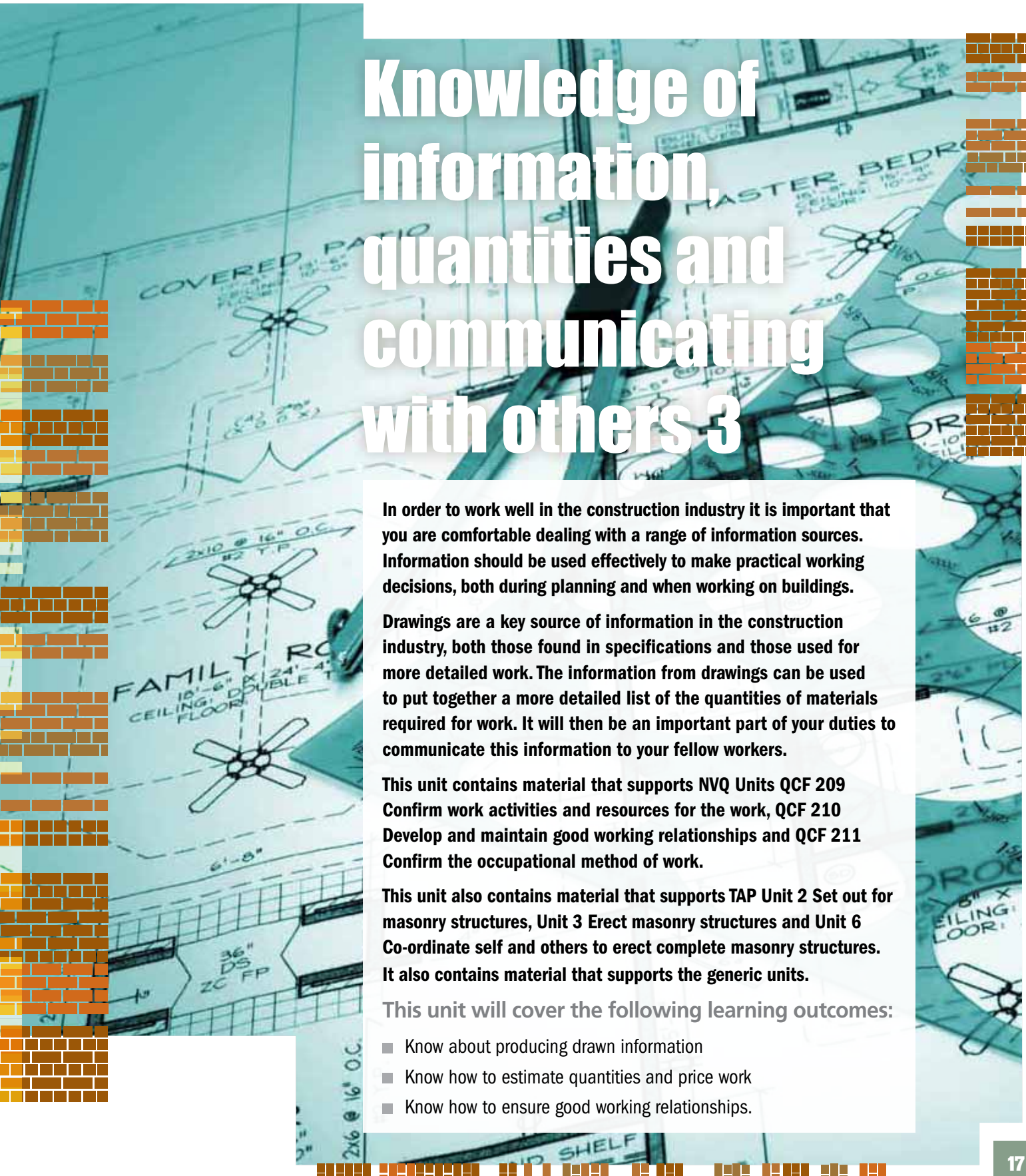
UNIT 3002



Knowledge of information, quantities and communicating with others 3

In order to work well in the construction industry it is important that you are comfortable dealing with a range of information sources. Information should be used effectively to make practical working decisions, both during planning and when working on buildings.

Drawings are a key source of information in the construction industry, both those found in specifications and those used for more detailed work. The information from drawings can be used to put together a more detailed list of the quantities of materials required for work. It will then be an important part of your duties to communicate this information to your fellow workers.

This unit contains material that supports NVQ Units QCF 209 Confirm work activities and resources for the work, QCF 210 Develop and maintain good working relationships and QCF 211 Confirm the occupational method of work.

This unit also contains material that supports TAP Unit 2 Set out for masonry structures, Unit 3 Erect masonry structures and Unit 6 Co-ordinate self and others to erect complete masonry structures. It also contains material that supports the generic units.

This unit will cover the following learning outcomes:

- Know about producing drawn information
- Know how to estimate quantities and price work
- Know how to ensure good working relationships.

Functional skills

In this unit, you will be practising **FE 2.2.2–2.2.5**, which relate to comparing, selecting, reading and understanding texts and using them to gather information, ideas, arguments and opinions. If there are any words or phrases you do not understand, use a dictionary, look them up on the Internet, or discuss with your tutor.

FM 2.2.1 and **2.2.2** relate to applying a range of mathematics skills to find solutions, using appropriate checking procedures and evaluating their effectiveness at each stage.

Types of drawing

Before looking at producing types of drawing, it is worth revising the different types of drawing that can be used as well as the process followed to create drawings.

Plans and drawings are vital to any building work as a way of expressing the client's wishes. Drawings are the best way of communicating a lot of detailed information without the need for pages and pages of text. Drawings form part of the contract documents and go through several stages before they are given to tradespeople for use.

Stage 1 The client sits down with an architect and explains their requirements.

Stage 2 The architect produces drawings of the work and checks with the client to see if the drawings match what the client wants.

Stage 3 If required, the drawings go to planning to see if they can be allowed, and are also scrutinised by the Building Regulations Authority. It is at this stage that the drawings may need to be altered to meet Planning or Building Regulations.

Stage 4 Once passed, the drawings are given to contractors along with the other contract documents, so that they can prepare their tenders for the contract.

Stage 5 The winning contractor uses the drawings to carry out the job. At this point the drawings will be given to you to work from.

There are three main types of working drawings: location drawings, component drawings and assembly drawings. We will look at each of these in turn.

Location drawings

Location drawings include:

- **block plans,** which identify the proposed site in relation to the surrounding area (see Figure 2.01). These are usually drawn at a scale of 1:2500 or 1:1250
- **site plans,** which give the position of the proposed building and the general layout of things such as services and drainage (see Figure 2.02). These are usually drawn at a scale of 1:500 or 1:200
- **general location drawings,** which show different elevations and sections of the building (see Figure 2.03). These are usually drawn at a scale of 1:200, 1:100 or 1:50.

Find out

Use information about your local area to complete a block plan for your building and its surrounding buildings, roads etc.

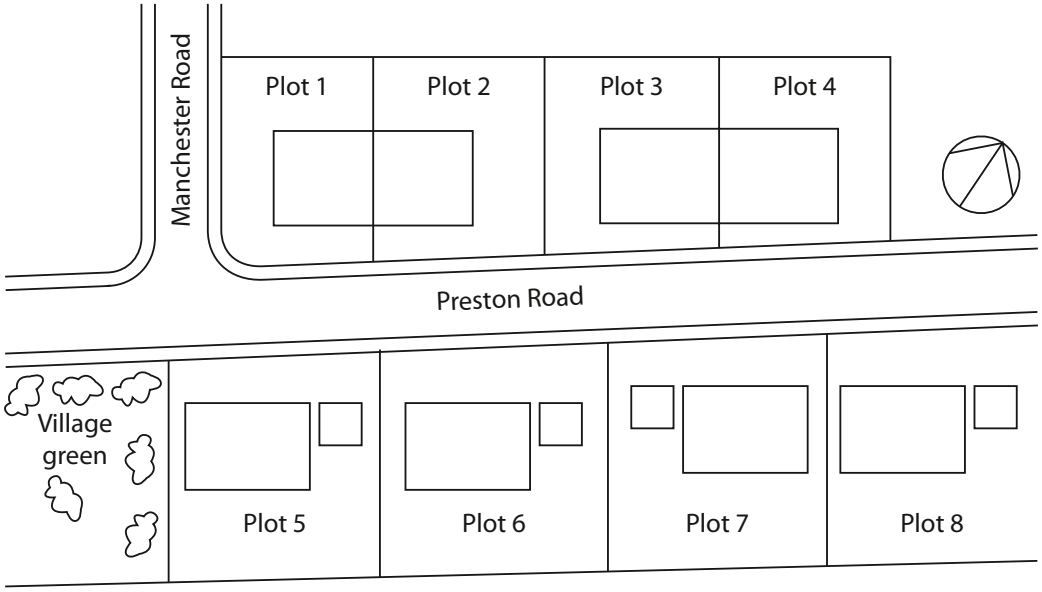


Figure 2.01 Block plan

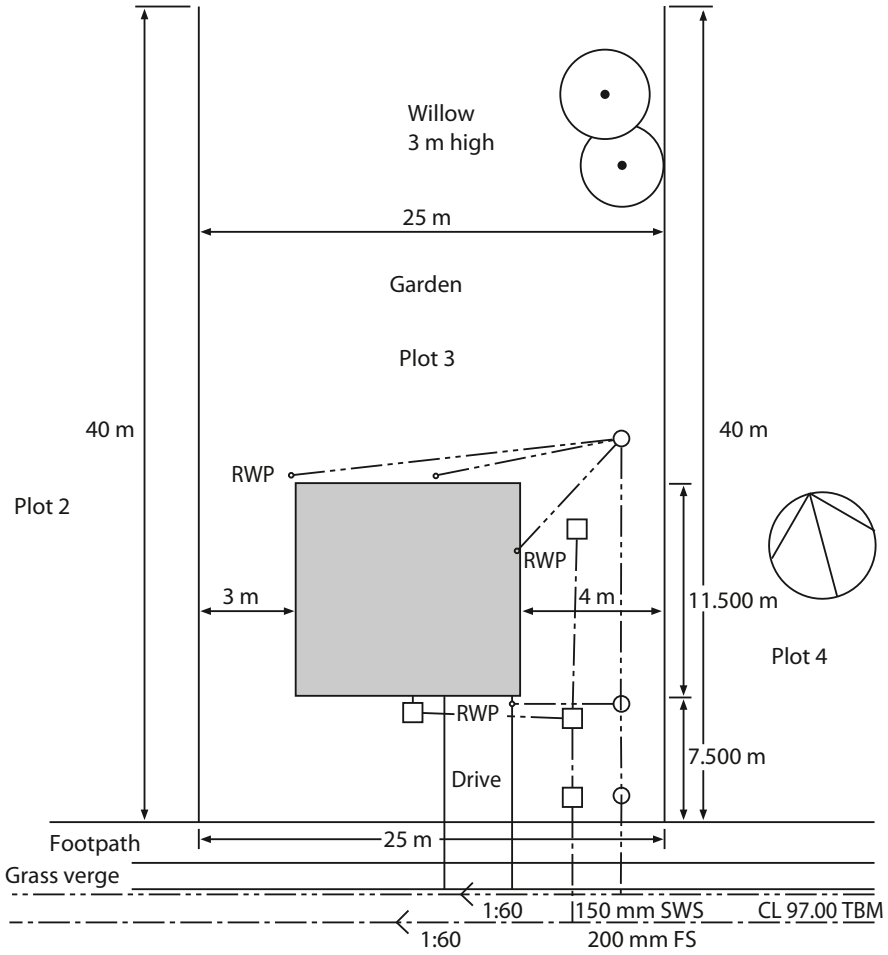


Figure 2.02 Site plan

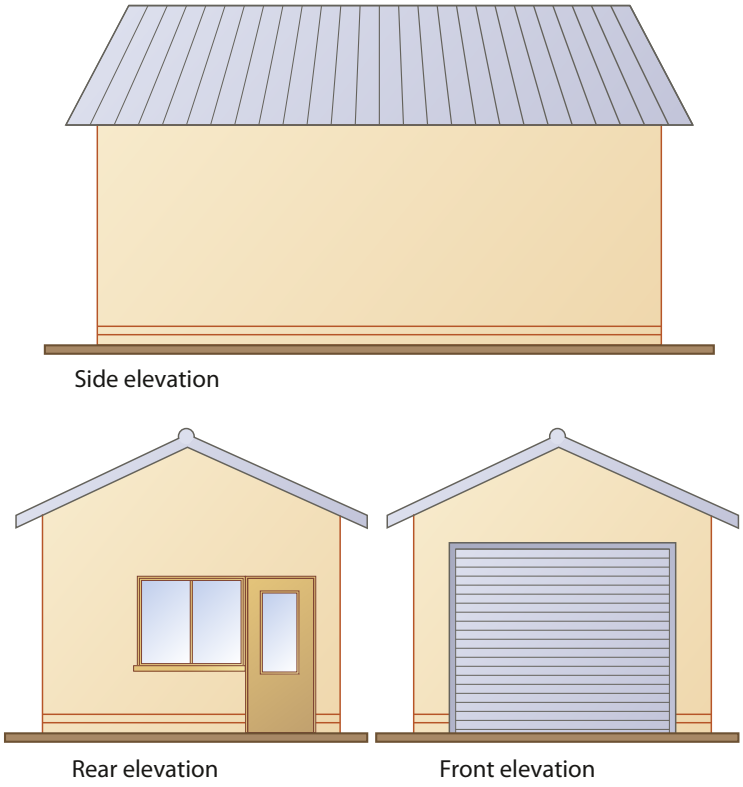


Figure 2.03 General location drawing (of a one room per floor building)

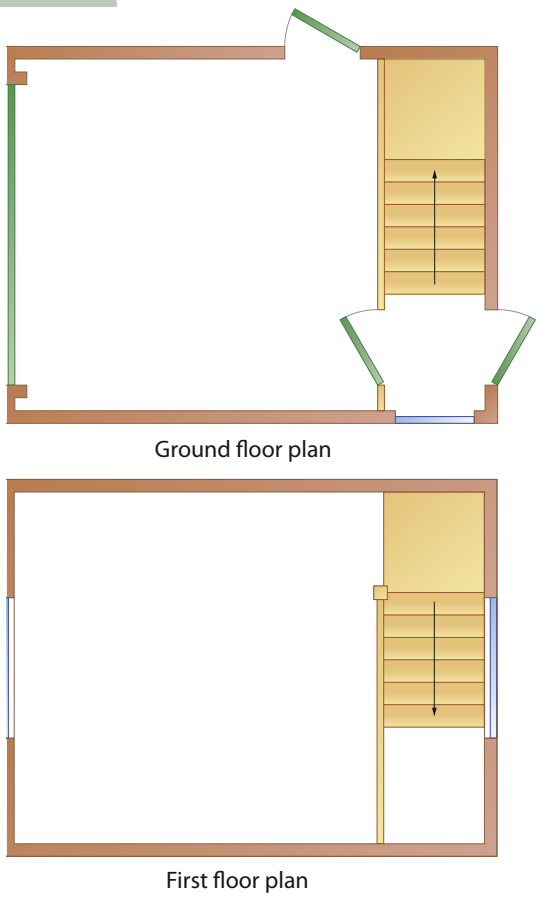


Figure 2.04 Floor plan (of a one room per floor building)

