and shops Structural engineer: helps to design and build large structures and buildings, such as hospitals, sports stadiums and bridges
Designer	May be involved in interiors or landscaping and is generally involved in the **aesthetic** layout of spaces. This could include furnishings, plants and other works of a decorative nature
Surveyor	Quantity surveyor: oversees construction projects, manages risks and controls costs Building surveyor: advises clients about the design, construction, maintenance and repair of buildings Land surveyor: measures the shape of the land and gathers data for civil engineering and construction projects

Estimator	Works out how much it will cost for a company to supply products and services to its clients
Site or construction manager	Organises the work on building projects, making sure it is completed safely, within budget and on time
Clerk of works	Oversees the quality and safety of work on a construction site, making sure that building plans and specifications are being followed correctly
Town planner	Helps shape the way towns and cities develop and balances the demands on land with the needs of the community
Building control officer	Makes sure building regulations are followed
Health and safety inspector and CDM co-ordinator	Health and safety inspector: ensures that workplaces are safe for workers and members of the public, and checks that employers and employees follow health and safety regulations Construction design and management co-ordinator: advises the client on health and safety matters during the design process and planning phases of construction

KEY TERM

Aesthetic: the beauty of something and how that is appreciated by the person looking at it.

Craft

The definition of a craftsperson relates to an individual that has been trained and qualified to perform a task or job. The table below highlights some of the key roles carried out by members of the craft team and other skilled and trained workers that apply their specialist skills within a construction project. The management of the day-to-day activities of this skilled group may be undertaken by a supervisor, foreperson or chargehand, many of whom will also be skilled craftspeople who have a practical working role as well.

▲ Figure 1.11 Scaffolders working on site

Bricklayer	Builds houses, repairs walls and chimneys and refurbishes decorative stonework. He or she also works on restoration projects
Carpenter and joiner	Makes and installs wooden structures, fittings and furniture
Dry liner	Uses plasterboard panels to build internal walls, suspended ceilings and raised flooring in houses, offices and shops
Electrician	Installs, services and fixes electrical equipment, circuits, machinery and wiring
Foreperson	Often known as foreman, but this role can be carried out by a person of any gender. The individual takes day-to-day responsibility for managing the work of a team of workers. A **general foreperson** may take responsibility for several trades and a **trade foreperson** may take responsibility for a particular trade, e.g. foreperson bricklayer
Painter and decorator	Prepares and applies paint, wallpaper and finishes to different surfaces
Plant operator	Works with machinery and equipment used on building sites
Plasterer	Prepares and plasters walls and ceilings ready for decoration and finishing
Plumber	Installs and services hot and cold water systems, heating systems and drainage networks
Roofer	Re-slates and tiles roofs, fits skylight windows and replaces lead sheeting and cladding
Scaffolder	Designs, erects and dismantles scaffolding on buildings that allows workers to work safely at height
Stonemason	Carves blocks of stone and lays and fits stonework into place on construction projects
Tiler	Tiles walls and floors in kitchens, bathrooms, shops, hotels and restaurants

Operatives

Sometimes referred to as labourers or construction operatives, these roles involve a range of practical tasks that help skilled construction workers. This could include digging trenches, mixing and laying concrete, operating machinery, using equipment such as cement mixers, drills and pumps, and moving, loading and unloading materials.

▲ Figure 1.12 Building operatives working on site

Construction industry career opportunities

The Technical Certificate in Painting and Decorating is aimed at those looking to work in the construction industry specifically as a craftsperson in painting and decorating. A painter and decorator is an important part of any construction team, as he or she has the skills and knowledge to use a range of coverings, such as paint and wallpaper, to enhance and protect plaster, metal and wood surfaces. The Technical Certificate allows you to gain an understanding of the skills and knowledge that are important when working as a painter and decorator and to progress to further training in this area. This qualification is designed to help you enter employment in the construction industry as a painter and decorator.

Progression routes

- **National Vocation Qualification (NVQ)**: this is a work-based qualification (available at various levels) that combines learning and practical working.
- **Apprenticeship**: allows you to gain a qualification (at various levels) while working alongside someone who is already qualified and experienced in their role. An apprenticeship combines practical training in a job with study, usually one day a week.
- **Degree-level course**: these are usually completed at college or university over three to four years. Depending on the subject, these courses combine coursework, exams and practical learning. It is possible to study for a degree in your own time or part-time combined with work and supported by your employer.

ACTIVITY

Visit www.goconstruct.org/ or https://nationalcareers.service.gov.uk/ and find out more about apprenticeships and the various job roles in construction.

Importance of qualifications and continuing professional development

Once you are qualified, you can apply for a Construction Skills Certification Scheme (CSCS) card. This card provides proof that you can work on a construction site and have the appropriate training and qualifications for the jobs you do on site. The CSCS card ensures the workforce are appropriately qualified, and the scheme plays an important part in improving standards and safety on UK construction sites. Most principal contractors and major house builders require construction workers on their sites to hold a valid CSCS card.

Continuing professional development (CPD) means continuing to update and expand your knowledge and skills, even when qualified, to ensure that you always work in line with current industry practice.

ACTIVITY

Visit www.cscs.uk.com/ and find out what qualifications are required to apply for a skilled card as a painter and decorator.

