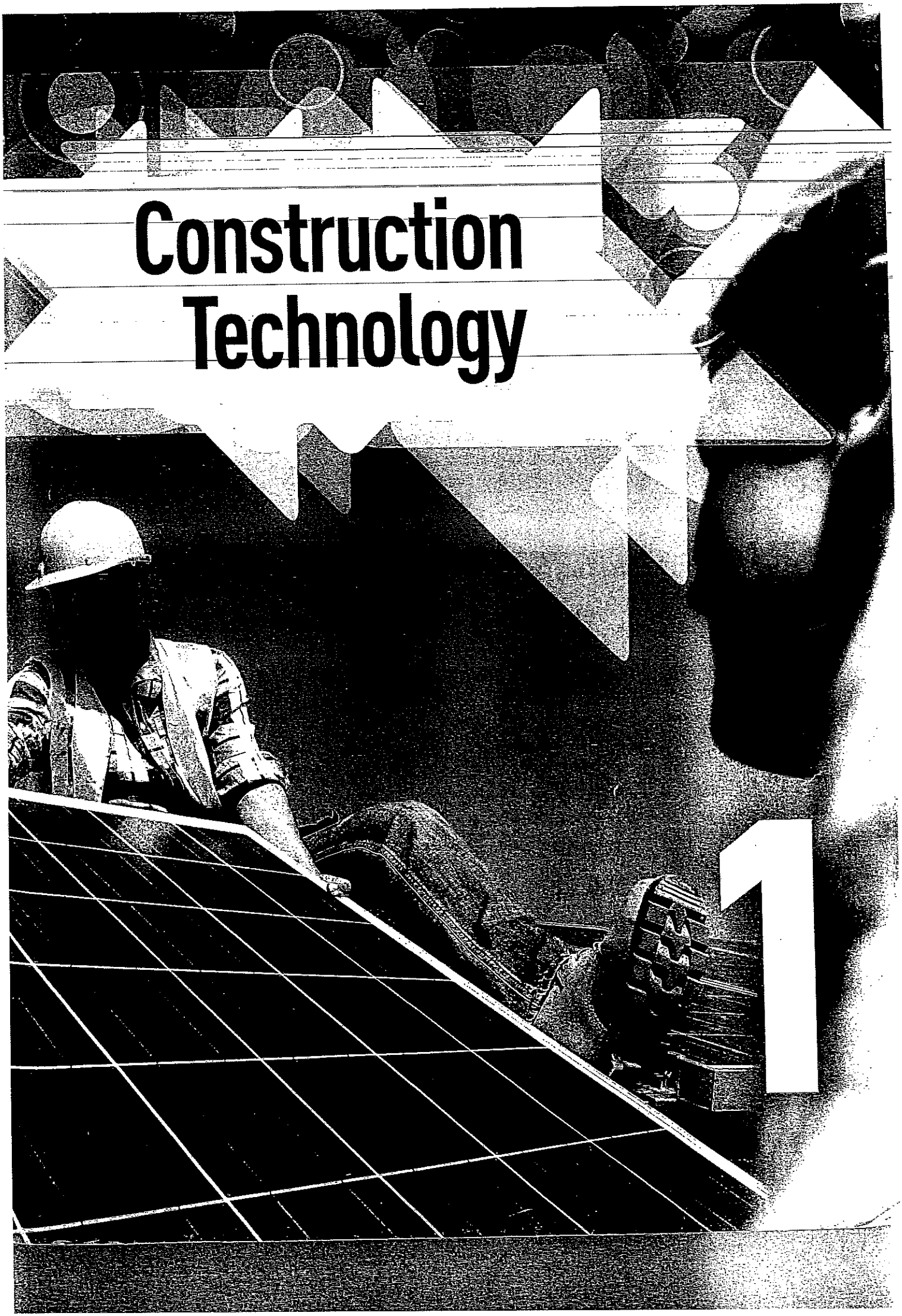


Construction Technology

1

Introduction

How much do you know about how a building is designed and constructed? You have probably thought about it before choosing to take this course, but you may not have realised how important this knowledge is to every job in the construction industry.