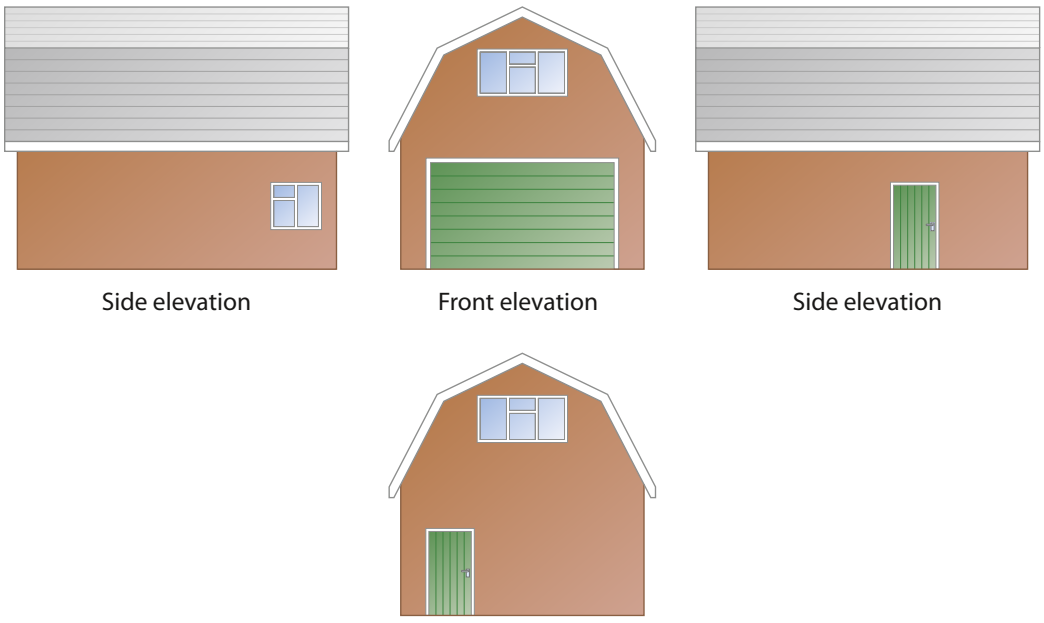


Figure 2.05 Elevation

Component drawings

Component drawings include:

- range drawings, which show the different sizes and shapes of a particular range of components (see Figure 2.06). These are usually drawn at a scale of 1:50 or 1:20
- detailed drawings, which show all the information needed to complete or manufacture a component (see Figure 2.07). These are usually drawn at a scale of 1:10, 1:5 or 1:1.

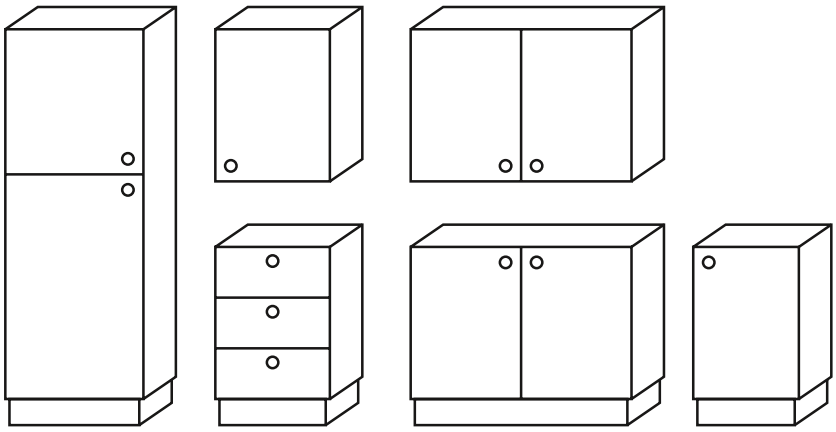


Figure 2.06 Range drawing

Assembly drawings

Assembly drawings are similar to detailed drawings (see Figure 2.08). They show in great detail the various joints and junctions in and between the various parts and components of a building. Assembly drawings are usually drawn at a scale of 1:20, 1:10 or 1:5.

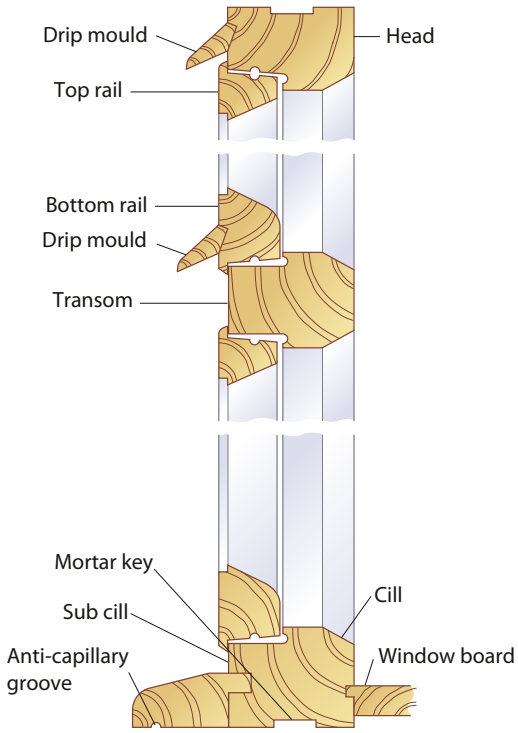


Figure 2.07 Detailed drawing

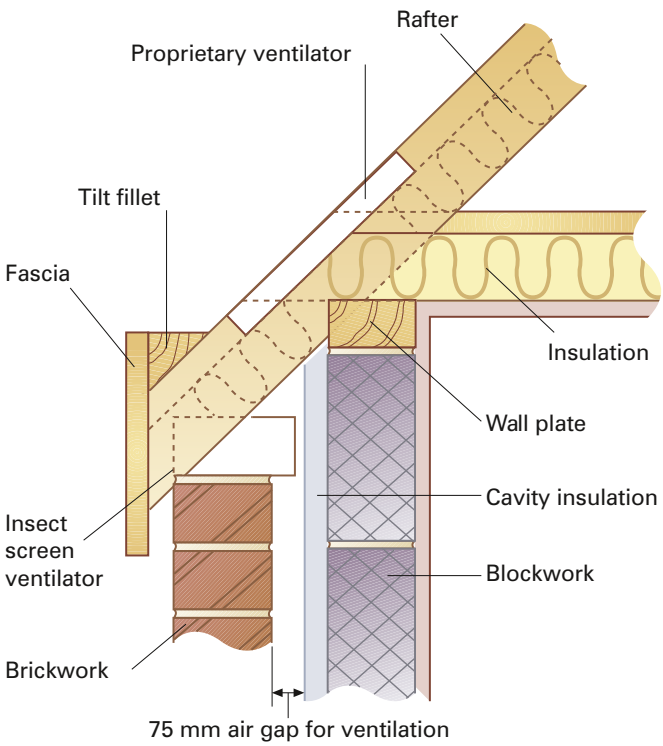


Figure 2.08 Assembly drawing

K1. Know about producing drawn information

Remember

Mistakes, either in design or interpretation of the design, can be costly.

When drawings are mentioned in the construction industry, people generally tend to think of the architect's drawings and plans that form part of the contract documents. These types of drawings are vital in the construction industry as they form part of the legal contract between client and contractor.

However, there are other forms of drawings that are just as important. Setting-out drawings are used to mark out for complex procedures such as constructing cut roofing, staircases or brick arches; and with advances in technology, CAD (computer-aided design) is being used more often.

Advantages of computer-aided design (CAD)

Find out

What different CAD programs are available for use online? Use the Internet to locate some good examples of these programs and use them to produce some simple 2-D diagrams.

Computer-aided design (CAD) is a system in which a draftsperson uses computer technology to help design a part, product or whole building. It is both a visual and symbol-based method of communication, with conventions particular to a specific technical field.

CAD is used particularly at the drafting stage. Drafting can be done in two dimensions (2-D) and three dimensions (3-D).

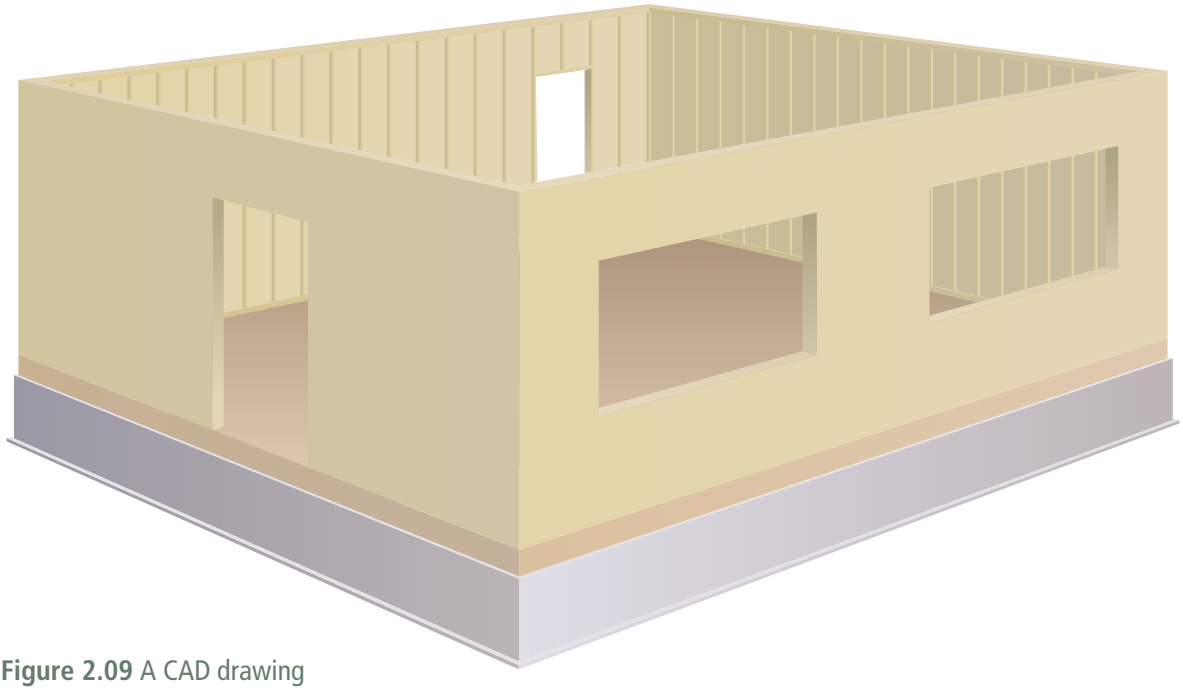


Figure 2.09 A CAD drawing

CAD is one of the many tools used by engineers and designers, and is used in many ways, depending on the profession of the user and the type of software in question.

There are several types of CAD. Each requires the operator to think differently about how they will use it, and they must design their virtual components in a different manner for each.

Many companies produce lower-end 2-D systems, and a number of free and open source programs are available. These make the drawing process easier, because there are no concerns about the scale and placement on the drawing sheet that accompanied hand drafting – these can simply be adjusted as required during the creation of the final draft.

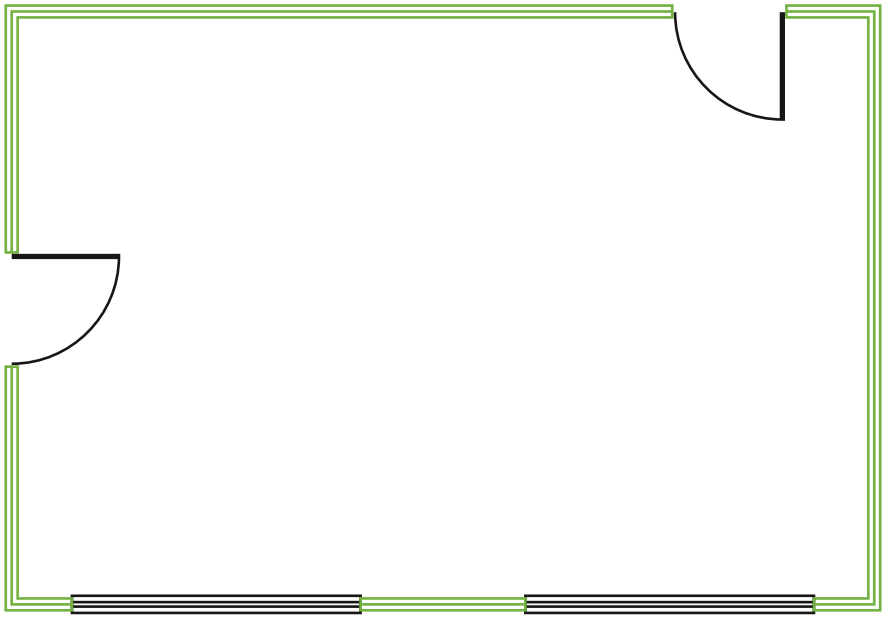


Figure 2.10 A simple 2-D CAD drawing

3-D wireframe

3-D wireframe is in essence an extension of 2-D drafting. Each line has to be manually inserted into the drawing. The final product has no mass properties associated with it, and cannot have features directly added to it, such as holes. The operator approaches these in a similar fashion to the 2-D systems, although many 3-D systems allow you to use the wireframe model to make the final engineering drawing views.

Did you know?

Google SketchUp is a simple, free 2-D CAD program, and IKEA and B&Q, among others, operate simple 2-D CAD programs for designing kitchens, etc.