Communication within a construction team

Good communication is essential in the day-to-day running of a construction project. For each project there will be a chain of **hierarchy** that enables information to be properly managed and documented. The chain of hierarchy will vary depending on the size of the project. For example, on a large project it is usual for the client to communicate their requirements to the architect who will in turn share the information with the main contractor for further sharing through the chain of command to the workforce.

KEY TERM

Hierarchy: the system in which members of an organisation are ranked according to relative status or authority.

▲ Figure 1.13 Meeting on site

Key personnel involved in day-to-day communication

The **site manager** is responsible for overseeing the project and communicating the **main contractor's** directions. He or she will communicate with the various **supervisors** and **forepersons** and they will in turn communicate and direct the activities of the individuals in the workforce. Through this chain of communication, the wishes of the client are carried out.

Further daily communication is carried out by the various operatives organising and working together to ensure the project runs in the most efficient manner for all concerned.

Others involved in wider communication

In a large building project, there will be many other individuals and bodies that have a role to play in the wider communication of information. The **architect** will carry out the design to meet the needs of the client. He or she will liaise with local authority planners and environmental and building control officers to ensure the project meets all the legislative requirements before passing information on to the main contractor.

In turn, the main contractor will appoint a **health and safety co-ordinator** to plan how the project will be set up and managed safely **and a construction design and management (CDM) co-ordinator** to help everyone involved in the project to communicate effectively. The CDM co-ordinator's role is to advise the client on matters relating to health and safety during the design process and during the planning phases of construction. The principal duties of the CDM co-ordinator are as follows.

- Notify the Health and Safety Executive of the particulars of a project, as specified in schedule 1 of the Regulations using Form F10. The HSE is informed if a project is likely to last longer than 30 days or involve more than 500 person-days of construction work.
- Advise the client as to whether the materials and processes selected for the project are acceptable in terms of quality and quantity.
- Co-ordinate health and safety aspects of design work and co-operate with others involved with the project to allow the work to proceed in a safe manner.
- Help with communication between the client, designers and contractors.
- Provide, or ensure that the client provides, pre-construction information.

- Advise on the construction phase plan before construction works begin.
- Advise on any subsequent changes to the construction phase plan.
- Work with the principal contractor regarding any ongoing design work during construction.
- Prepare the health and safety file, and then give the health and safety file to the client at the end of the construction phase.

The HSE will appoint inspectors who will carry out inspections of building works to ensure that laws relating to health and safety are being adhered to. The inspector will:

- investigate when an accident occurs, something has gone wrong or a complaint is made, to find out whether people working on site or nearby are at risk
- ensure action is taken to control risks and when someone is breaking the law
- take appropriate enforcement action in relation to any **non-compliance**, ranging from advice on stopping dangerous work activities to prosecuting when people are put at serious risk of harm
- provide advice and guidance to help everyone to comply with the law and avoid injuries and ill health at work.

Inspectors have the right of entry to your premises as well as the right to talk to employees and safety representatives, and to exercise powers necessary to help them fulfil their role.

KEY TERM

Non-compliance: not following the requirements of legislation, for example the Health and Safety at Work Act, and potentially working in an unsafe manner.

Local residents

It is important that the community, and especially owners or residents of adjoining properties, are kept informed about the ongoing construction work, and any disruption to their daily lives should be kept to a minimum. They should be told of disruption to electricity, gas or water supplies or any other issues in a polite, respectful way to reduce potential conflict during the construction process.

Methods of communication

Written

The written form of communication is vital within construction and is used in many ways within a project. In most cases the formal documents that are produced by the architect on behalf of the client will be in a written format. These form part of the contract and will therefore have a legal bearing, particularly in any dispute regarding design, costs and other building processes. The documents that are communicated between clients, architects and contractors will need to be kept throughout the life of the project as they will be required frequently during the building process for costings, quantities, resources, planning purposes, cost control, programming and to obtain tenders. These documents can now be managed using a **building information modelling (BIM)** system.

Sometimes more informal documents are used for communication purposes, such as emails and handwritten notes, although these can be scanned so that a record is kept.

KEY TERM

Building information modelling (BIM): a digital process for creating and managing information about a construction project throughout its lifecycle, from its earliest conception to completion and potentially its eventual demolition.

Advantages of written communication

Written communication is more accurate and precise and is less likely to lead to confusion or misunderstanding. Examples and illustrations can easily be used too, and a permanent record is created that can be referred back to if needed. Written communication is acceptable as a legal document, so for this reason, any important verbal discussions should be written down to provide confirmation of what was said.

Verbal

Communication with colleagues and line management may involve a face-to-face chat or a more formal site meeting. Communication helps to ensure that work is done on time and to the required standard.

Verbal communication is the commonest form, but text messaging and phone calls can be convenient. Emails or letters ensure a record of the conversation is kept. Day-to-day communication between colleagues and the foreperson will mostly be verbal unless there is formal information to be shared such as colour schedules or other aspects of the specification that are written down so there is no misunderstanding or confusion.

Regular communication reduces the chance of misunderstandings and helps to keep things on track. To communicate effectively, you need to be polite, respectful and to speak appropriately with a wide variety of people while maintaining good eye contact. It is important to listen well, present your ideas appropriately, speak clearly and **concisely** and be professional.