Different parts of buildings serve different purposes and so they need to perform in different ways. A roof, a floor and a wall all need to be strong and stable, but they have different jobs and so they must be designed to resist different forces.

In modern construction, sustainability is also a key feature of any design. This ensures new developments do not have a negative effect on the environment.

Whether you are a plumber, an architect, a groundworker or a site manager, it is vital to understand the processes in the construction of buildings. This unit is the foundation of your understanding of the built environment.

Assessment You will be assessed using a paper-based examination lasting one hour.

In this unit you will:

A understand the structural performance required for low-rise construction

B explore how sub-structures are constructed

C explore how superstructures are constructed.

The unit has made me think more about how buildings are designed and constructed. I really enjoyed doing the sketches as they helped me to understand the different processes and materials that can be used. I'd never even thought about them before!

Andy, *15-year-old aspiring electrician*

Performance requirements

Introduction

A building has to be designed and constructed to fulfil certain performance requirements. It has to be strong and stable, but it also needs to able to do other things, such as resist fire and bad weather. People should be comfortable in the building whether it is a house or a workplace. Buildings should also now reach goals of sustainability in materials and construction when they are built.

Key terms

Performance – how well a building provides a comfortable, safe environment for its occupants.

Stable – when a structure can keep its balance without moving.

Sustainability – preserving resources for future generations and minimising the impact of construction activities on the natural environment.

Strength and stability

Loads are the various forces acting on a structure such as a building. A building structure is made up of walls, floors, roofs and foundations. These are called the elements of a building and need to be strong enough to support various loads. If they are not, the building may fall down. There are three types of loads:

1 **dead** – this is a load that does not move, such as the weight of the building itself

2 **dynamic** – these are loads that can change during the use of a building, such as the load from people and furniture

3 **impact** – this is when something hits a building or falls on it, such as a heavy object.

Link

Sketching is a good way to improve your understanding of how a building performs. For more about sketching and construction drawings, see *Unit 2: Construction and Design* and *Unit 5: Construction Drawing Techniques*.

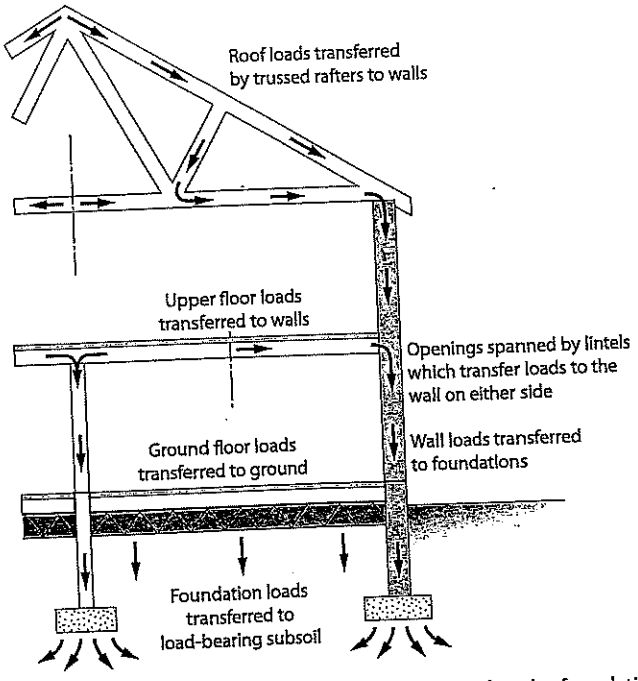


Figure 1.1 A dynamic load is transferred from the roof to the foundations through the walls and floors

The loads depend upon the location of the building. These loads are transferred from the roof to the foundations through walls and floors as shown in Figure 1.1. A building has enough strength if it can resist these loads and remain stable.

Discussion

Think about the building you live in. Working in groups, answer the following questions.

1 Which parts of this building are holding it together?

2 Are you putting any load on the building? What type of load is this?

Case study

Meena is a structural engineer. Every day, she has to think about the performance requirements of the buildings she designs so that these are strong and stable. She is designing a block of flats in the city centre. The building will also have a sports complex at the ground floor, including a swimming pool. The building will have four storeys.

1 Why does Meena have to think about the performance requirements of the different parts of a building at the beginning of the design process?