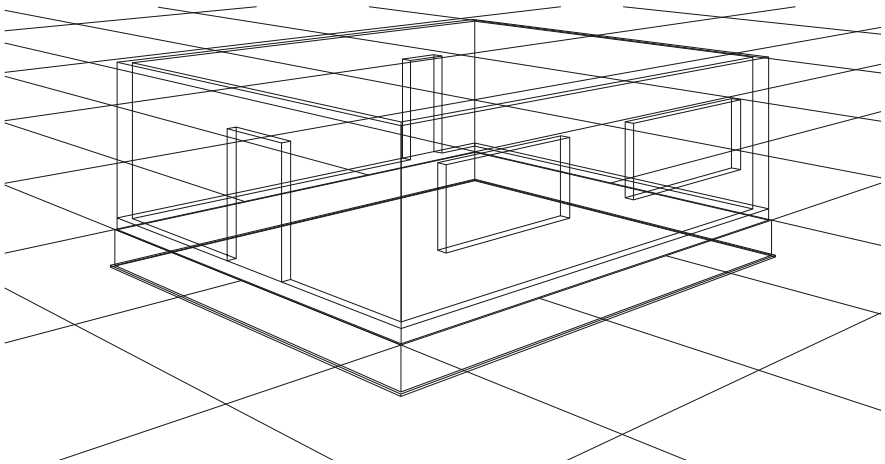


Figure 2.11 A 3-D wireframe produced using CAD

3-D dumb solids

3-D 'dumb' solids are created in a way corresponding to manipulations of real-world objects. Basic three-dimensional geometric forms (prisms, cylinders, spheres, and so on) have solid volumes added to or subtracted from them, as if assembling or cutting real-world objects. Two-dimensional projected views can easily be generated from the models. The sorts of basic 3-D solids that are created do not usually include tools to easily allow motion of components, set limits to their motion, or identify interference between components.

Figure 2.12 A 3-D view of a house produced using CAD

Top-end systems

Top-end systems offer the capabilities to incorporate more organic, aesthetic and ergonomic features into designs. Free-form surface modelling is often combined with solids to allow the designer to create products that fit the human form and visual requirements, as well as the interface with the machine.

Uses of CAD

CAD has become an especially important technology within the scope of computer-aided technologies, with benefits such as lower product development costs and a greatly shortened design cycle. CAD enables designers to lay out and develop work on screen, print it out and save it for future editing, saving time on their drawings.

Details required for floor plans

To complete floor plans you will need to use a range of different information sources. Some of the key pieces of information you will need to know about are covered below.

Sections

Sectional drawings are useful as they can show details of how certain aspects of a structure are constructed. They show a cross section of the build, using symbols to indicate what materials are used.

These drawings are particularly useful for showing how floors are constructed and also for types of walls, such as sleeper walls.

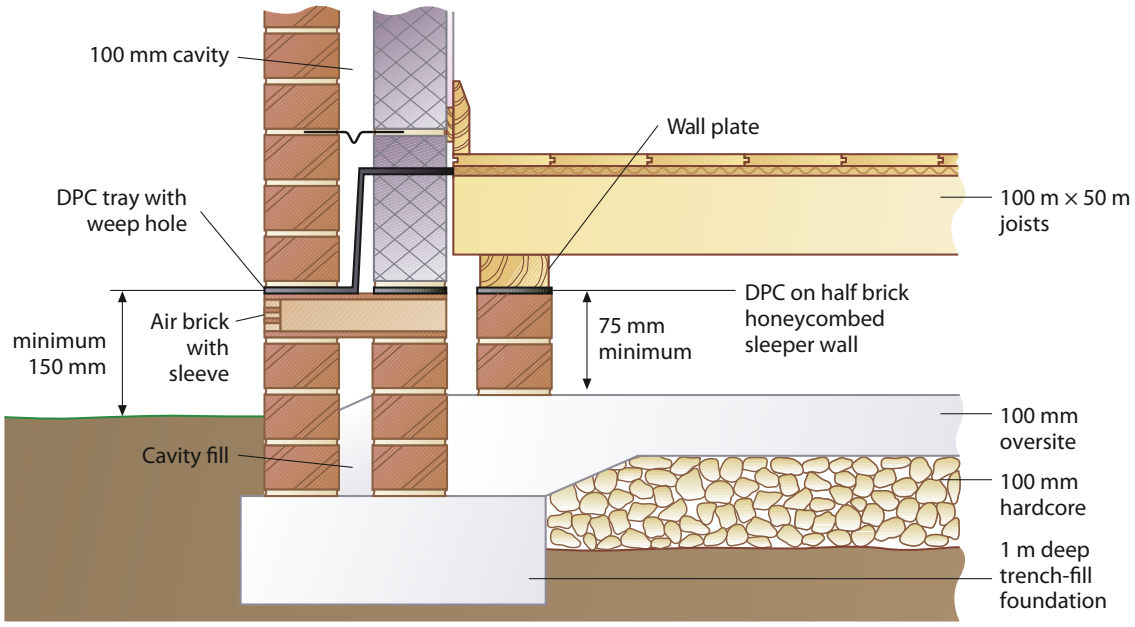


Figure 2.13 Section through floor and wall

Datum points

The need to apply levels is required at the beginning of the construction process and continues right up to the completion of the building. The whole country is mapped in detail and the Ordnance Survey place datum points (bench marks) at suitable locations from which all other levels can be taken.

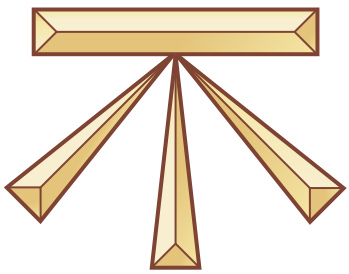


Figure 2.14 Ordnance bench mark

Ordnance bench mark (OBM)

OBMs are found cut into locations such as walls of churches or public buildings. The height of the OBM can be found on the relevant Ordnance Survey map or by contacting the local authority planning office. Figure 2.14 shows the normal symbol used, although it can appear as shown in Figure 2.15.

Site datum

It is necessary to have a reference point on site to which all levels can be related. This is known as the site datum. The site datum is usually positioned at a convenient height, such as finished floor level (FFL), D.P.C. and ground level for a structural floor.

The site datum itself must be set in relation to some known point, preferably an OBM, and must be positioned where it cannot be moved.

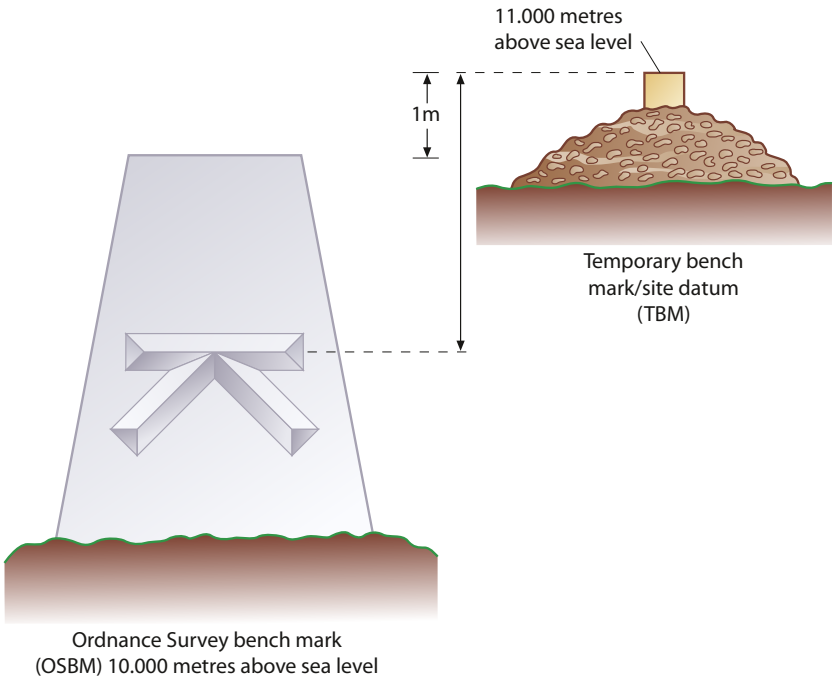


Figure 2.15 Site datum and OBM

Figure 2.15 shows a site datum and OBM, illustrating the height relationship between them.

If no suitable position can be found a datum peg may be used, its accurate height transferred by surveyors from an OBM, as with the site datum. It is normally a piece of timber or steel rod positioned accurately to the required level and then set in concrete. However, it must be adequately protected and is generally surrounded by a small fence for protection, as shown in Figure 2.16.

Temporary bench mark (TBM)

When an OBM cannot be conveniently found near a site it is usual for a temporary bench mark (TBM) to be set up at a height suitable for the site. Its accurate height is transferred by surveyors from the nearest convenient OBM.

All other site datum points can now be set up from this TBM using datum points, which are shown on the site drawings. Figure 2.17 shows datum points on drawings.

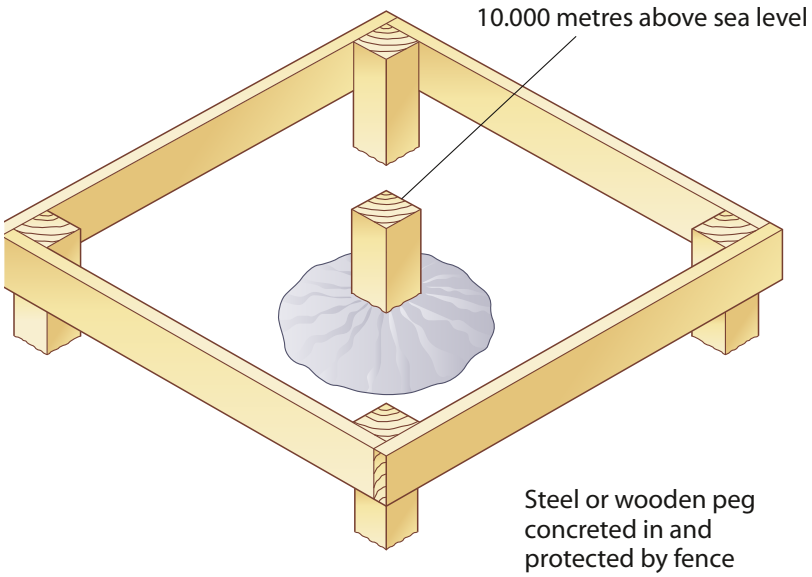


Figure 2.16 Datum peg suitably protected

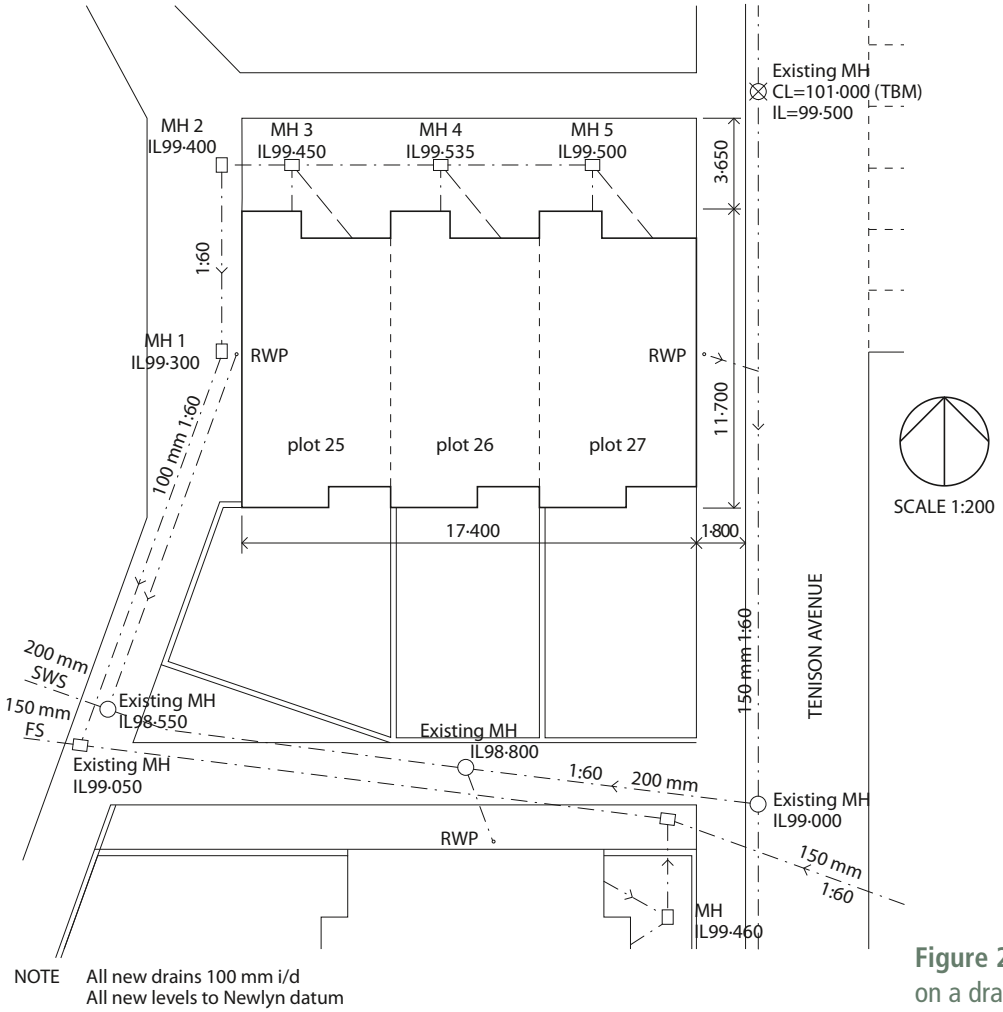


Figure 2.17 Datum points shown on a drawing

Wall constructions

The positioning of internal walling is important when planning out a floor as internal walling, particularly solid block walling or load-bearing walling, will place strain on the floor. This strain will have to be supported. Internal walling can be built directly onto the foundations. This will break the area of flooring into smaller sections and is usually done in larger buildings. The alternative is that the whole area can be floored and the area which the internal walls are to be built on can be reinforced with either **sleeper walls** or reinforced concrete or steel beams.

The position of the internal walling is also used by other trades, as they need to know where the services need to be run.