KEY TERM

Concisely: providing information in a few words, so that communication is brief, but with enough detail to cover all the points.

2 UNDERSTAND CONSTRUCTION INFORMATION

Building controls and regulations

There are various controls and regulations that need to be followed when planning and carrying out construction projects, and it is useful to know what they are and how they apply to any project that you work on.

Planning permission

Most building projects require planning permission, particularly new builds but also anything from an extension on a house to a new shopping centre. When renovation projects involve the change of use of a building, for example when a public house is converted into a residential home, planning permission is required for the change to take place. Local authorities are responsible for deciding whether a building project should go ahead.

Building regulations

Building regulations are minimum standards required by law for the design, construction and alteration of almost all building work. The regulations were developed by the UK government and approved by parliament. The Building Regulations 2010 cover the construction and extension of buildings and these regulations are supported by Approved Documents. Approved Documents set out detailed practical guidance on compliance with the regulations. Building regulations approval is different from planning permission, and both may be needed for a project.

An application for building regulations approval can be made to any local authority building control department or approved inspector. The British government has developed a one-stop shop website for planning and building approval requirements, called the Planning Portal, www.planningportal.co.uk, which has lots of information on this topic.

Health and safety law

Most issues related to health and safety law are covered under the Health and Safety at Work Act (HSWA) 1974. This Act places a legal duty on employers to ensure, so far as reasonably practicable, the health, safety and welfare of employees, and to ensure that employees and others are kept safe. Under the Act, employers have an obligation to ensure any potential risk of work-related injury is eliminated or controlled. If there are five or more employees then there must be a written health and safety policy statement, setting out how the management of health and safety is covered in the organisation.

The management of health and safety is further covered under the Management of Health and Safety at Work Regulations (MHSWR) 1999. These Regulations require employers to consider the health and safety risks to employees and to carry out a **risk assessment** to protect employees from exposure to reasonably foreseeable **hazards** and risks. Those risks include work-related violence.

KEY TERMS

Risk assessment: an assessment of the hazards and risks associated with an activity, and how to reduce and monitor them. The aim of the risk assessment is to identify work hazards and put in place measures to reduce the risk of that hazard occurring.

Hazard: anything that can cause harm.

The Construction Design Management Regulations (CDM 2015) are the main regulations for managing the health, safety and welfare of those working on construction projects. CDM Regulations apply to all building and construction work, including new build, demolition, refurbishment, extensions, conversions, repair and maintenance.

Further information about the Health and Safety at Work Act and other health and safety law related to construction is provided later in this chapter.

Quality and standards

Most industry sectors have a set of standards, and there are currently over 3500 standards relevant to construction in the UK. Meeting a high standard of quality, whether in the supply or use of materials, is a key issue for the construction industry. Quality of workmanship in all areas is also important. Most standards are set out in a series of documents supplied and managed by the British Standards Institute (BSI). British Standard (BS) publications are technical specifications or practices that can be used as guidance for the production of a product, for carrying out a process or for providing a service. The BSI Kitemark, first introduced in 1903, is commonly found on a range of products, including construction products.

▲ Figure 1.14 The BSI Kitemark confirms that the product that carries it conforms to the relevant British Standards

Quality Management ISO 9001 is the international standard covering a range of quality management standards, including customer focus, managing the business by a series of processes (rather than the people) and focusing on continual improvement. If used by an employer or on a project, ISO 9001 provides the basis for an overall focus on quality and producing products and projects to a high standard.

Types and uses of construction information

Construction projects are complex and involve a significant amount of information that is used to manage, support and organise the project, as explained below.

Specifications

Specifications are normally drawn up as a written document based on a client's needs. The document sets out the requirements in a logical form and is one part of a **building contract**. The specification will describe the types of materials and finish required and should be read in conjunction with the drawings to ensure that everything follows the correct criteria.

KEY TERM

Building contract: an agreement between the client and contractor, which forms a legal agreement of what is included in the work, such as how much it will cost, how payments will be made and the start and completion dates.

Drawings

Information contained in drawings is an important part of most construction projects. A series of drawings will be produced by the architect or engineer to provide a visual illustration of the project. Being able to view the construction project as a drawing makes it easier to understand than just a written description of the project. A drawing will show the location of the project, layouts, and will include detailed drawings that show how something should be built. It is important that the drawings are read in conjunction with any specification, as the written and drawn detail together are what a construction team need to follow. You will look at some commonly used drawings later in this chapter.

Schedules

Schedules give details of elements of the construction, such as repeated design elements, including doors and windows. A typical door schedule is shown below.