2 Meena is making a list of all the loads this block of flats would have. What sort of loads should she think about when she is designing the building?

3 Are the loads you have mentioned live, dead or dynamic?

Slump testing on a building site. What do you think will happen if the water : cement ratio is too high or too low?

Testing and grading materials

The strength and stability of a building depends on the materials used to construct it. These materials are tested to make sure they have the needed strength.

Concrete is commonly used in foundations and floors, so its strength is crucial. Before concrete is used, tests are carried out on site to make sure it is strong enough.

- Slump testing checks that the **ratio** of water and cement in wet concrete is correct. If wet concrete loses its shape or 'slumps' too easily, the balance is not right.
- Compressive strength testing checks that the hardened concrete is strong enough to withstand loads.

Timber is used in structures such as frames of buildings or roof trusses, as well as in doors and windows. The strength of various types of timber is tested. Timber is then sorted into various groups. This process is called stress grading or strength grading.

Mortar testing is performed by making cubes of mortar to check how much water can pass through it, or if there are any gaps causing leakage.

Key term

Ratio – the proportion of one thing to another. For example, if a ratio of water : cement is 1 : 2, there is twice as much cement as water.

Remember

A British Standard starts with the letters BS. The document tells us that the material meets the minimum standards needed in Britain. A European standard starts with the letters EN, which means that the document has details about materials meeting the standards needed in Europe. A standard containing 'BS EN' shows that both British and European standards have been met.

Specifying and grading materials

For any building, the designer tells the construction team clearly about the type of materials to be used. This is called material specification.

The materials selected will comply with either British Standards or European Standards. These are standards that ensure the quality of materials used in all sorts of industries, including construction. It is important to use materials that meet these standards because this makes sure the building has the right strength to support the loads.

Did you know?

Adding steel bars in concrete increases its strength. This is then called reinforced concrete. Concrete without any steel bars is described as plain concrete.

The material specification will also confirm the strength of material needed. Most materials are graded or classified according to their strength.

The strength of a material is calculated by working out how much pressure it can take. This pressure is measured in Newtons per square millimetre (N/mm^2), which means the amount of pressure that a piece of the material measuring 1 mm by 1 mm can resist. So if the strength of a concrete mix is 30 N/mm^2, a piece of that concrete measuring 1 mm by 1 mm could withstand 30 Newtons of pressure before it broke. The strengths of different materials are as follows.

Key terms

Coniferous – these are trees that have cones, such as pine, larch and fir. Timber used from these trees is also called softwood.

Deciduous – these are trees whose leaves fall during the year. Examples include oak, beech, ash and walnut. Timber used from these trees is also called hardwood.

Hardcore – materials such as broken bricks, stone or concrete, which are hard and do not readily absorb water or deteriorate.

Aggregate – a term used to describe the rock material used in concrete and hardcore such as gravel and sand.

- **Concrete** – available strengths of concrete range from 8 N/mm^2 to 60 N/mm^2. When specifying materials, concrete with a strength of 25 N/mm^2 is written as C25. The higher the number that is next to the letter C, the stronger the concrete is. If concrete is to be used to take the load of a structure, its strength should be at least 25 N/mm^2. The standard that is relevant to concrete strengths is BS EN 206-1.
- **Timber** – timber strength ranges from 14 N/mm^2 to 70 N/mm^2. When it is being specified, the letter C (**coniferous**) means softwood and D (**deciduous**) means hardwood. This means that timber is classified from C14 to C50 and D30 to D70. A D30 timber is a hardwood with a strength of 30 N/mm^2. The strength class is stamped on the timber.

Activity 1.1

You are working on a house that will be built using a wooden frame. The designer has specified a C30 timber for the frame and a D30 timber for the wooden floor. What sort of timber do you need to buy?

- **Bricks** – these are classified according to their strength and the amount of moisture that they can absorb. All bricks should have a minimum strength of 5 N/mm^2. The relevant standard for clay bricks is BS EN 771.
- **Hardcore** – this is used to provide an even base under the floors. It is a mix of gravel, sand, broken bricks and crushed concrete, and is also known as **aggregate**. It is classified based on the size of the pieces of material in the mixture. The higher the number in the classification, the larger the pieces are.
- **Mortars** – these provide a bond between layers or courses of brick and block work. These are classified according to where they will be used. For example, a commonly used mortar in masonry is called G, which means it is for general purpose. The other classification is based on how these are made – for example, factory-based or site-based. BS EN 998 is the relevant standard.