Key term

Sleeper wall – sometimes known as a dwarf wall this is a smaller wall built to support the ground floor joists

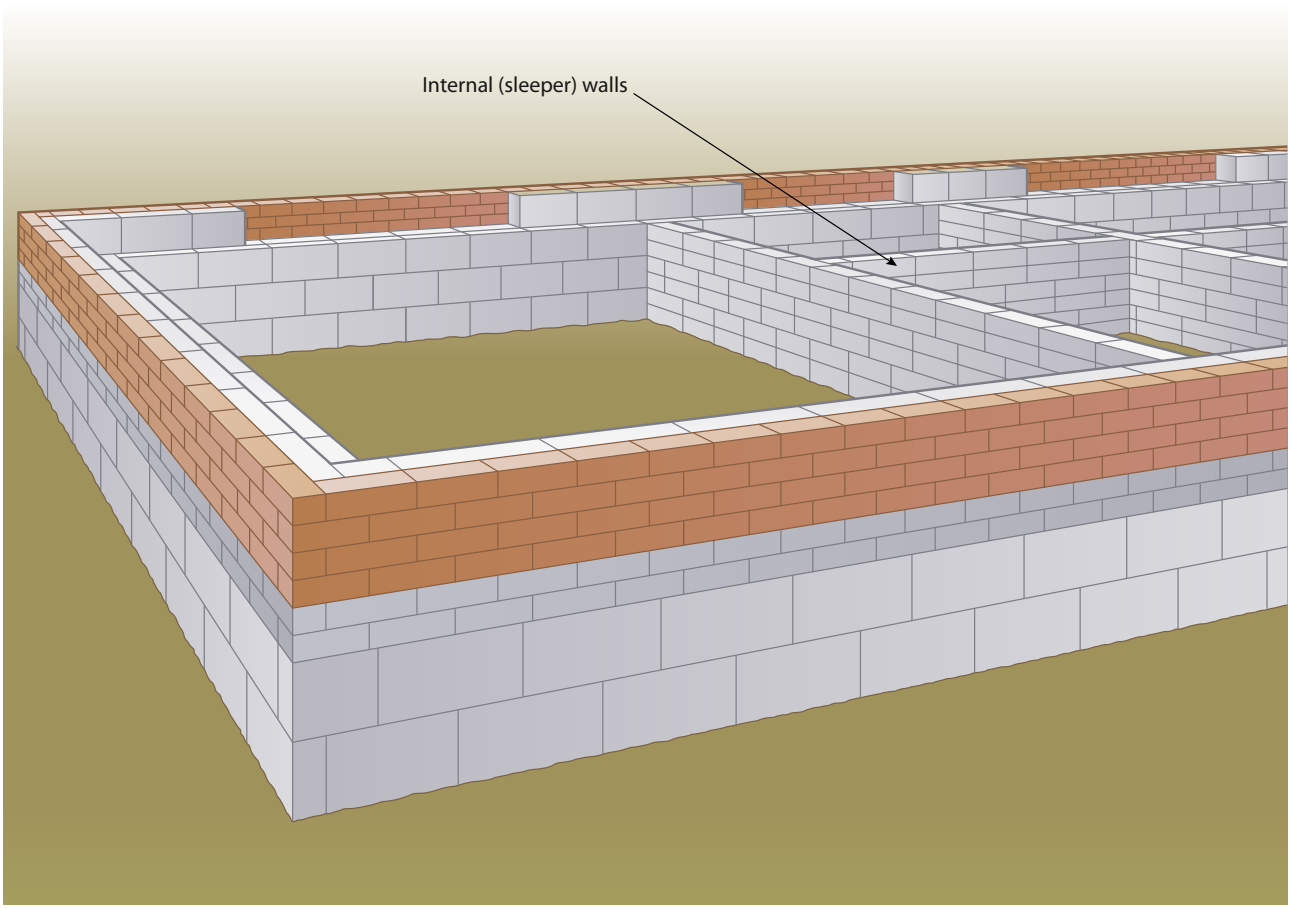


Figure 2.18 Internal (sleeper) walls being built into foundations

Material codes

Almost all the materials that are used in construction must adhere to British Standards. Each type of material must pass stringent tests so that it can be classified by the BSI and be used. With the move into European markets some of the codes will now be prefixed ISO (International Organization for Standardization).

The following is a list of BS ISO that relates to flooring:

Timber

- BS EN 383:2007 – Timber structures. Tested by determining embedment strength and foundation values for dowel type fasteners.
- BS 5268-2:2002 – Structural use of timber with a code of practice for permissible stress design, materials and workmanship.

Concrete, aggregates and masonry

- BS EN 12350-1:2009 – Testing fresh concrete. A sample of concrete is tested.
- BS EN 1097-8:2009 – Tests for mechanical and physical properties of aggregates.
- BS EN 12390-3:2009 – Testing hardened concrete. A compressive strength test is made of specimens.
- BS EN 12390-5:2009 – Testing hardened concrete. A flexural strength test is made of specimens.
- BS EN 12390-7:2009 – Testing hardened concrete. The density of hardened concrete is tested.

Materials that have been stamped with the relevant BS number will have been tested to meet the required standards or a sample of the materials will have been tested.

Remember

Diagrams and drawings include a great deal of information about the type and quality of materials used in their construction.

Depth dimensions and heights

The depth dimensions and heights of materials used in flooring construction will be identified by the architect. They will then use the relevant BSI specification to decide which type, and size, of materials will be suitable for each job.

Schedules and specifications

Specifications

The specification or 'spec' is a document produced alongside the plans and drawings and is used to show information that

cannot be shown on the drawings. Specifications are almost always used, except in the case of very small contracts. A specification should contain:

- **site description** – a brief description of the site including the address
- **restrictions** – what restrictions apply such as working hours or limited access
- **services** – what services are available, what services need to be connected and what type of connection should be used
- **materials description** – including type, sizes, quality, moisture content, etc.
- **workmanship** – including methods of fixing, quality of work and finish.

The specification may also name subcontractors or suppliers, or give details such as how the site should be cleared, and so on.

Working life

You are working on a job and have received the site plans, which show the layout of the services. You start to dig out for the services but when you reach the site where the mains gas should be, you find it is not where the drawing shows.

What could have caused this problem? You will need to look at the sources of information you have used to make your decisions, and check to see what could have caused the mistake. What other problems could arise from using faulty information?

What effect could this have financially? You will also need to think about the impact not only on money but also the time that might be needed to carry out the project. What impact could this have on your company's reputation?

Functional skills

This exercise will allow you to practise **FM 2.3.1** Interpret and communicate solutions to multistage practical problems.

Figure 2.19 A good spec helps to avoid confusion when checking material deliveries

Schedules

A schedule is used to record repeated design information that applies to a range of components or fittings. Schedules are mainly used on bigger sites where there are multiples of several types of house (4-bedroom, 3-bedroom, 3-bedroom with dormers, etc.), each type having different components and fittings. The schedule avoids the wrong component or fitting being put in the wrong house. Schedules can also be used on smaller jobs such as a block of flats with 200 windows, where there are six different types of window.

Find out

Schedules are not always needed on contracts, particularly smaller ones. Think of a job/contract that would require a schedule and produce one for a certain part of that job: for example, doors or brick types.

The need for a specification depends on the complexity of the job and the number of repeated designs that there are. Schedules are mainly used to record repeated design information for:

- doors
- windows
- ironmongery
- joinery fitments
- sanitary components
- heating components and radiators
- lintels
- kitchens.

A schedule is usually used in conjunction with a range drawing and a floor plan.

Figures 2.20–2.22 are basic examples of these documents, using a window as an example:

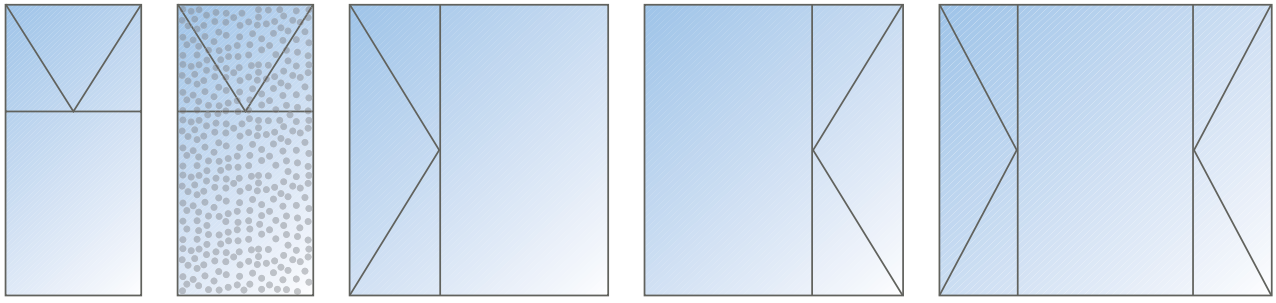


Figure 2.20 Range drawing

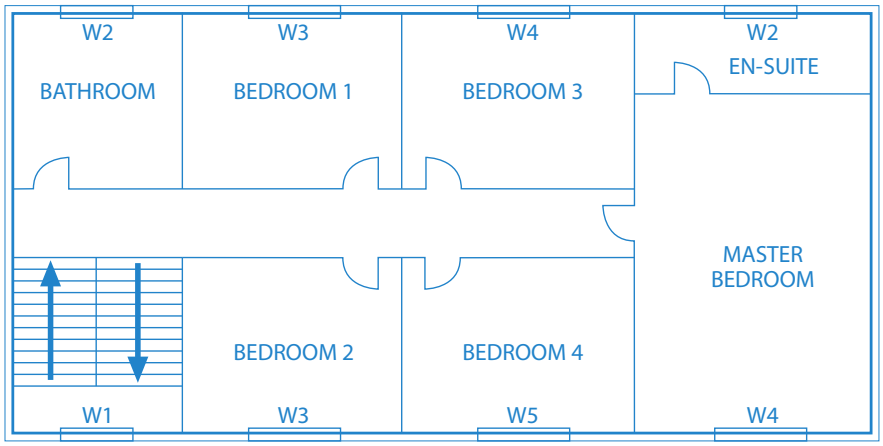


Figure 2.21 Floor plan

WINDOW	SIZE	EXTERIOR	INTERIOR	LOCATION	GLASS	FIXING
Window 1	600 x 1200 mm	Mahogany wood grain uPVC	White uPVC	Stairwell	22 mm thermal resistant double glazed units	Fixed with 100 mm frame fixing screws
Window 2	600 x 1200 mm	Mahogany wood grain uPVC	White uPVC	Bathroom En suite	22 mm thermal resistant double glazed units with maple leaf obscure pattern	Fixed with 100 mm frame fixing screws
Window 3	1100 x 1200 mm	Mahogany wood grain uPVC	White uPVC	Bedroom 1 Bedroom 2	22 mm thermal resistant double glazed units	Fixed with 100 mm frame fixing screws
Window 4	1100 x 1200 mm	Mahogany wood grain uPVC	White uPVC	Bedroom 3 Master bedroom	22 mm thermal resistant double glazed units	Fixed with 100 mm frame fixing screws
Window 5	1500 x 1200 mm	Mahogany wood grain uPVC	White uPVC	Bedroom 4	22 mm thermal resistant double glazed units	Fixed with 100 mm frame fixing screws

Figure 2.22 Schedule for windows

The schedule shows that there are five types of window, each differing in size and appearance; the range drawing shows what each type of window looks like; and the floor plan shows which window goes where. For example, the bathroom window is a type 2 window, which is 600 x 1200 mm with a top-opening sash and obscure glass.

Setting out drawings

Setting out drawings are as important as contract documents. You must be aware of how certain tasks are set out and what drawings can be created to aid in the setting out process.

Setting out drawings are most often needed on smaller jobs, where there is limited or no information from the architect in the form

of contract document drawings. Setting out drawings can also be used on larger sites where there has been an alteration or an oversight by the architect.

Here is where the most common forms of setting out drawings are used:

- in carpentry, for cut roofing, where there may be no information on the true lengths of rafters
- in joinery, when setting out for stairs, where there may be no information on the individual rise, etc.
- in bricklaying, where you may come across setting out drawing for arch centres, such as segmental or gothic arches.

We will now look at a brief example of how roofing and brick arches are set out.

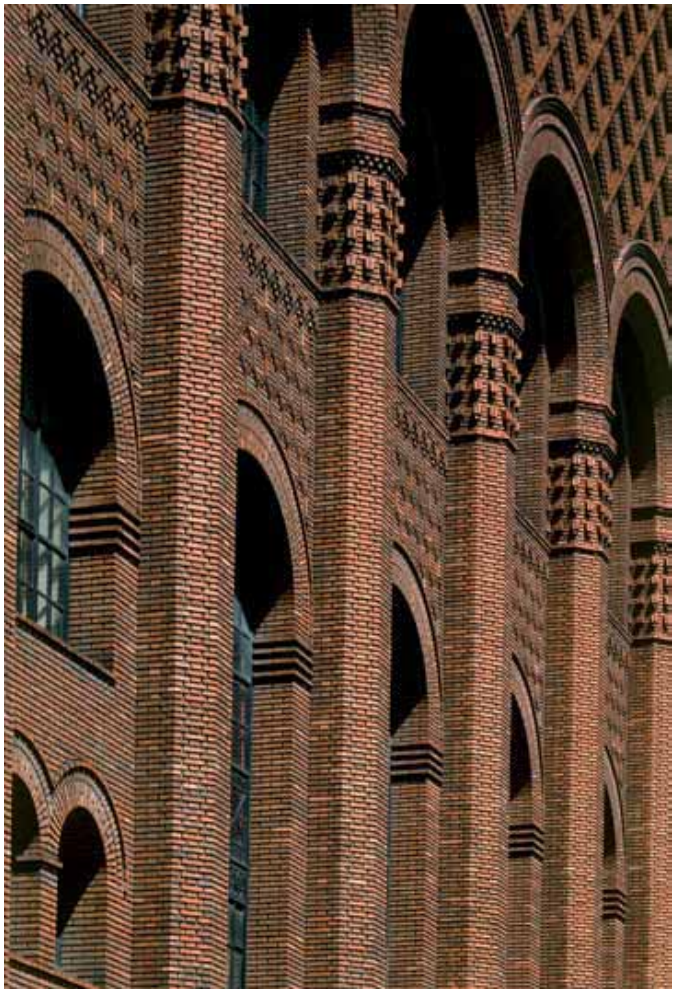


Figure 2.23 Setting out drawings are crucial for creating arches like these

Finding the true length of a common rafter

Most drawings will tell you the **span** and **rise** of the roof. From these, you can create a drawing that will tell you the true length of the common rafter, and also what angle the ends of the rafter should be cut at.

This true length is the actual length that the rafter needs to be, and all the rafters can be cut to length from the setting out drawing. The setting out drawing for a roof is usually drawn on a sheet of plywood to a scale that fits the sheet.