Master internal door schedule							
Ref:	**Door size**	**SO width**	**SO height**	**Lintel type**	**FD30**	**Self closing**	**Floor level**
D1	838 x 1981	900	2040	BOX	Yes	Yes	GROUND FLOOR
D2	838 x 1981	900	2040	BOX	Yes	Yes	GROUND FLOOR
D3	762 x 1981	824	2040	BOX	No	No	GROUND FLOOR
D4	838 x 1981	900	2040	N/A	Yes	No	GROUND FLOOR
D5	838 x 1981	900	2040	BOX	Yes	Yes	GROUND FLOOR
D6	762 x 1981	824	2040	BOX	Yes	Yes	FIRST FLOOR
D7	762 x 1981	824	2040	BOX	Yes	Yes	FIRST FLOOR
D8	762 x 1981	824	2040	N/A	Yes	No	FIRST FLOOR
D9	762 x 1981	824	2040	BOX	Yes	Yes	FIRST FLOOR
D10	762 x 1981	824	2040	N/A	No	No	FIRST FLOOR
D11	686 x 1981	748	2040	N/A	Yes	No	SECOND FLOOR
D12	762 x 1981	824	2040	BOX	Yes	Yes	SECOND FLOOR
D13	762 x 1981	824	2040	100 HD BOX	Yes	Yes	SECOND FLOOR
D14	686 x 1981	748	2040	N/A	No	No	SECOND FLOOR

Bill of quantities

A bill of quantities is drawn up by the quantity surveyor and describes everything that is contained within the specification, drawings and schedules. A bill of quantities contains general information, including the name of the client, address and details of the site and details of the quality of the materials and workmanship.

BILL OF QUANTITIES

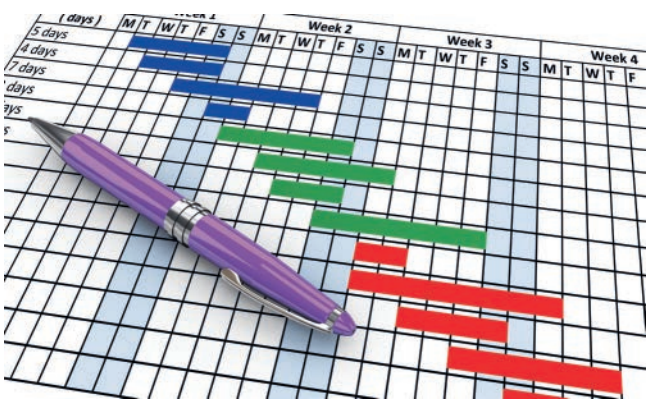
(Assuming Civil Engineering Standard Method of Measurement (CESSM3) is used.)

					Amount	
Number	**Item description**	**Unit**	**Quantity**	**Rate**	**£**	**P**
	CLASS A: GENERAL ITEMS Specified Requirements Testing of Materials					
A250	Testing of recycled and secondary aggregates	sum				
	Information to be provided by the contractor					
A290	Production of Materials Management Plan	sum				

					Amount	
Number	Item description	Unit	Quantity	Rate	£	P
	Method Related Charges					
	Recycling Plant/Equipment					
A339.01	Mobilise; Fixed	sum				
A339.02	Operate; Time-related	sum				
A339.03	De-mobilise; Fixed	sum				
	CLASS D: DEMOLITION AND SITE CLEARANCE					
	Other Structures					
D522.01	Other structures; Concrete	sum				
D522.02	Grading/processing of demolition material to produce recycled and secondary aggregates	m^3	70			
D522.03	Disposal of demolition material offsite	m^3	30			
	CLASS E: EARTHWORKS Excavation Ancillaries					

A bill of quantities will also include descriptions of items in terms of quantities and size and will have space for contractors to estimate the cost of a single item and record their projected costs. The example illustrates just one page from a project; in reality a bill of quantities will have many pages.

Deciding who will do the construction work is an important part of any project. Before the contract can begin, the specification, drawings, schedules and bill of quantities will be sent to a number of contractors (usually a minimum of three) asking them to estimate the cost of the work. Once the contractors have returned their estimates the architect will discuss with the client and make a recommendation of the contractor most suitable to carry out the work. This recommendation is likely to be based on the contractor's experience and availability as well as cost.



▲ Figure 1.15 Programme of works

Programme of works

Once the contract has been awarded to the chosen contractor and signed, the contractor will put together a programme of works. This describes when various tasks will happen, and when trades, materials and equipment are required. The programme of works is plotted on a chart (often referred to as a Gantt chart) so it can be easily seen when plant and labour are required, and whether each part of the project is running on time.

Building information modelling

Building information modelling (BIM) is an intelligent 3D model-based process that enables engineering, architecture and construction professionals to plan, design, construct and manage a project more efficiently and helps all team members to work to the same standards as one another. Typically, BIM is used on large construction projects, especially those awarded by government. It can be continually updated so that if amendments are made, they are automatically saved and shared with all members of the project team. All the documents listed above will form part of the information sharing, along with communications notes and all the documentation connected with the project throughout its **lifecycle**.

KEY TERM

Lifecycle: the entire time that something exists. For a building, this includes its design, construction, operation and eventual disposal.

Technical drawings used in the construction industry

Each part of a construction project has to be designed and the details of each design communicated to the project team who will build each component and put components together. One way of communicating the designs and details is to produce drawings that represent how the building will look and how it is put together.