Research

Which European standard deals with the classification of timber?

Remember

All timber is labelled to describe its strength and condition. Timber should be in 'dry' condition for use in a building. If it does not say 'dry', it will be 'wet' and should not be used, as it will not be strong enough.

Just checking

1 What does BS stand for? What does it indicate?
2 What are the two standard tests used to check the strength of concrete?
3 How is the strength of a material calculated?

Cavity walls

Cavity walls are walls constructed as two halves, called skins or leaves. The gap between the two skins is called a cavity, which is normally filled with insulating material above ground level. Below ground level, it is filled with concrete to make it both stronger and more stable.

As a cavity wall is constructed in two halves, **wall ties** are provided to connect these together. This makes sure the wall will stay in place and will not move. Wall ties should be provided every 900 mm horizontally and every 450 mm vertically as shown in Figure 1.2. These wall ties make sure a cavity wall provides both strength and stability or composite strength and stability.

Key term

Wall tie – a component used to join the two halves or skins of a cavity wall.

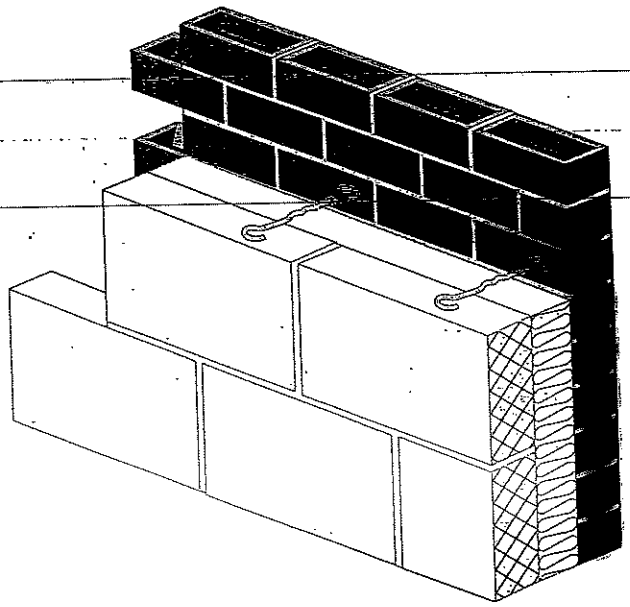


Figure 1.2 Cavity walls are provided with wall-ties to make them stable. What do you think might happen if a cavity wall did not have any wall ties?

Activity 1.2

Sketch a diagram showing the transfer of loads from the walls into the foundations.

Remember

Sketching does not mean that you have to produce a perfect drawing. It just means that you have to represent an object, whether that is a brick wall or a whole building.

Assessment practice 1.1

Complete the sentences below.

1 A timber classified as C45 is: [1]

- ☐ **A** a hardwood
- ☐ **B** planed all round
- ☐ **C** a softwood
- ☐ **D** deciduous.

2 Wall ties are provided: [1]

- ☐ **A** so that the wall looks good
- ☐ **B** for no particular reason
- ☐ **C** only horizontally for stability
- ☐ **D** both horizontally and vertically for stability.

Research

- Find out which Building Regulations affect work on buildings no taller than 12 m.
- Find out the maximum height, length and thickness of a cavity wall for a two-storey building.

Fire resistance

Fire-resistant buildings can save lives and damage to property. Fire resistance can even make sure a building stays standing after a fire.

Key term

Intumescent paint – paint that is intumescent swells when heated. This makes it fire resistant, as when it is heated up by fire, it expands and becomes a thicker layer on top of the painted material. This slows down the transfer of heat to the painted material.

Fire-resistant materials

When building a new structure, it can be best to build using fire-resistant materials. These include:

- plasterboard
- concrete
- blockwork
- **intumescent paint** applied to an existing structure to improve its fire resistance.