Key terms

Span – the distance measured in the direction of ceiling joists, from the outside of one wall plate to another, known as the overall (O/A) span

Rise – the distance from the top of the wall plate to the roof's peak

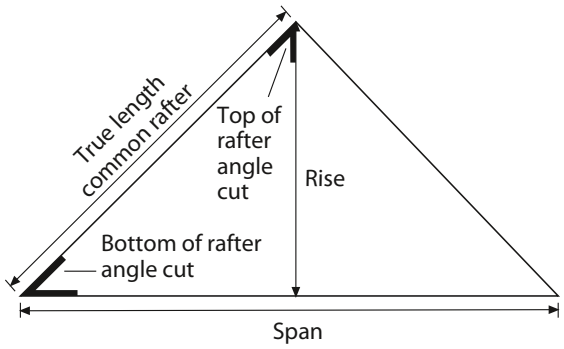


Figure 2.24 Finding common rafter true length

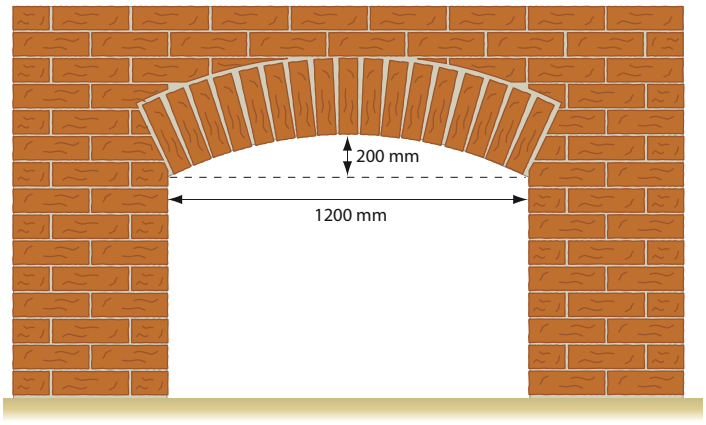


Figure 2.25 An example of a segmental arch

Setting out a segmental brick arch

Most drawings will show you the opening span of the arch, but some may not tell you the radius. Without the radius, you cannot build the arch correctly.

We will now look at how setting out drawings can aid you in setting out this arch.

Find out

Using the Internet and other resources, find out what sort of scales are best to use for drawing up setting out drawings for these different components and builds.

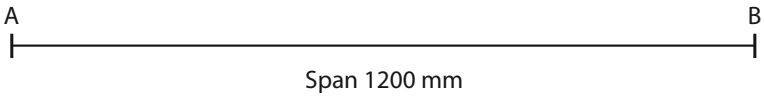


Figure 2.26 Establish the span (a length of 1200 mm has been used here, shown as A–B)

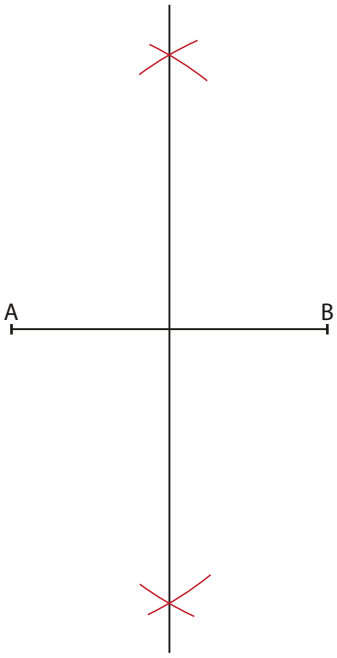


Figure 2.27 Bisect this line

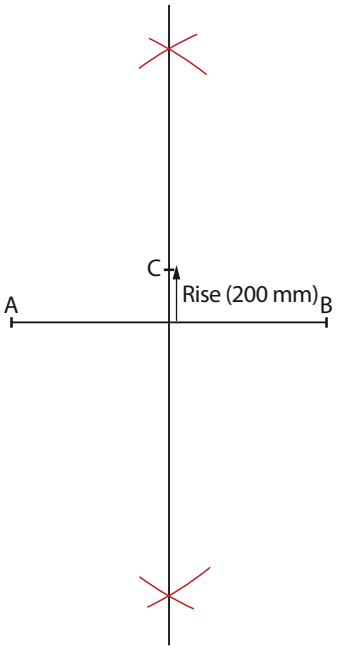


Figure 2.28 Establish the rise (the distance from the springing line (A–B) to the highest point of the soffit shown as C). The rise is normally one sixth of the span so, in this case, the rise is shown as 200 mm

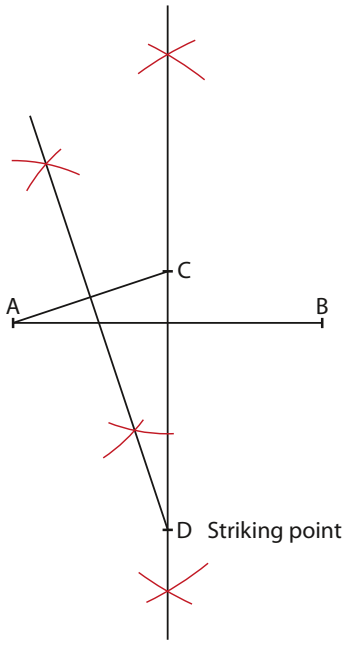


Figure 2.29 Draw a line from A to C and bisect this line. The point where this bisecting line crosses the bisecting line of the span will be the striking point for the arch (shown here as point D). From striking point D open out compass to point A and draw an arc across to point B. This will provide the **intrados** for the arch

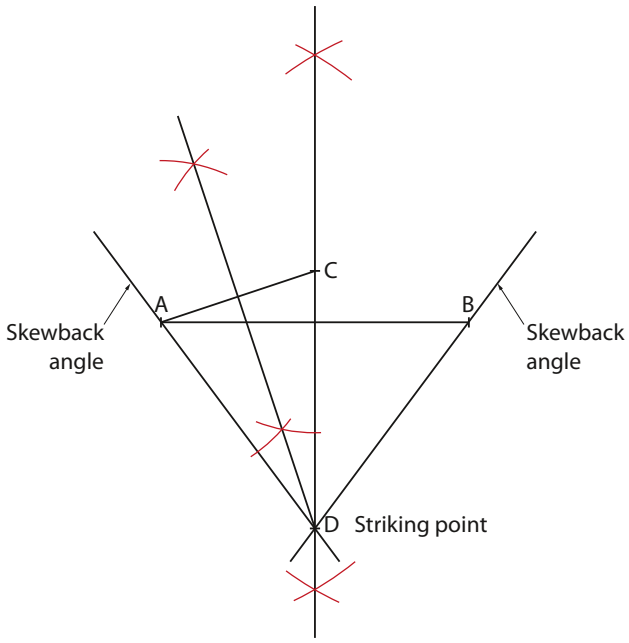


Figure 2.30 Draw a line from D through A and a line from D through B. These lines will provide the angle for the **skewbacks**. From point A establish depth of arch ring (point E) above point A along A–D. Set compass from point D to point E and draw an arch. This will provide the **extrados**

Setting out for a segmental arch can also be drawn out on a sheet of plywood but, in this case, it can be drawn full size, with the drawing being cut out and used as a template for the arch centre.

Key terms

Skewbacks – the angle at the springing point at which the arch rings will be laid

intrados – the interior curve of the arch ring

extrados – the outside line of the arch ring

Reasons for the use of elevations and projections

Building, engineering and similar drawings aim to give as much information as possible in a way that is easy to understand. They frequently combine several views on a single drawing. These may be of two kinds:

- **elevation** – the view we would see if we stood in front or to the side of the finished building
- **plan** – the view we would have if we were looking down on it.

The view we see depends on where we are looking from. There are then different ways of 'projecting' what we would see onto the drawings. The three main methods of projection, used on standard building drawings, are orthographic, isometric and oblique.

Orthographic projection

Orthographic projection works as if parallel lines were drawn from every point on a model of the building on to a sheet of paper held up behind it (an elevation view), or laid out underneath it (plan view). There are then different ways that we can display the views on a drawing. The method most commonly used in the building industry, for detailed construction drawings, is called 'first angle projection'. In this the front elevation is roughly central. The plan view is drawn directly below the front elevation and all other elevations are drawn in line with the front elevation. An example is shown in Figure 2.31.

Figure 2.31 Orthographic projection

Find out

Research, using the Internet and other resources, how isometric projection is used to sketch components.

Isometric projection

In isometric views, the object is drawn at an angle where one corner of the object is closest to the viewer. Vertical lines remain vertical but horizontal lines are drawn at an angle of 30 degrees to the horizontal. This can be seen in Figure 2.32.

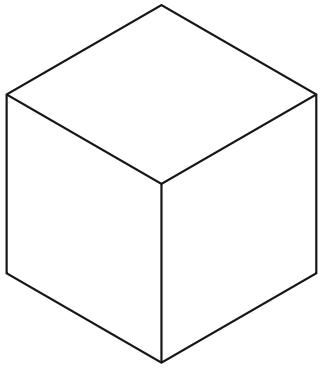


Figure 2.32 Isometric projection

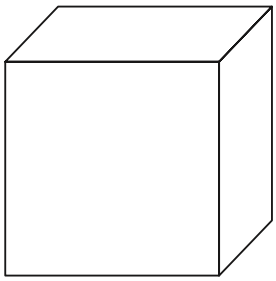


Figure 2.33 Oblique projection

Oblique projection

Oblique projection is similar to an isometric view, with the object drawn at an angle where one corner of the object is closest to the viewer. Vertical lines remain vertical but horizontal lines are drawn at an angle of 45 degrees to the horizontal. This can be seen in Figure 2.33.

Working life

You have been tasked with building a segmental brick arch, but there is minimal information on the drawing. You decide to just build the arch but soon run into problems with the radius.

What could have prevented the problems? You will need to think about the processes you could have followed to check information and who you could have consulted with about any problems. What should you do now? You will need to think about the impact any action could have not only on you but also anyone else you may be working with on site. What effect can this have on the building and on the profitability of the job?

Functional skills

This task will allow you to practise **FE 2.3.1–2.3.5** Write documents, including extended writing pieces, communicating information, ideas and opinions effectively and persuasively.

Use of hatchings and symbols

All plans and drawings contain symbols and abbreviations, which are used to show the maximum amount of information in a clear and legible way.

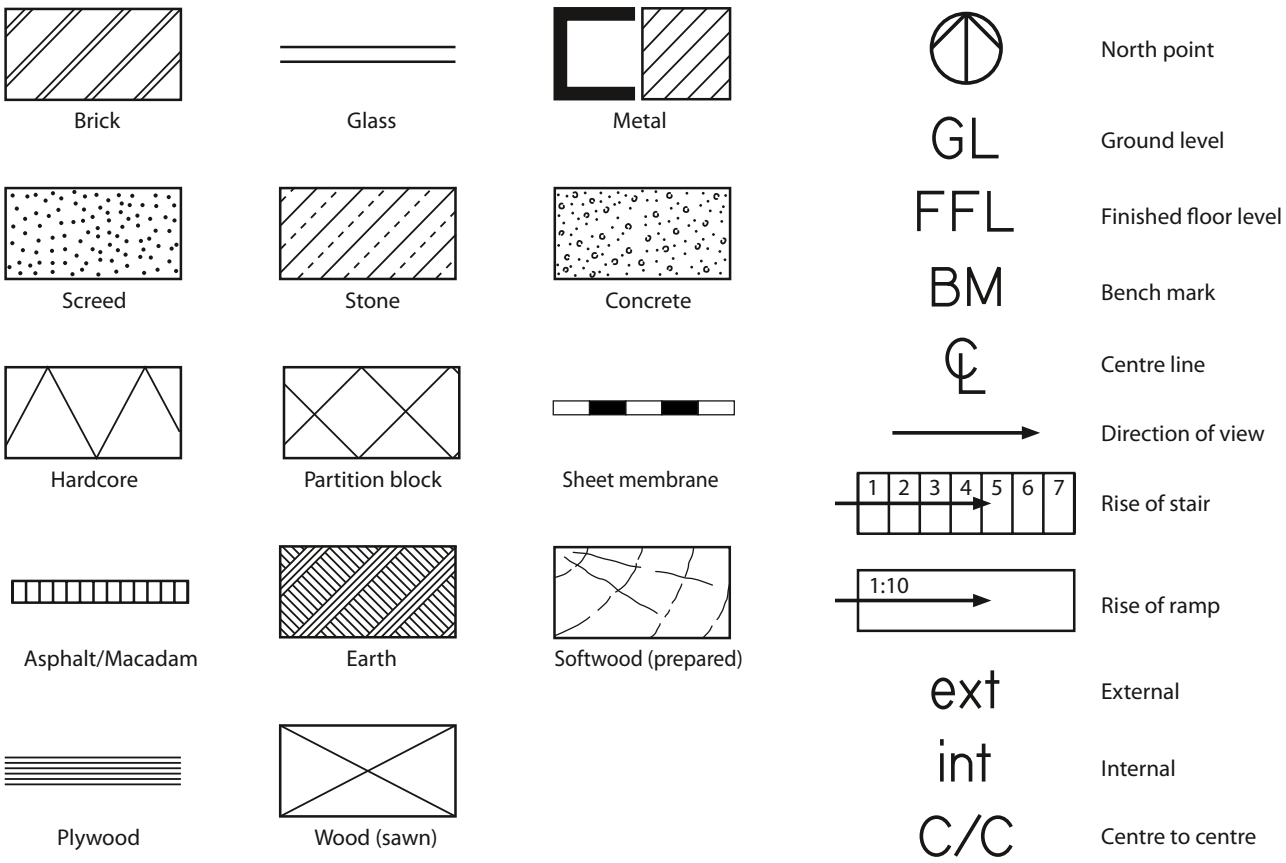


Figure 2.34 Symbols

Item	Abbreviation	Item	Abbreviation
Airbrick	AB	Hardcore	He
Asbestos	asb	Hardwood	Hwd
Bitumen	bit	Insulation	Insul
Boarding	bdg	Joist	Jst
Brickwork	bwk	Mild steel	MS
Building	bldg	Plasterboard	Pbd
Cast iron	CI	Polyvinyl acetate	PVA
Cement	ct	Polyvinyl chloride	PVC
Column	col	Reinforced concrete	RC
Concrete	conc	Satin chrome	SC
Cupboard	cpd	Satin anodised aluminium	SAA
Damp proof course	DPC	Softwood	Swd
Damp proof membrane	DPM	Stainless steel	SS
Drawing	dwg	Tongue and groove	T&G
Foundation	fnd	Wrought iron	WI
Hard board	hdbd		

Table 2.01 Abbreviations

Working life

You have been issued a scale drawing for building internal walls, but some of the dimensions are missing. What should you do?

What complications could arise from scaling from the drawing as it is? Think about the importance the drawings have to the planning of the whole project. What could happen if the information you are using is unreliable or incorrect?

What effect could building a wall in the wrong place have? This could have an impact on a range of people – not just you, but also other craftspeople working on site and the client.

Remember

A scale is merely a convenient way of reducing a drawing in size.

Why different scales are used

All building plans are drawn to scales by using symbols and abbreviations. To draw a building on a drawing sheet, its size must be reduced. This is called a scale drawing.

Using scales

The scales that are preferred for use in building drawings are shown in Table 2.02.

Type of drawing	Scales
Block plans	1:2500, 1:1250
Site plans	1:500, 1:200
General location drawings	1:200, 1:100, 1:50
Range drawings	1:100, 1:50, 1:20
Detail drawings	1:10, 1:5, 1:1
Assembly drawings	1:20, 1:10, 1:5

Table 2.02 Preferred scales for building drawings

These scales mean that, for example, on a block plan drawn to 1:2500, 1 mm on the plan would represent 2500 mm (or 2.5 m) on the actual building. Some other examples are:

- on a scale of 1:50, 10 mm represents 500 mm
- on a scale of 1:100, 10 mm represents 1000 mm (1.0 m)
- on a scale of 1:200, 30 mm represents 6000 mm (6.0 m).