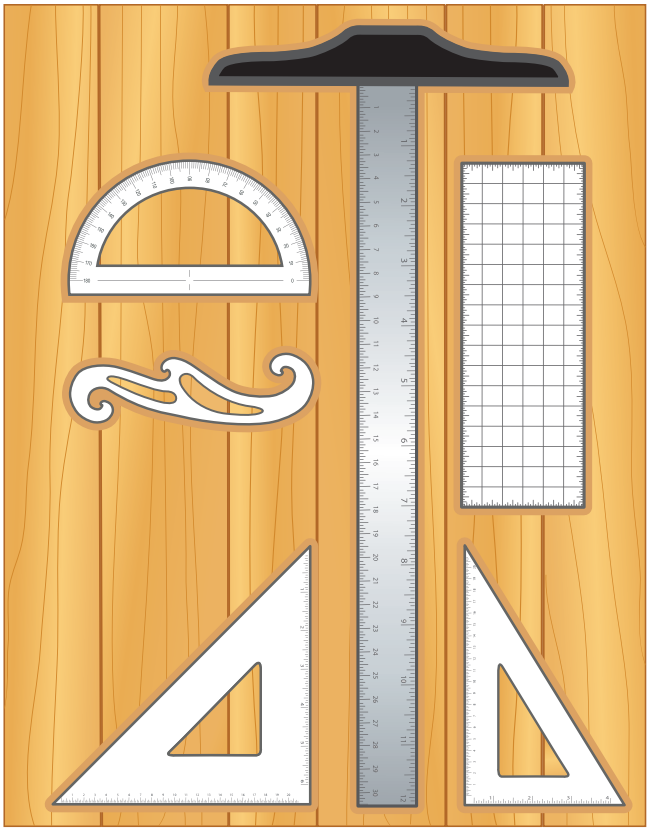
Drawing methods

Manual drafting

Manual drafting involves using just hands and pen or pencil to draw lines and shapes to produce the drawings used in a construction project. Typically, tracing paper, a drawing board, T-square for horizontal and vertical lines, set squares, scale ruler and pens and pencils are used to produce the drawings. The tracing paper can then be copied to enable multiple copies to be shared with those involved in the project.

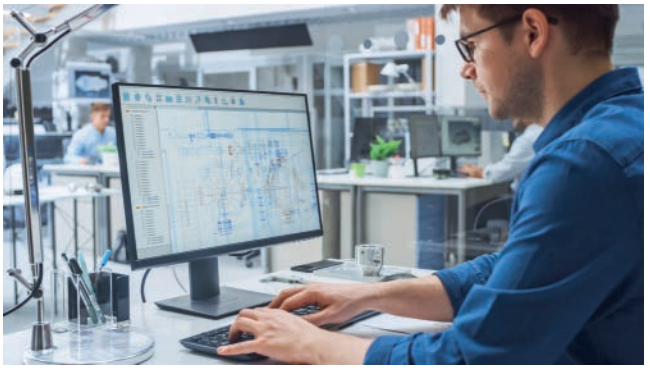
Figure 1.17 shows a T square, set squares, protractor, French curves and a graph template, which are all items that can be used in manual drafting techniques.

▲ Figure 1.16 Manual drawing



▲ Figure 1.17 Equipment used in manual drawings

CAD and CAD/CAM



▲ Figure 1.18 Computer-aided design

CAD (computer-aided design) refers to the use of software to create precise technical drawings or technical illustrations when designing a product or object as part of the construction process. CAD can be used to create 2D technical drawings or 3D models of items and can also be used to generate animations and other presentational material. Dimensions, descriptions of components and references to specifications, etc.,

can be added so that the CAD diagram is as useful as possible to the project team.

CAD/CAM (computer-aided design/computer-aided manufacture) is used to design items and produce computer programs that can operate machinery to manufacture multiple items in a factory or workshop. Robots can be programmed to manufacture parts and carry out tasks that enable the construction of buildings and their elements within a factory ready for delivery to site.

Drawing information

Buildings and their components need to be scaled down, so they fit onto sheets of paper when drawn. Drawings show the positions of rooms, windows, doors, kitchen units and so on. When elevations are shown, more detail can be added with measurements related to the vertical view.

Some of the **scales** commonly used for elevations are 1:200, 1:100, 1:50, 1:10, 1:5 and 1:1. A scale of 1:1 is full size.

KEY TERM

Scale: the relation between the real size of something and its size on a drawing. For example, 1:1 is full size, while 1:5 means the drawing is one-fifth of the size of the real object.

IMPROVE YOUR MATHS

Using a tape measure, measure a wall or rectangular object within the room you are in. Take note of the measurements in either metres or millimetres. What size would the object be drawn if it was to be drawn at a 1:5 representation?

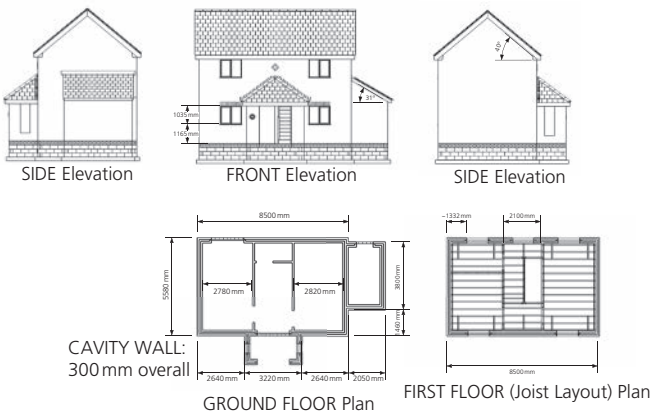
For example, a wall that is 2400 mm wide and 1200 mm high (2400 mm × 1200 mm) would be drawn at 480 mm × 240 mm at a scale of 1:5.