Fire-resistant design

The design of a building can also affect its fire resistance. Buildings are usually divided into sections called fire compartments, so that a fire in one compartment will not affect the others. These compartments are separated by features known as fire barriers. These include fire walls and separating floors made out of concrete, door closers which stop doors being left ajar, and fire-resistant doors that are steel, painted with intumescent paint. This stops the spread of fire and makes it easier for firefighters to put out the fire.

Equipment for fire resistance

Other features can also be used to stop fires occurring or spreading, or to make a building safer if a fire does break out, such as:

- fire escapes – these allow people to reach safety without using stairs or lifts inside a building. Fire escpes are often attached to the sides of buildings
- refuge areas – these are fire-resistant areas inside a building, designed to be used by less able bodied people, or people with reduced mobility
- cavity fire barriers – these are used to stop the spread of fire through cavities in a building, such as in a wall or ceiling
- fire alarm systems and smoke detectors – these help to alert people to the fire as soon as possible, making it easier to get everyone out of a building quickly and safely
- sprinkler systems – these help to put out fires, especially small fires. They are located in the ceiling and switch on automatically when a fire is detected.

Why is a fire escape necessary even if there are internal stairs and a lift?

Assessment practice 1.2

1 Carry out a survey of your college building and identify two fire-resistance measures that have been provided. [2]

2 Explain the functions of: [2]

- fire barriers
- sprinkler systems.

Thermal insulation

Key term

Thermal insulation – insulation against heat loss.

Buildings have to be heated to make them comfortable to live in. However, buildings are not airtight, so they lose heated air through gaps in their structure or in the materials used to construct them. This is why buildings need thermal insulation.

A poorly insulated building will use more energy to maintain a comfortable temperature inside. This means that the energy costs will be higher. A well-insulated building uses less energy and so is cheaper to heat.

Can insulation be made of sustainable materials?

U-values

A U-value is used to measure heat loss from any element of a building. A lower U-value means that the building element is well insulated. The Building Regulations Approved Document L specify the U-values for various elements of a building. These are shown in Table 1.1 below.

Table 1.1 Acceptable U-values in a new building (from Building Regulations, Approved Document L)

Element of building	Highest acceptable U-value
Roof	0.20 W/m²K
Wall	0.30 W/m²K
Floor	0.25 W/m²K
Windows	2.00 W/m²K

Activity 1.3

A house has recently been built and you have been asked to check whether it has the right U-values. Using Table 1.1 above and the following information, comment on whether the U-values below are acceptable.

- Floor 0.22 W/m²K
- Windows 1.98 W/m²K
- External walls 0.70 W/m²K

Types of insulation

There are lots of different kinds of insulation and it is important to choose the right one for the job. This is done by using the right type of insulation.

Table 1.2 Some different types of insulation

Type	Made from	Advantages	Disadvantages
Sheep's wool	Wool	• Can be reused and recycled • Absorbs extra moisture	• Has some non-renewable material • Thermal conductivity can increase if compressed
Glass fibre or glass mineral wool	Recycled glass and silica	• Fire resistant • Does not rot • Can be recycled	• Made from silica, which is not a renewable material • Carbon emissions during its production

continued

Table 1.2 continued

Type	Made from	Advantages	Disadvantages
Rock mineral wool	Rocks	• Fire resistant • Does not rot • Can be recycled	• Production is not environment friendly • Can cause temporary skin irritation
Cellulose	Recycled newspapers	• Made from recycled material • Can be reused and recycled	• Paper dust during installation • Can release gases from the printing inks on the recycled paper
Foam	Crushed glass	• Can be recycled • Has good compressive strength	• Production is not environmentally friendly

Research

Select a building, such as your house or your school or college. Find out the type of insulation used in:

- the walls
- the roof.

Think about why this insulation might have been used in this location.