Accuracy of drawings

Printing or copying of drawings introduces variations that affect the accuracy of drawings. Hence, although measurements can be read from drawings using a rule with common scales marked (Figure 2.35), you should work to written instructions and measurements wherever possible.

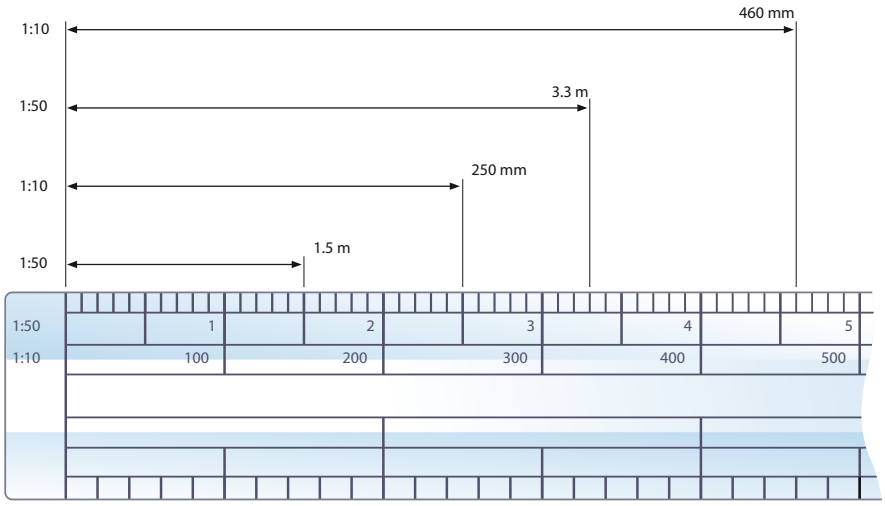


Figure 2.35 Rule with scales for maps and drawings

Find out

With a little practice, you will easily master the use of scales. Try the following:

- On a scale of 1:50, 40 mm represents: _____
- On a scale of 1:200, 70 mm represents: _____
- On a scale of 1:500, 40 mm represents: _____

Remember

You can use a scale to:

- work out the actual measurement from a plan
- work out how long to draw a line on the plan to represent an actual measurement.

Key term

Ratio – one value divided by the other

Scale drawings

Building plans are drawn to scale. Each length on the plan is in proportion to the real length. On a drawing that has been drawn to a scale of 1:10, 1 mm represents 10 mm. On the same scale:

- a length of 50 mm represents an actual length of 5 × 10 = 500 mm
- a length of 120 mm represents an actual length of 12 × 10 = 1200 mm
- an actual length of 34 m is represented by a line 34 ÷ 10 = 3.4 cm long.

Scales are often given as **ratios**. For example:

- a scale of 1:100 means that 1 cm on the drawing represents an actual length of 100 cm (or 1 m)
- a scale of 1:20 000 means that 1 cm on the drawing represents an actual length of 20 000 cm (or 20 m).

Table 2.03 shows some common scales used in the construction industry.

1:5	1 mm represents 5 mm	5 times smaller than actual size
1:10	1 mm represents 10 mm	10 times smaller than actual size
1:20	1 mm represents 20 mm	20 times smaller than actual size
1:50	1 mm represents 50 mm	50 times smaller than actual size
1:100	1 mm represents 100 mm	100 times smaller than actual size
1:1250	1 mm represents 1250 mm	1250 times smaller than actual size

Table 2.03 Common scales used in the construction industry

Now look at the following examples.

Example

A plan is drawn to a scale of 1:20. On the plan, a wall is 45 mm long. How long is the actual wall?

1 mm on the plan = actual length 20 mm

So 45 mm on the plan = actual length 4.5 × 20 = 900 mm or 0.9 m.

Remember

To make scale drawings, architects use a scale rule. The different scales on the ruler give the equivalent actual length measurements for different lengths in cm, for each scale.

Example

A window is 3 m tall. How tall is it on the plan of 1:20?

3 m = 3000 mm
an actual length of 20 mm is 1 mm on the plan
actual length 3000 mm = 3000 ÷ 20
= 150 mm
Therefore, the window is 150 mm tall on the plan.

K2. Know how to estimate quantities and price work

For all construction projects it is necessary to calculate the amounts of materials and other resources that will be needed. As part of this you will also need to be able to make a calculation on the expected cost of these materials. This is called an estimate.

Estimates are used on all construction projects when setting a budget for the work. For many projects, a client will look for tenders from a range of contractors. This means the potential contractors put together their own estimates for the work, with the client selecting the estimate that best meets their needs – usually the estimate that presents the best value.

This section will look at the information used to create an estimate and plan a project.

The tender process

Tendering is a competitive process where the contractor works with a specification and drawings from the client and submits a cost estimate for the work (including materials, labour and equipment). Tenders are often invited for large contracts, such as government contracts, with strict fixed deadlines for the tenders to be received.

An estimator will calculate the total cost in the tender. Using the information in the specification the estimator calculates the amount of materials and labour needed to complete the work. The final tender is based on this estimation.

All the tenders for a contract will then present their case and costs to the client, who will then decide on one business to be offered the contract.

Working life

You have been invited to tender a bid for a large public contract. Business has been slow, and you really need it if you are to keep your business afloat and avoid redundancies.

Two of the other tenders concern you. One is priced so low that, if you match it, you may make a small loss. In the other, the contractor promises to recycle 45 per cent of materials, to use only sustainable materials and to employ 70 per cent of the workforce locally – matching this may mean you have to lay off some workers and may only make a small profit.

What should you do? What stipulations could you introduce to help improve your bid? What could the consequences be of not getting the contract – or, indeed, of getting it?

Functional skills

This exercise will allow you to practise **FM 2.3.1** Interpret and communicate solutions to multistage practical problems. If you give oral answers to questions from your tutor, you will be able to practise **FE 2.1.1–2.1.4** Make a range of contributions to discussions and make effective presentations in a wide range of contexts.

Quoting

A quote is basically part of the tender process but it will only contain pricing information on materials, labour, etc. The quote will state how much the job will cost without any additional information that may appear on a tender, such as making a percentage of the workforce local or recycling a certain amount of materials.

The quote is then used as part of the tender to give an idea of the potential cost of a job. Companies submitting tenders will look to make this quote as attractive as possible to the client.

Estimated pricing

Estimated pricing is used to create the quote. An estimator will look at what is required and provide an estimated price for it.

Tenders for jobs may take many months for the successful tender to be selected so an estimator who prices everything up exactly as it is now may be wrong in six months time as the price of labour or materials may have changed. This means they will instead give an estimated price, based on a calculation of how much the materials or labour may cost in the future.

The resources used for making an estimated price and a final price include:

- materials
- purchase orders and invoices
- time study sheets, labour schedules, job sheets and site diaries
- building supplier's price lists and equipment availability lead times.

Prime cost

This is the final total cost of all material costs, labour costs and expenses for the project. This sum will need to be agreed by all parties before work begins.

Provisional sums

A provisional sum describes work for which the exact scope and extent have yet to be defined. Neither party involved will attempt to create an accurate price for this work until a contract is agreed. The provisional sum is usually included in the contract price as an estimate. Many contracts include a clause allowing for the provisional sum to be omitted and replaced with the final figure.

Did you know?

On smaller jobs the client may wish to order the materials themselves as they may be able to get a better deal and save money.

Resources required for a construction task

The materials used for a job will usually depend on what the client wants. This is particularly the case for smaller jobs where the

client may want certain fixtures or fittings. Where any structural or large alterations will be needed to accommodate the client's plans, a client may want to consult an architect or local planning authority or even their contractor as to what materials they must have to meet regulations.

If a client insists on arranging and organising any material requirements then it is important to ensure that they are aware of exactly what type and size of materials are required and when they are required; otherwise not only can it hold up the job but may lead to a poor job being done with substandard materials, which can affect your reputation.

More problems can develop when clients order materials themselves as they may lack the technical knowledge needed for ordering materials. For example, they may think they are getting cheaper materials by ordering 3″ x 2″ timber studwork or cheaper common bricks. However 3″ x 2″ may not be strong enough and 4″ x 2″ should be used, or particular bricks, such as engineering bricks, may be needed.

Larger jobs will be led by the client's wishes, carried out through an architect. This will ensure the correct materials are stated on the building documentation. The larger companies will usually have contracts in place with suppliers which will allow them to purchase materials at cheap rates.

Remember

As well as ordering possibly the wrong size, other problems arising from the client dealing with the materials can be substandard materials and delays in materials delivery, all of which can cause delays in the job.

Working life

You are working on a renovation project when your boss calls you to ask what materials you need for the next few weeks. You are caught a bit off-guard, and you rush around – giving your boss a list of materials over the phone. When the materials are delivered, there are some discrepancies: it's not what you said, as far as you can remember. You phone your boss to tell him and he gets cross, blaming you for the mistakes.

Who is to blame? What should have been done? You will need to think about the ideal process that should have been followed. What information could you have used? Where would you get this information? What would be the best way of getting this information to your boss?

Any specialist materials will be resourced by a buyer. They will look at which companies provide the materials, what the cost is and what attributes the company has, such as whether they work with fair trade etc.

Remember

Bills of quantities are used to help contractors provide a tender for a contract. A bill of quantities is put together for a task, including labour, materials etc.

Bill of quantities

The bill of quantities is produced by the quantity surveyor. It gives a complete description of everything that is required to do the job, including labour, materials and any items or components, drawing

Figure 2.36 Every item needed should be listed on the bill of quantities

on information from the drawings, specification and schedule. The same single bill of quantities is sent out to all prospective contractors so they can submit a tender based on the same information – this helps the client select the best contractor for the job.

All bills of quantities contain the following information:

- **preliminaries** – general information such as the names of the client and architect, details of the work and descriptions of the site
- **preambles** – similar to the specification, outlining the quality and description of materials and workmanship, etc.
- **measured quantities** – a description of how each task or material is measured with measurements in metres (linear and square), hours, litres, kilograms or simply the number of components required
- **provisional quantities** – approximate amounts where items or components cannot be measured accurately
- **cost** – the amount of money that will be charged per unit of quantity.

The bill of quantities may also contain:

- any costs that may result from using subcontractors or specialists
- a sum of money for work that has not been finally detailed
- a sum of money to cover contingencies for unforeseen work.

Figure 2.37 is an extract from a bill of quantities that might be sent to prospective contractors, who would then complete the cost section and return it as their tender.

Item ref No	Description	Quantity	Unit	Rate £	Cost £
A1	Treated 50 × 225 mm sawn carcass	200	M		
A2	Treated 75 × 225 mm sawn carcass	50	M		
B1	50 mm galvanised steel joist hangers	20	N/A		
B2	75 mm galvanised steel joist hangers	7	N/A		
C1	Supply and fit the above floor joists as described in the preambles				

Figure 2.37 Sample extract from a bill of quantities

To ensure that all contractors interpret and understand the bill of quantities consistently, the Royal Institution of Chartered Surveyors and the Building Employers' Confederation produce a document called the Standard Method of Measurement of Building Works (SMM). This provides a uniform basis for measuring building work, for example stating that carcassing timber is measured by the metre whereas plasterboard is measured in square metres.

Advantages and disadvantages of purchasing and hiring plant

Plant hire is an important aspect of a construction job to be taken into consideration – usually during the tender stage. The hiring of plant is not essential on all jobs but most jobs, and especially large ones, will require some plant to be hired in one way or another.

The type of plant that can be hired ranges from portable power tools to mobile tower scaffolding. It could also include cranes and diggers.

However, not all plant is hired and some items are bought outright by the company rather than hired. Most companies will have all the relevant trade-related power tools. For example, carpenters will have bought their own cordless drills or circular saws and bricklayers will have bought their own cement mixers.

If a certain item of plant is required and is not already owned, is it better to buy or hire? The final decision you make will depend on a variety of factors but will mainly come down to cost. If something large like a crane is required then obviously the cheapest option is to hire one rather than buy it. But for something small it may still often be better to hire. Similarly, if you only need to use an item for a small length of time for a specialist job, it would be much better to hire it rather than buy it.

Remember

If you are hiring plant such as cranes, you will also need to employ a qualified operator to use it.

There are exceptions to this. For example if a carpenter had ten kitchens to fit then it would be better to buy a worktop jig for a router at £80 rather than hire one on ten different occasions at £10 per hire.

Planning the sequence of material and labour requirements

We have already looked at how specifications and schedules are used to plan construction projects and establish the requirements of the project.

The main planning relating to the sequence of material and labour requirements will be taken into account when the programme of work is devised. This usually takes the form of a bar or progress chart which is covered in more detail below.

To plan sequences of material and labour requirements, you will also need to be familiar with some of the common methods of working used to ensure the smooth operation of materials and labour. This includes:

- work programmes and critical path analysis
- stock rotation systems
- lead times
- pricing systems.

Work programmes

Did you know?

The Gantt chart is named after the first man to publish it. This was Henry Gantt, an American engineer in 1910.

Bar charts

The bar or Gantt chart is the most popular work programme as it is simple to construct and easy to understand. Bar charts have tasks listed in a vertical column on the left and a horizontal timescale running along the top.

	Time in days									
Activity	1	2	3	4	5	6	7	8	8	10
Dig for foundation and service routes										
Lay foundations										
Run cabling, piping, etc. to meet existing services										
Build up to DPC										
Lay concrete floor										

Figure 2.38 Basic bar chart

Each task is given a proposed time, which is shaded in along the horizontal timescale. Timescales often overlap as one task often overlaps another.

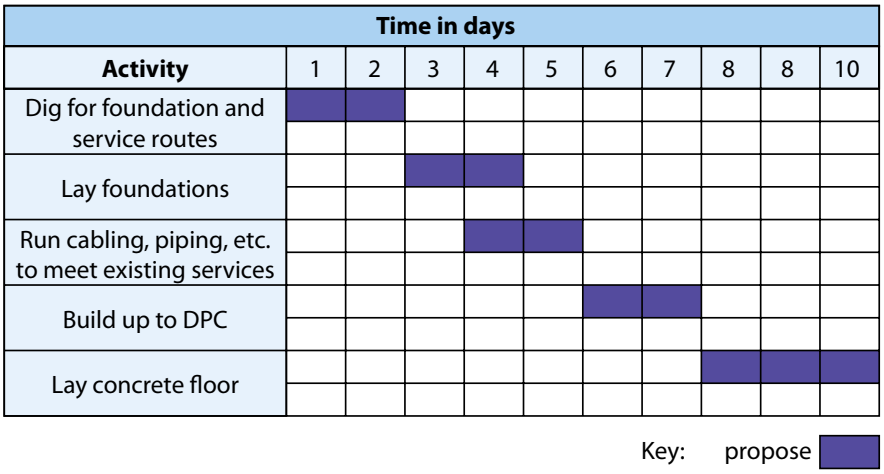


Figure 2.39 Bar chart showing proposed time for a contract

The bar chart can then be used to check progress. Often the actual time taken for a task is shaded in underneath the proposed time (in a different way or colour to avoid confusion). This shows how what has been done matches up to what should have been done.