Types of drawing

Drawings are used in construction projects to provide details and information. The types of drawings that conform to a set of common standards which are accepted and used by the construction industry are described as follows.

Orthographic projection

Orthographic projection is a drawing technique used to represent three-dimensional objects as a series of two-dimensional 'flat' drawings in which there is no perspective. Orthographic projection is a type of 'parallel' projection in which the four views of an object are shown. The orthographic projection commonly used in the UK is called first angle projection. In Figure 1.19, all four sides and the plan view of the building are shown.

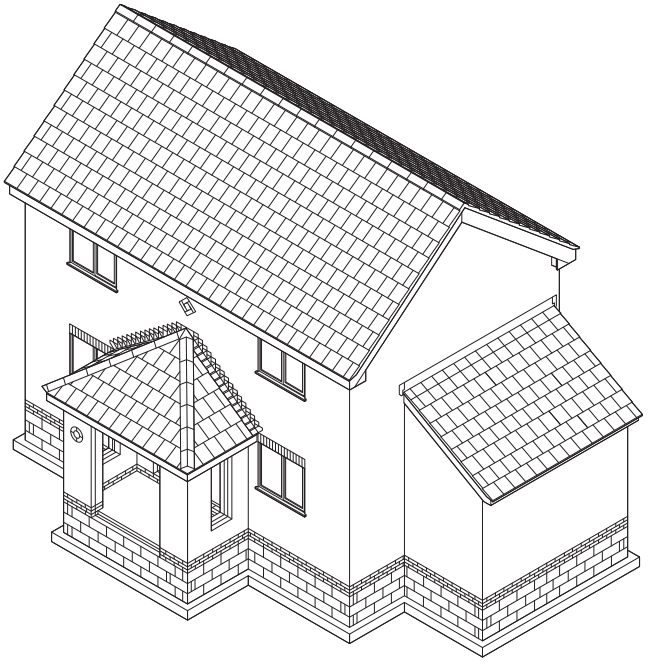


▲ Figure 1.19 Orthographic projection

Isometric projection

Isometric projections are a pictorial projection of a solid object on a flat surface. They are drawn so that all vertical lines remain vertical and their length is to scale, but all horizontal lines are drawn at an angle of 30°. They should not be used for scale drawings but just used to provide a three-dimensional view.

▲ Figure 1.20 A scale rule that has pre-marked scales on the side is used to ensure drawings are accurate



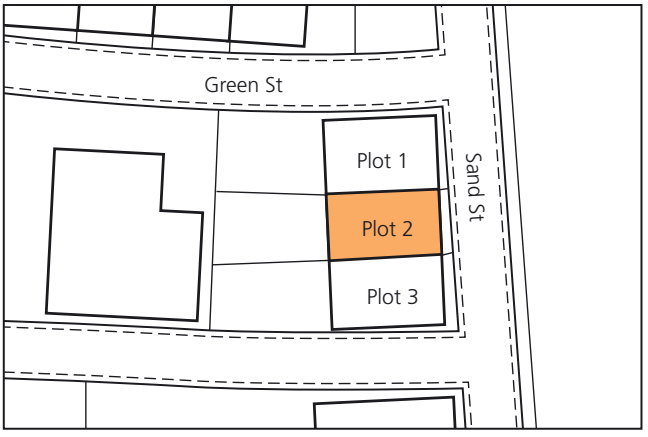
▲ Figure 1.21 Isometric projection of a house with porch and side extension

Location drawings

These are usually prepared by an architect or architectural technician. They show the location of the building plot, position of the building and areas within the building.

Block or location plans

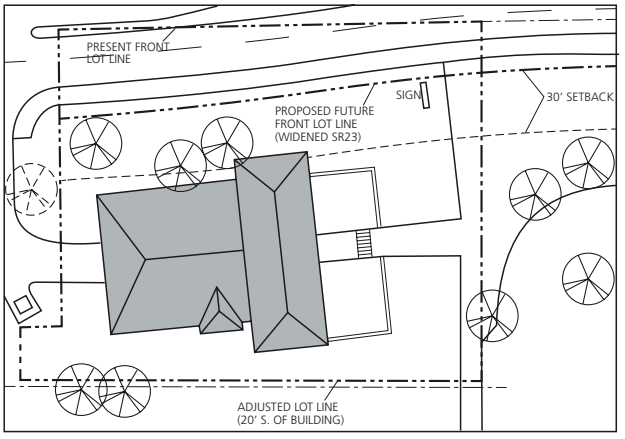
A block plan shows a property in relation to the surrounding properties. The scale used tends to be 1:1250 or 1:2500. Very little detail is available from this type of plan. The direction north is usually shown.