Assessment practice 1.3

1 Explain the difference between sheep's wool insulation and foam insulation. [4]

2 Identify two materials that would give good roof insulation in a terraced house. [2]

Thermal resistance

Buildings can also be constructed from materials that resist the movement of heat. This means that less heat escapes through them and so they need less insulation. These materials have **thermal resistance** and they include:

- aerated lightweight concrete blocks – these can be used to construct walls. The blocks are made of aerated concrete, which is concrete with a lot of air in it. Air is very insulating when it is trapped between solid layers – for instance, when it is cold and you put on an extra jumper, you trap a layer of air between layers of clothing, which insulates you from the cold. So aerated concrete blocks provide better insulation
- timber – this can be used to create features such as window frames and doors. It ca also be used to construct timber-framed buildings
- lightweight **screed** – this is made with lightweight aggregates. These contain more air, so lightweight screed gives good insulation.

Key terms

Thermal resistance – this is measured as an R-value. This shows the ability of a material to reduce heat loss because it resists the movement of heat through it. Increasing the thickness of a material increases its R-value.

Screed – this is made from cement and sand to provide a level surface before a floor is laid.

Location

Some areas of a building are more likely to lose heat than others. Table 1.3 shows which types of insulation are best for different parts of a building.

Discussion

Why do you think a roof and a floor might need different kinds of insulation?

Table 1.3 Different kinds of insulation are needed in different locations

Location	Appropriate insulation
Cavity walls	The cavity in a cavity wall can be filled with an appropriate insulating material such as cellulose or mineral wool.
Solid walls	Plasterboard can be used to line solid walls and help reduce heat loss.
Roof	Mineral wool insulation could be used between joists.
Floors	Sheep's wool insulation could be used under floors.
Windows and doors	• Double glazing improves a building's U-values by stopping unnecessary heat loss. • Draught strips can be applied to door frames to improve the air-tightness of doors by stopping draughts.

Key term

Double glazing – this is a technology used to make windows less likely to lose heat. A double-glazed window is made of two panes of glass with a narrow gap in between them. The air is sucked out of this space to create a vacuum. It is difficult to transfer heat through a vacuum, so a double-glazed window loses less heat.

Assessment practice 1.4

Chris is designing a house for a client who is interested in sustainability and wants to keep their future energy costs as low as possible.

1 Name two areas or elements of the proposed building that are most likely to lose heat. [2]

2 For each area or element named in question 1, suggest a suitable insulation material. Give reasons why you have chosen that material. [4]

Sound insulation

A building should be insulated to resist letting sound through its structure. This means that people living in one house are not disturbed by noise from their **adjacent** neighbour. Good sound insulation is important in improving quality of life by reducing external noise into the building, such as traffic or the sound of overhead aircraft. It also ensures privacy, so that your next-door neighbour cannot overhear your conversations!

When sound travels inside a building, it bounces off the walls, ceilings and floors. Sound can also travel in from outside, from passing vehicles or passers by. This sound can travel inside through windows, doors or external walls. This creates **noise** and thus affects the human comfort of the people using the building – that is, it makes it less enjoyable for people in there.

Key terms

Adjacent – next to or touching something. For example, the houses either side of a terraced house are adjacent to it.

Noise – this is any unwanted sound. Noise should be avoided wherever possible.

Types of sound insulation

Buildings therefore have to be insulated against this noise. Like thermal insulation, there are a lot of different types of sound insulation. These include:

- **triple glazing** – used in doors and windows
- **heavy density blockwork** – used to construct sound-resistant walls between adjacent rooms and flats
- **sound insulation quilt** – usually used in floors and cavity walls as well as in ceilings and under floors
- **plasterboard layers** – generally used in insulating both solid walls and cavity walls
- **flooring mats and carpeting** – these can be an effective form of sound insulation as they absorb noise. If no carpets are provided, the sound will bounce off the walls and floors, resulting in noise
- **acoustic ceilings** – made up of special materials that absorb sound and are used where good sound transmission is required, such as in theatres, music rooms or home cinemas.

When designing a building, it is really important to locate sound insulation appropriatel You should think about the likely uses of rooms and the potential noise levels of each roor

Activity 1.6

You are planning a new arts and drama building for your local college or school. The building is going to have:

- a music studio
- two drama performance studios
- six practice rooms for music practice, including one room for a drum kit
- a dance studio.

What sort of sound insulation are you going to need? Where will it be needed? Remember to give reasons for your answers.