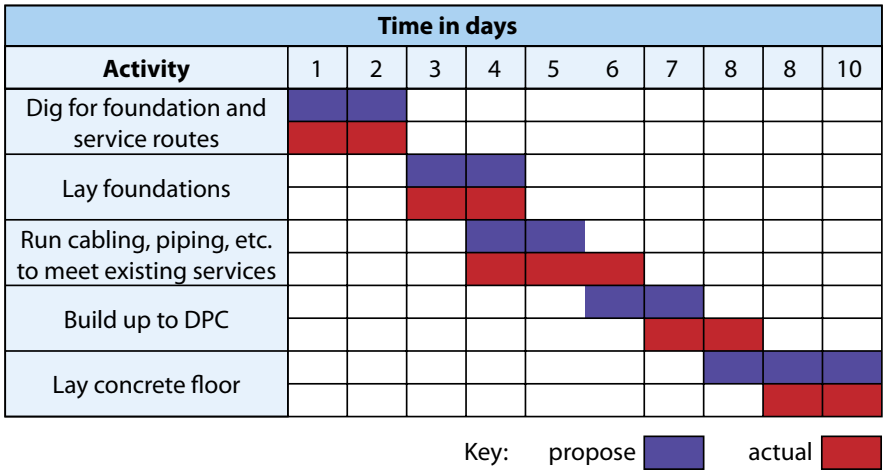


Figure 2.40 Bar chart showing actual time half way through a contract

As you can see, a bar chart can help you plan when to order materials or plant, see what trade is due in and when, and so on. A bar chart can also tell you if you are behind on a job; if you have a penalty clause written into your contract, this information is vital.

Did you know?

Bar charts are used to identify areas that could cause problems. You will need to have an idea about the sort of things that can go wrong on a project and plan contingencies to deal with any problems.

Did you know?

Bad weather is the main external factor responsible for delays on building sites in the UK. A Met Office survey showed that the average UK construction company experiences problems caused by the weather 26 times a year.

When creating a bar chart, you should build in some extra time to allow for things such as bad weather, labour shortages, delivery problems or illness. It is also advisable to have contingency plans to help solve or avoid problems, such as:

- capacity to work overtime to catch up time
- bonus scheme to increase productivity
- penalty clause on suppliers to try to avoid late or poor deliveries
- source of extra labour (e.g. from another site) if needed.

Good planning, with contingency plans in place, should allow a job to run smoothly and finish on time, leading to the contractor making a profit.

Critical paths

Another form of work programme is the critical path. Critical paths are rarely used these days as they can be difficult to decipher. The final part of this chapter will give a brief overview of the basics of a critical path, in case you should come across one.

A critical path can be used in the same way as a bar chart to show what needs to be done and in what sequence. It also shows a timescale but in a different way from a bar chart: each timescale shows both the minimum and the maximum amount of time a task might take.

The critical path is shown as a series of circles called event nodes. Each node is split into three: the top third shows the event number, the bottom left shows the earliest start time, and the bottom right the latest start time.

The nodes are joined together by lines, which represent the tasks being carried out between those nodes. The length of each task is shown by the times written in the lower parts of the nodes. Some critical paths have information on each task written underneath the lines that join the nodes, making them easier to read.

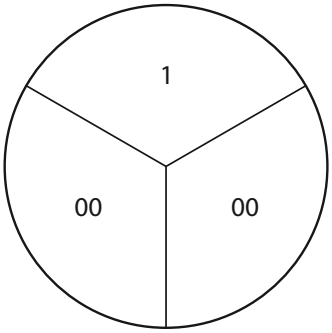


Figure 2.41 Single event node

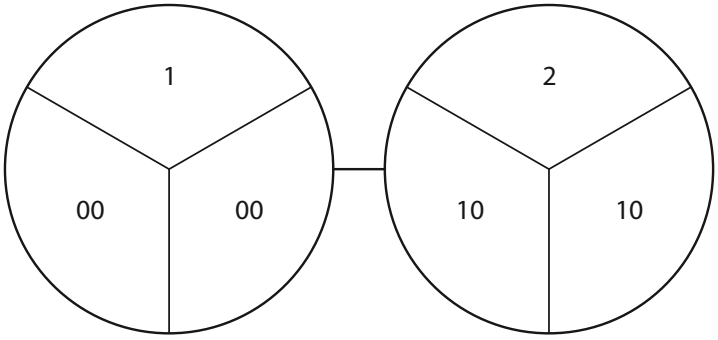


Figure 2.42 Nodes joined together

On a job, many tasks can be worked on at the same time, e.g. the electricians may be wiring at the same time as the plumber is putting in the pipes. To show this on a critical path, the path can be split.

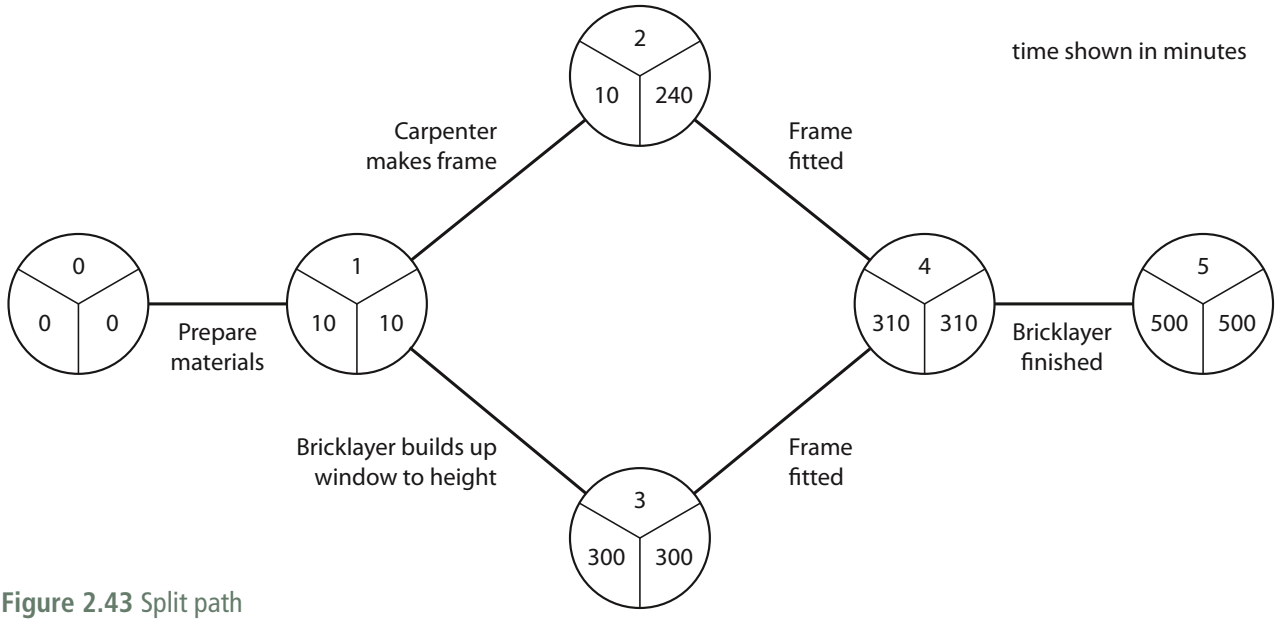


Figure 2.43 Split path

The example in Figure 2.43 shows how a critical path can be used for planning building in a window opening, with a carpenter creating a dummy frame.

The event nodes work as follows:

- **Node 0** – This is the starting point.
- **Node 1** – This is the first task, where the materials are prepared.
- **Node 2** –This is where the carpenter makes the dummy frame for the opening. Notice that the earliest start time is 10 minutes and the last start time is 240 minutes. This means that the carpenter can start building the frame at any time between 10 minutes and 240 minutes into the project. This is because the frame will not be needed until 300 minutes, but the job will only take 60 minutes. If the carpenter starts after 240 minutes, there is a possibility that the job may run behind.
- **Node 3** –This is where the bricklayer must be at the site, ready for the frame to be fitted at 300 minutes, or the job will run behind.
- **Node 4** – With the frame fitted, the bricklayer starts at 310 minutes and has until node 5 (500 minutes) to finish.
- **Node 5** –The job should be completed.

Remember

Whichever way you choose to programme your work, your programme must be realistic, with clear objectives and achievable goals.

When working with a split path it is vital to remember that certain tasks have to be completed before others can begin. If this is not taken into account on the critical path, the job will run over (which may prove costly, both through penalty clauses and also in terms of the contractor's reputation).

On a large job, it can be easy to misread a critical path as there may be several splits, which could lead to confusion.

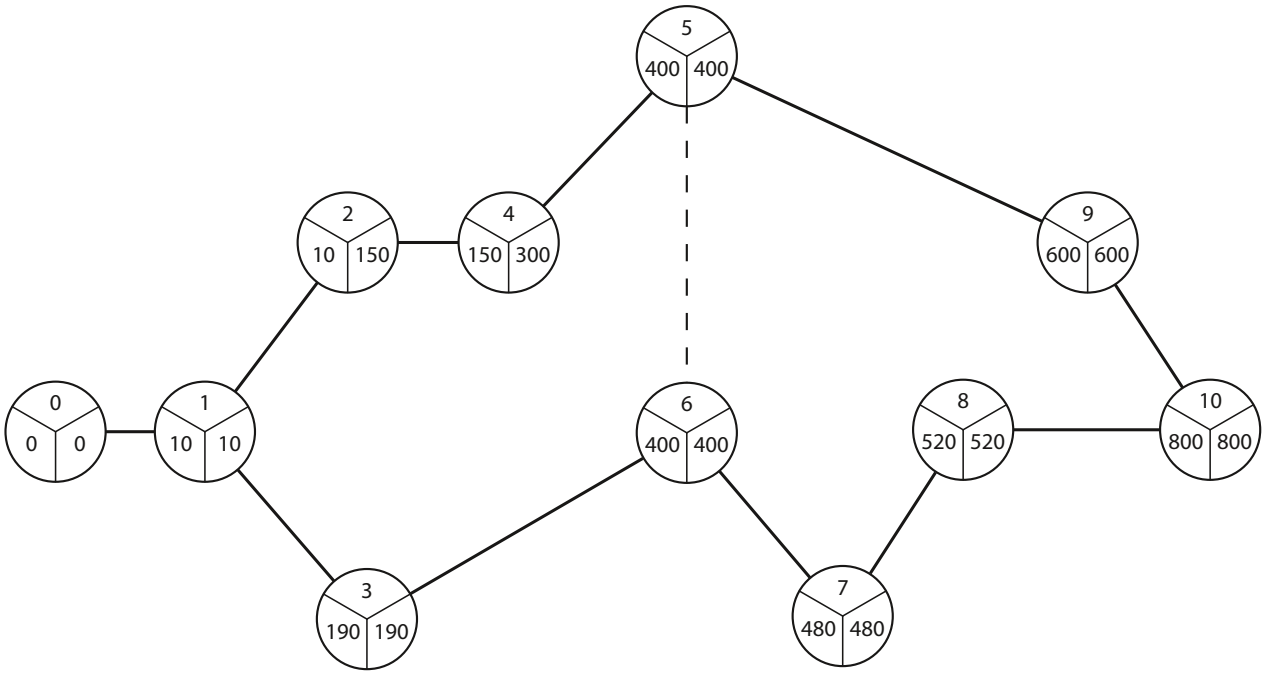


Figure 2.44 Critical path for a large job

Functional skills

This exercise will allow you to practise **FM 2.3.1** Interpret and communicate solutions to multistage practical problems and **FM 2.3.2** Draw conclusions and provide mathematical justifications.

Working life

You have been tasked with designing a programme of work for a large contract involving the building of 20 houses. You have been told you need to plan all the work that needs to be carried out, as well as ensuring that all the materials required for the work are purchased and delivered to site on time and to schedule, so that they will be ready for work to continue without delay.

- What sort of thing should you check prior to starting?
- What should you do about plant, labour and materials?
- What sort of programme should you use (bar or critical path)?
- What amenities should you consider?

Stock systems

Stock systems are mainly used with larger companies, suppliers and larger sites. A good stock system will ensure that all the materials required on site are available when needed and that no

materials are damaged either through overstocking, which can lead to storage problems, or by materials such as plaster going off.

When taking delivery of materials, the newest materials are placed at the back in storage. This will ensure that the older materials are used first, while they are still in date.

Lead times

Lead times are how long you should expect to wait for a new delivery of materials. Certain materials are not always readily available in a supplier's stock and even suppliers may have to order certain things. For example oversized timbers would need to be ordered in or steel beams which required specially machining or manufacturing would need to be created to order. Where items like these are required, time is built into the planning stage to contact the suppliers and ask for the lead times for these items to ensure that they are available when they are required.

Pricing systems

Pricing systems are also thought through at the tender and the planning stage to ensure that the price paid for labour during price work is not too much. Price work, which is covered in more detail in the next section, is set to ensure that all labour tasks are given a price and that the price for the tasks is set in a way which will get the job done on time. Pricing tasks too high can see the job taking longer.

Example

If hanging a door is priced at £40 per door then a tradesman may only do five doors in a day then finish as he feels he has earned enough for the day, whereas if the doors are priced at £30 or even £20 then the worker will try to do more so that they have earned a good daily wage.

The reverse of this is pricing the jobs too low – which may see the company struggling to get anyone to do the work for a low price.

Calculating hours

The way that labour is paid for can be split into two different methods.

Day work/Hourly rate

This rate is used when the tradesperson will be paid a specific amount for every hour that they work. The amount will depend on where the work is being carried out, as the cost of living is different in each area.

Remember

Materials such as plaster or cement have a use-by date on them; generally, such materials will set or go off about this date. To prevent this, it is vital that the materials are used before this happens.

Places where the cost of living is low may receive £10–£20 per hour. In areas with a high cost of living (such as London) the rate may be £20–£30 per hour or more. The experience of a worker will also affect the day work rate. Newly qualified Level 2 apprentices will not be paid the same as someone with 30 years of experience.