▲ Figure 1.22 Block plan

Site plans

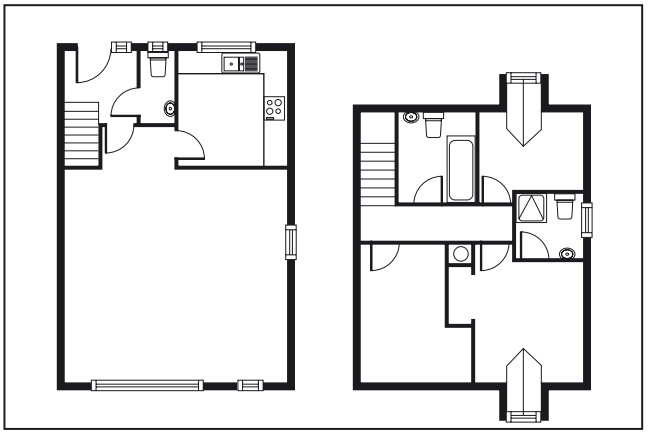
Site plans show the plot in more detail, with drainage and road layouts. In Figure 1.23, the size and position of the existing building and the proposed extensions are shown in relation to the boundary of the property. A scale of 1:200 or 1:500 is usually used.



▲ Figure 1.23 Site plan

Floor plans

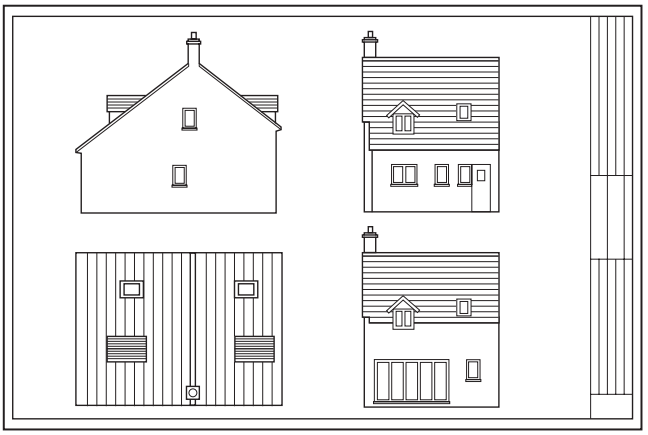
Floor plans show the position of walls and size of rooms along with the layout of elements within the building, such as kitchen units and bathroom suites. A scale of 1:100 or 1:50 is commonly used for floor plans.



▲ Figure 1.24 Floor plan

Elevations

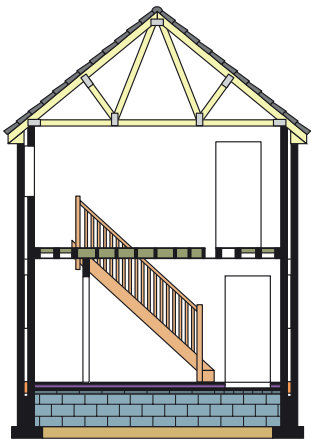
An elevation shows a particular face of a building. Figure 1.25 is an exterior elevation that shows the roof, doors and windows. Interior elevation views are also used to show the vertical layout of the walls, which is useful when planning kitchens and other fitted furniture. Scales of 1:100, 1.50 and 1:20 are commonly used for elevations.



▲ Figure 1.25 Elevations

Sections

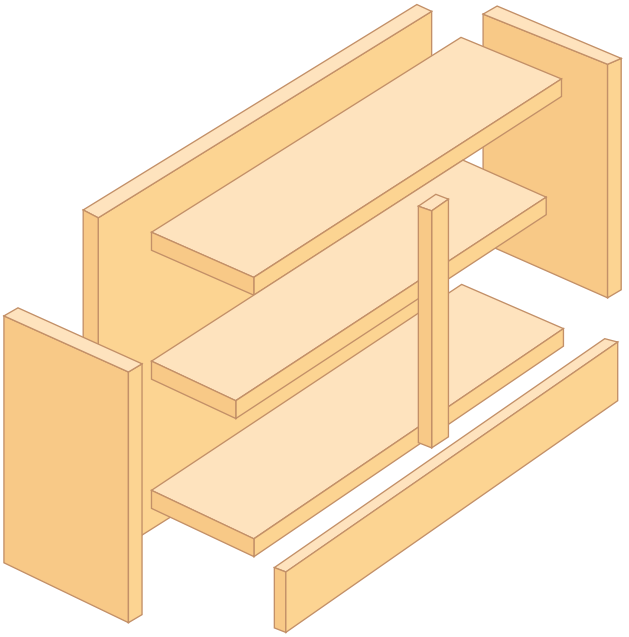
A section drawing is a cut through of a part of a building or a component to show greater detail. The section drawing in Figure 1.26 shows a cut through of the building and its construction from foundation level through to roof level. Scales of 1:100, 1:50 and 1:20 are commonly used for section drawings.



▲ Figure 1.26 Section

Detail, assembly or component drawings

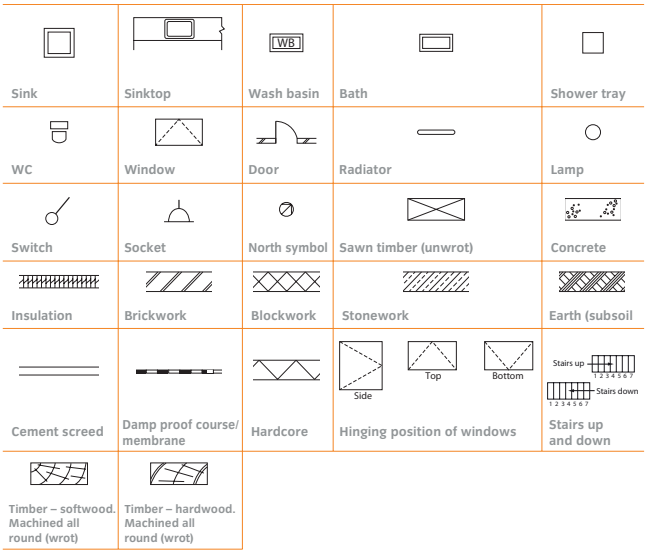
Detail, assembly or component drawings show more detail and sometimes include written instructions. The drawing in Figure 1.27 shows details of the construction of a cupboard. Scales of 1:10, 1:5, 1:2 and 1:1 are normally used to show how components are assembled.