Provision of sound insulation

Good sound insulation can be achieved by:

- increasing the density of a material. This means that the speed of sound trying to pass through these materials is slowed down
- using robust design details. A robust detail is a set of drawings or sketches that makes sure buildings have the right sound insulation, according to Part E of the Building Regulations. This ensures that all buildings have the correct insulation bu into their design
- dividing the building structure in a way that sound from one part does not travel the other part. This is called sound isolation of a structure. For example, in larger buildings, one part can be detached from another
- using machinery silencers. These help to reduce the noise from machinery used in the construction process. This is especially important when working on a site adjacent to other houses.

Discussion

- Why do you think that noise in buildings from either people or machinery can be a problem?
- Think about a time when you were disturbed by other people's noise. Do you agree with the term 'noise pollution'?

Assessment practice 1.5

The grid below shows a number of locations and different types of insulation. Match the location to the appropriate type of insulation. [3]

Proposed location	Type of insulation
A music studio in a drummer's garage	Triple glazing
A conservatory on the flight path to Heathrow	Heavy-density blockwork
A house next to a busy main road	Acoustic ceiling

Research

1. Find an appropriate robust detail for a masonry wall.
2. Sketch and label the detail.

Weather resistance

Buildings are designed and constructed to provide a comfortable environment for their occupants. This means that they should protect people from weathering elements, such as heat, cold, humidity and rainwater.

These weathering elements can also damage the building and its finishes. For instance, if rainwater can enter a building through the roof, this will not only stain the walls but also damage them, reducing the building's **useful life**.

How are buildings made resistant to the weather elements? There is a variety of waterproof and **impervious** materials available to the construction industry. These include:

- **using materials such as PVC** to make guttering, **soffits** and window frames. PVC is a plastic and is very weather resistant, particularly against water. Mastic can be used to keep ventilation ducts weatherproof, as it stops the water penetrating through
- **rubber weather seals** and **sealants** – these are applied to doors and windows to stop water entering into the building. Seals and sealants do so by either blocking the entry or letting it drain
- **weather stripping** – these are strips of vinyl that are used to close the gaps in a door or window so that building is weatherproof. Draught strips are also used so that the building is airtight and does not lose heat
- **falls** – these are slopes provided on outer frames of doors and windows as well as on sills so that these can easily shed the water off
- **overhangs** – overhanging eaves above the window also protects it from weathering elements
- **flashings** – these are metal sheets, usually made of lead, used to cover the joins between the roof and a feature protruding from the roof, such as a chimney. This makes the structure weatherproof.

Key terms

Useful life – the length of time that a building fulfils the needs of the people who live or work in it.

Impervious – not allowing water to pass through.

Soffits – the undersides of eaves.

Discussion

Why do you think a sloping exterior sill could be considered a weather-resistant feature? Should the sill slope towards the window or away from the window?

Take it further

Explain why you have chosen the measures that you have picked.

Assessment practice 1.6

Identify four measures you could take to make a house weather resistant. [4]

Sustainability

A sustainable building is designed and constructed to make as small an impact on the natural environment as possible. **Sustainability** aims to:

- achieve reduction in building energy use – this not only reduces energy costs but also reduces the impact of fossil fuels on the environment
- conserve **finite resources** – natural resources such as water and timber are limited or finite. These need to be used carefully so that there is enough for future generations, so wastage of these resources should be avoided
- reduce carbon emissions to the atmosphere – when **fossil fuels** are burned (for instance when a car uses petrol or a power station burns coal), carbon dioxide is released into the atmosphere. Over time, this causes the Earth's temperature to rise, causing issues such as rising sea levels and droughts. It also causes air pollution.

Link

For more information about sustainability, see *Unit 11: Sustainability in Construction.*

Key terms

Sustainability – meeting the needs of the present without giving up the needs and rights of future generations.

Fossil fuels – non-renewable fuels such as coal, oil, gas or peat.

Brownfield – sites that have already been used.

Greenfield – sites that have never been used before.

Orientation – the direction a building faces.