Price work

This rate is used when the tradesperson will be paid for the work they carry out. Examples of this include a carpenter who receives £20 for every door they hang or a painter who gets £300 for every flat they decorate. This method is often preferred, although it can mean that you may have to work harder. However, the more work you do the more you will earn. Again, the prices for these will vary not only from area to area but even within trades.

Example

A carpenter may get paid £2000 to fit a truss roof but only £250 to fit a small kitchen in a flat. A painter may get paid £15 to paint the inside of a window compared with £20 to paint the outside. These differences in price are worked out prior to the job starting and take into account things such as weather or hazards. The roof may look like the best job at £2000, but if it is raining heavily for a week, or alterations to the scaffold are required, then you may not get much work done. However, you may be able to fit seven kitchens in a week no matter what the weather.

Did you know?

When estimating the labour costs for a job it is easier to use the day work rate method as you can calculate how many hours the job will take.

The price work method is calculated by working out how many hours it will take to complete the task and then giving a certain price to that task, based on the day work rate.

For example, the day work rate may be £20 per hour and a roof should take 100 hours. This means a price of £2000 will be put forward.

Remember

The £2000 price is for the whole roof. If four people work on it they will get paid £500 each, not the full £2000.

Range of added costs for estimating which affect profitability

When estimating prices, there is a range of added costs that need to be considered. You will need to factor in these costs before you begin pricing a job.

These added costs can also affect the final profitability of a project.

Remember

Other factors that can affect profitability include delays caused by weather, worker strike action and other external elements over which you may have no control.

Types of insurance

All companies that carry out work must be insured through public liability and if they employ others then they will also need employer's liability insurance.

- **Public liability insurance** – this will cover you if someone is accidentally injured by you or your business operation. It will also cover you if you damage third party property while on any work-related business. The cover should include any legal fees and expenses which can result from any claim by a third party. You should aim to have a level of insurance which covers you for at least £1,000,000. This may seem a lot but you could have several cases directed at you at any one time. **Premiums** for public liability can start from around £100 per year. Failure to have public liability insurance can see your company go bankrupt if a claim is made and you are not covered.
- **Employer's liability insurance** – this is also required by law if you employ other people. If an employee should be injured at work, or become ill as a result of the work that you ask them to carry out, then employer's liability insurance gives you a minimum level of cover if you are sued. Cover for this should start at £5,000,000. Again this may seem a lot but the premium can again be as little as £100. Failure to have employer's liability insurance can lead to a fine of up to £2,500 for any day you operate without this insurance. Insurance policy certificates must be retained for 40 years, as illness that can occur may appear at a later stage and you need evidence of cover.

You will need to make National Insurance contributions. These are paid to build up your entitlement to certain social security benefits, including state pensions. The amount of money you pay will depend upon your employment status (employed or self-employed). Employers will also be expected to make a contribution to each employee's National Insurance, again with the amount depending on how much they earn.

Key term

Premium – the amount you pay in order to be covered by an insurance company. The premium will be based on a quote given to you by the company and will be paid in one lump sum or, as is more common, in instalments over a year

Did you know?

Combined policies for both of these types of insurance are usually the best way to operate and premiums can start from around £180.

Stage payments

Stage payments are often used in contracts of any size but more so in large contracts and they usually mean that a percentage of the total price for the job will be paid upon the construction reaching a certain stage. This can be beneficial to both parties, as some small contractors will like a small percentage paid up-front so that they can organise the delivery of materials or pay for other costs that have arisen during the job. If the job is half done, then 50 per cent of the payment can be made. Usually, with a stage payment, a small percentage is held back at the end of the job for a short period of time to allow for any faults or blemishes that appear to be fixed.

VAT

VAT or Value Added Tax is a form of tax that is charged on most goods and services that VAT registered businesses provide in the UK. The current rate of VAT in the UK is 20% (since January 2011) but it can fluctuate. This happened after the financial crisis in 2009 when it was lowered to 15%. The VAT amount means that services or goods have an extra percentage added to them as a tax. For example a power tool may cost £100 but with the current rate of VAT added you will have to pay £120.00 for it.

PAYE

Find out

Using the Internet and other sources, find out the current rate of tax and show the impact it would have on earnings.

PAYE or Pay As You Earn is a method of paying income tax and National Insurance contributions. Your employer will deduct these amounts from your wages before you are paid. For example you may earn £300 per week but, after deductions, this could fall to just over £200. With regard to PAYE, every employed person is given a tax code which relates to the amount of tax you pay. A tax code could be 117L which means that you could earn up to £6,475 per year (c. 2010–11) before you pay tax but any money you earn over this amount will be taxed.

Functional skills

This task will allow you to practise **FE 2.3.1–2.3.5** Write documents, including extended writing pieces, communicating information, ideas and opinions effectively and persuasively.

Self-employed workers will not follow the PAYE system but will be paid the full amount. However, they are expected to keep a note of their earnings and expenses and once a year will file a tax return in which they will pay all the year's taxes in one lump sum (usually in January, six months in arrears and for the six months ahead, with another sum payable in July). Employers will also pay tax on each employee

Travel expenses

Travel expenses are occurred when travelling to and from a job and although they usually consist of fuel expenses it is also important to consider other things such as bridge tolls or congestion charges. It may not seem like much at the time but a job that lasts 20 or 30 days and which includes a £10 charge for these can easily see the profits start to fall so it is worth considering this when pricing up a job.

Profit and loss

It is important that profit and loss balance sheets are kept by a company, as these will show how the company is performing over a period of time. The simplest form of profit and loss will show how much money a company has taken and deduct from it the amount spent. For example, a job may be priced at £10,000 which has taken four weeks to complete – during which £8,000

has been spent on materials, wages, taxes etc.; this means that the profit for this period is £2,000.

Suppliers' terms and conditions

All suppliers will have some form of terms and conditions which will outline what restrictions are in place for the use of goods and services. These are used as a form of insurance by the company and will include things such as payments, the customer's responsibilities and the company's liability.

Wastage

Wastage can have a massive effect on profitability as the more waste there is, with regard to materials and other ancillaries, the more money is lost out of your profits. A simple way to keep a tab on wastage is to monitor what is ordered against what is needed. For example if 2.5 m lengths of timber are required then you should only order the next size up, which would be 2.7 m, as ordering 3.0m lengths would create waste and expense.

Building up a price

As has been shown previously, building up a price is not simply about calculating what materials, equipment and labour are required but also involves other factors such as insurances, taxes, expenses and so on. If you do not take these things into account, you can quickly see your profits evaporate.

K3. Know how to ensure good working relationships

Good working relationships are absolutely vital when working on site. It is important to have good relationships not only with those who you are working with directly, but also with other trades and professionals you come into contact with. In addition, you need to have a good relationship with the client, who is the overall 'boss' of the entire project!

There are number of methods that can be used to achieve good working relationships on site. These include the following.

- **Good planning** – it has been mentioned time and again that good planning is vital on a site but never more so than when ensuring that good working relationships are maintained. Planning that the correct trades are in when needed will avoid problems between them, as having the wrong trades in or having them arrive in the wrong order can lead to work having to be re-done, which will cause conflict.

- **Regular site meetings** – these can be vital in preventing conflict as each trade should be represented and they can give updates on progress or possible conflicts.
- **Ensuring that competent tradespeople are employed** – working with or after workers who have not done a good job will lead to conflicts as the work they do may have to be re-done. This will cause problems for the people who have to put the work right and can lead to delays which will create conflict with the trades who are waiting to get on with their work.
- **Leaving your work area clean and clear** – this may sound simple but leaving a mess for the following tradespeople will upset them as they will either have to clean up themselves or wait until it is clean. This will delay their work and if on price work will cost them money.
- **Working safely** – again a simple point but this is crucial as not working safely will lead to hazards and possible injuries which can cause conflicts.

Maintaining trust and confidence in colleagues

One of the main components of a continued good working relationship is trust. Just as in everyday life, having trust and confidence in a colleague or friend can help with the relationship in the same way that having no trust or confidence can break it. By doing simple things such as arriving when you say, doing what you say and by being open and honest you can start to bring trust into the relationship. Being professional, helpful and working to the best of your ability will instil confidence in your colleagues. This is important as having no confidence in work colleagues can create problems and conflict.

Explain the need for accurate communication throughout the stages of construction

Accurate communication is vital for efficient relations between everyone who may be involved in a business, from the employer and employees through to clients and suppliers.

Most of the crucial moments when you will need to use good, clear and effective communication relate to decisions that will have a wider effect on the business and those working around you. Some examples of these include the following.

- **Alterations to drawings** – it is important to communicate any changes to these to everyone involved, as all the planning, estimating, material orders and work programmes will be based

in part on these drawings. Not communicating changes could lead to mistakes in all these areas.

- **Variations to contracts** – the contract with the client is the crucial document that dictates all decisions that are made on a worksite. Changes to this document must be made known throughout a business.
- **Risk assessments** – the results of these assessments have a direct impact on the safety of workers on site, and should be made known to all.
- **Work restrictions** – these should be communicated to everyone as a restriction is put in place for a specific reason. The restrictions may be put in place for safety reasons. This would mean the area is unsafe so everyone who may be affected needs to be told.

Functional skills

In answering the Check it out and Check your knowledge questions, you will be practising **FE 2.2.1** Select and use different types of texts to obtain relevant information, **FE 2.2.2** Read and summarise succinctly information/ ideas from different sources and **FE 2.2.3** Identify the purposes of texts and comment on how effectively meaning is conveyed.

You will also cover and **FM 2.3.1** Interpret and communicate solutions to multistage practical problems and **FM 2.3.2** Draw conclusions and provide mathematical justifications.

FAQ

How do I know what scale the drawing is at?

The scale should be written on the title panel (the box included on a plan or drawing giving basic information such as who drew it, how to contact them, the date and the scale).

How do I know if I need a schedule?

Schedules are only really used in large jobs where there is a lot of repeated design information. If your job has a lot of doors, windows, etc., it is a good idea to use one.

Which type of programme should I use: bar chart or critical path?

It is up to the individual which programme they use – both have their good points – but a bar chart is the easiest to set up and work from.

What if it rains for the entire 20-day duration of the job?

The job would be seriously behind schedule. You can't plan for the weather in this country, but it would be unwise to start an outside job during a rainy season. There are companies that can provide scaffolding with a fitted canopy to protect the work area, which would be ideal for a job in this situation. Larger jobs have longer programmes, and when they are drawn up they are made more flexible to allow for a lot of rainy days.

Check it out

1. Describe the main advantages of using a CAD system and use it to create a 3-D wireframe and dumb solids program.
2. Produce a component drawing for an item that you are familiar with.
3. Produce a detailed drawing of a component you are familiar with.
4. Using a suitable scale, create a setting out drawing for a segmental brick arch with an opening span of 1.8 m, so that the rise and radius can be identified.
5. Using a suitable scale, create a setting out drawing for a rafter with a span of 3.5 m and a rise of 1.4 m, so that the true length of the rafter and angles of cuts can be identified.
6. Explain in detail the process followed in the client/architect consultation on projects.
7. Describe the purpose of a bill of quantities and then put together your own example using a job you are familiar with.
8. Draw up a flow chart explaining the different steps involved in the tender process, both for the client and for those companies who are submitting tenders.
9. Put together your own schedule for the work on one of the jobs you have carried out. Put together two versions of this schedule: a bar chart and a critical path, using event nodes.
10. Take a task that you are familiar with as part of your work. Think about all the possible costs and implications that are connected with this job. Try to work out a price for it, including all the ancillaries discussed above, such as taxes.
11. Draw up a method statement that describes the best working practices for communicating with other trades on site. Make a clear note of the important information that you will need to make sure is conveyed from one person to another while working.

Getting ready for assessment

The information contained in this unit, as well as continued practical assignments that you will carry out in your college or training centre, will help you with preparing for both your end-of-unit test and the diploma multiple choice test. It will also aid you in preparing for the work that is required for the synoptic practical assignments.

Working with contract documents such as drawings, specifications and schedules is something that you will be required to do within your apprenticeship and even more so after you have qualified. Similarly, when working professionally you will need to be able to build up a price accurately and correctly.

You will need to be familiar with:

- producing drawing information
- determining quantities of material and price estimates
- a knowledge of good working relationships.

A particular focus of this unit has been the estimating of quantities and materials needed to build up a price. Learning outcome two has shown you how to analyse the resources required for a construction task, as well as the advantages and disadvantages that exist in hiring or purchasing equipment. You will need to be able to assess and evaluate the material needs of a project and then complete a plan for the sequence of labour and materials. You will also need to be able to identify the added costs that can contribute to the final price you build for a project.

To get all the information you need you will need to build on the maths and arithmetic skills that you learned at school. These skills will give you the understanding and knowledge you will need to complete many of the practical assignments, which will require you to carry out calculations and measurements including estimations of price for tasks to be completed.

You will also need to use your English and reading skills. These skills will be particularly important, as you will need to make sure that you are following all the details of any instructions you receive. This will be the same for the instructions you receive for the synoptic test, as it will for any specifications you might use in your professional life.

Communication skills have also been a focus of this unit, and of learning outcome three. This unit has shown the importance not only of communicating clearly and consistently with everyone on site, but also of building up relationships that are built on trust and confidence.

Teamwork is a very important part of all construction work and can help work to run smoothly and ensure people's safety. Relationships are a vital part of all teamwork and you will need to be able to demonstrate how the key personnel should communicate effectively within this team. The communication skills that are explained within the unit are also vital in all tasks that you will undertake throughout your training and in life.

Good luck!

Check your knowledge

1 What scale are block plans are usually drawn at?

a) 1:1250
b) 1:500
c) 1:200
d) 1:10

2 What stage is CAD normally used in a project?

a) final planning
b) drafting
c) pricing
d) on-site plans

3 What is the British standard code number for structural timber?

a) BS EN 12390-3:2009
b) BS 5268-2:2002
c) BS EN 1097-8:2009
d) BS EN 12350-1:2009

4 What information will a specification contain?

a) site description
b) services
c) workmanship
d) all of the above

5 What does a line drawn 45 mm long at a scale of 1:20 represent?

a) 90 mm
b) 900 mm
c) 9000 mm
d) 45 mm

6 A line drawn 25 mm long at a scale of 1:250 represents what?

a) 6000 mm
b) 6250 mm
c) 6500 mm
d) 6750 mm

7 When is employer's liability insurance required?

a) if you are employed
b) if you employ others
c) if you do any work
d) if you have public liability insurance

8 What must an employee pay?

a) VAT
b) PAYE
c) public liability insurance
d) all of the above

9 When might a stage payment be used?

a) when a small contractor may need some payment up front
b) when a job is to be completed in stages
c) when a contractor does not have all the money ready
d) for all large contracts

10 Which of these is the most important for building good working relationships?

a) good planning
b) working safely
c) regular communication
d) all of the above