▲ Figure 1.27 Assembly drawing

Symbols and hatchings

Symbols and hatching are used on drawings to indicate different types of material or elements of the building. The same symbols are used for all construction drawings, whether manually drafted or using CAD. These common symbols and hatchings conform to a British Standard format and were developed to allow all users to recognise standardised representations used within construction drawings. The British Standard used to enable a common understanding of the information in drawings is BS 8541-5:2015 Library objects for architecture, engineering and construction.



▲ Figure 1.28 Symbols and hatchings

ACTIVITY

On a sheet of paper produce a table of symbols to represent the following items:

- brickwork
- blockwork
- concrete
- insulation
- hardcore
- sawn timber
- softwood timber.

Health and safety and construction sites

This section provides an overview of the relevant legislation and guidance on health, safety and welfare in relation to working on a construction site.

Reference is made throughout this section to the Health and Safety Executive (HSE) website (www.HSE.gov.uk), which has concise and easy to follow information, and it is recommended that you become familiar with this resource. Some of the activities in this section require you to access and download information from the HSE website.

ACTIVITY

Familiarise yourself with the HSE website (www.hse.gov.uk/construction) and create a folder on your computer in which to store any useful HSE information.

The HSE enforces health and safety regulations when its inspectors visit construction sites to provide advice and guidance. If the site is engaging in unsafe activities an inspector may issue an enforcement or prohibition.

A good understanding and awareness of health and safety issues are required when working in construction, but at Level 2 you do not need to know all the detail. Figure 1.29 shows some of the health and safety requirements that are commonly found on construction sites.

▲ Figure 1.29 Safety signs

Health and Safety at Work etc. Act 1974

We all have a right to work in places where risks to our health and safety are properly controlled. The Health and Safety at Work etc. Act 1974 applies to all workplaces, and everyone who works on a building site or in a workshop is covered by this legislation. This includes employed and self-employed operatives, subcontractors, the employer and those delivering goods to the site. The Act not only protects those working on a construction site, it also ensures the safety of anyone else who might be nearby. The Health and Safety at Work etc. Act is sometimes referred to as HSWA or HASAWA.

Health and safety is about stopping you getting hurt at work or ill through work. Your employer is responsible for health and safety, but you have a role to play as well.

Key employer responsibilities

The key employer health and safety responsibilities under HASAWA are to:

- provide a safe working environment
- provide safe access (entrance) and egress (exit) to the work area
- provide adequate staff training
- have a written health and safety policy in place
- provide health and safety information and display the appropriate signs
- carry out risk assessments
- provide safe machinery and equipment and ensure it is well maintained and in a safe condition
- provide adequate supervision to ensure safe practices are carried out
- involve trade union safety representatives, where appointed, in matters relating to health and safety
- provide personal protective equipment (PPE) free of charge
- ensure the appropriate PPE is used whenever needed, and that operatives are properly supervised
- ensure materials and substances are transported, used and stored safely.

Key employee responsibilities

- Follow the training you have received when using any work items your employer has given you.
- Take reasonable care of your own and other people's health and safety.
- Co-operate with your employer on health and safety and wear the PPE supplied.
- Tell someone (your employer, supervisor or health and safety representative) if you think the work or inadequate precautions are putting anyone's health and safety at serious risk.
- Do not use drugs, medication or alcohol when working on a construction site as this can lead to poor judgement which could affect performance and lead to an increased risk of accidents.

Site induction

When you arrive on a new site you should be given an induction. Inductions make sure you know the key points related to your health, safety and welfare when on site. It is the responsibility of your employer to arrange the induction to take place before you begin work.

It is likely that your employer will make arrangements for the induction to be delivered by the site manager or possibly the site foreperson, who will follow the HSE's Guidance on Regulations, Managing Health and Safety in Construction: Construction (Design and Management) Regulations 2015. The Guidance on Regulations covers the following:

- senior management commitment to health and safety
- outline of the project
- management of the project
- first aid arrangements
- accident and incident reporting arrangements
- arrangements for briefing workers on an ongoing basis, for example toolbox talks
- arrangements for consulting the workforce on health and safety matters
- individual worker's responsibility for health and safety.

The induction might include information about:

- site layout
- site welfare facilities
- site rules
- details of key personnel such as supervisors, safety officers, first aiders and fire marshals
- responsibilities and legal duties
- co-ordination between contractors
- fire safety
- emergency procedures and muster points
- location of first aid equipment and fire extinguishers
- permit to work systems
- procedures for signing in and out
- parking arrangements
- method statements
- tools, plant, vehicles and equipment
- operating hours
- cleanliness and waste management
- meaning of signs

Painting and Decorating

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LEVEL 2 TECHNICAL CERTIFICATE (7907)
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