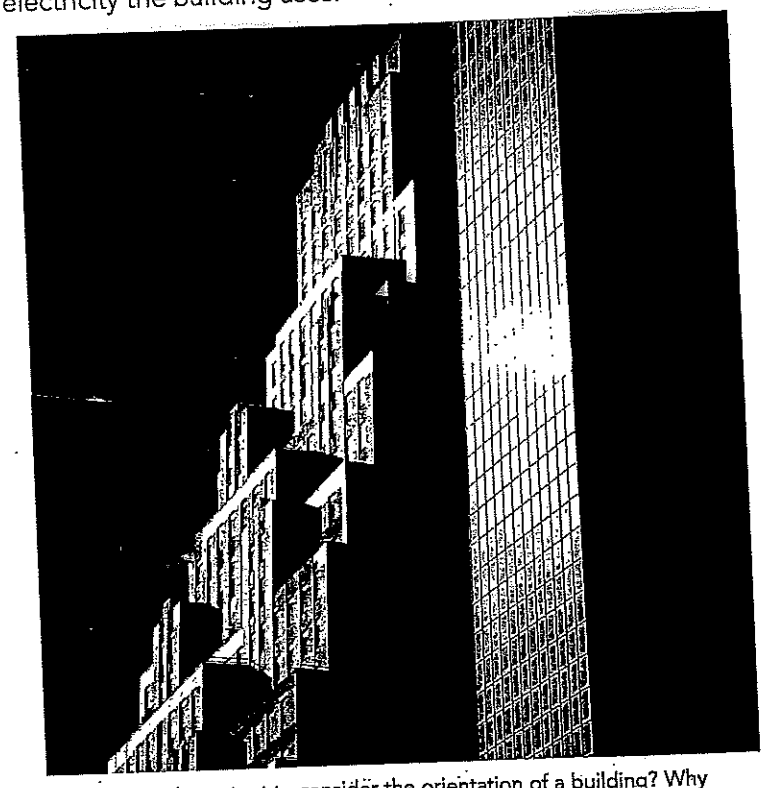
Prefabricated – 'pre' means 'before' and 'fabricated' means 'made'. The term describes the parts of the building made in a factory and brought to site for assembly only.

Embodied energy – the energy needed to produce a material from extraction to its point of use. It is also known as embedded energy, as it is the energy contained by or embedded in each brick, tile or piece of timber.

Methods of sustainable construction

In order to construct a truly sustainable building, sustainability must be part of its initial design. This can be as simple as making sure that the building is facing the right way! To achieve sustainability, the following things should be done.

- Reuse **brownfield** sites. This reduces the number of **greenfield** sites that are used for construction and so keeps a maximum amount of green space. As brownfield sites have usually already been built on, it may also mean that less energy would be needed to develop sites.
- Achieve maximum sunlight through building **orientation**. A building in the UK that faces south will get the maximum amount of natural light. This can reduce the amount of electricity the building uses.



Why is it so important to consider the orientation of a building? Why might this affect the fitting of solar panels?

- Reduce time and wastage by using local suppliers, ordering the right quantities of materials and using **prefabricated** materials.
- Recycle site waste by separation and reuse. Site waste is separated as people put domestic waste into different bins so that it can be easily recycled. Material can be reused as well, such as reusing old bricks and crushing waste concrete.
- Recycle waste materials. Instead of throwing away old items, such as copper tubing, you can reuse and recycle these. These recycled materials use less energy to be produced and thus have low **embodied energy**. They are more sustainable than those made from all-new raw materials. Another example is aluminium, which is found in earth but can also be reused by melting the old aluminium.
- Use sustainable materials that are from renewable sources in construction activities. For example, sheep's wool insulation is a sustainable material because the wool needed to make it can be regrown and so is renewable.

Discussion

Discuss in groups why prefabrication reduces wastage. Give two reasons.

Why do you think it is so important to use sustainable materials as much as possible?

Research

Using the internet, find out why construction with hemp is called carbon-negative.

Key terms

Render – a type of plaster finish used on external as well as internal walls. It can improve a building's insulation.

Cladding – a covering or coating on the outside of a structure.

Sustainable materials

Using sustainable materials is an important part of the construction industry today. They ensure that we do not waste our natural resources.

Table 1.4 Sustainable materials and their uses

Material	Sustainability
Hemp	This is a widely grown plant and has excellent insulation properties. Hemp can be mixed with lime to make insulation products.
Lime	This is a natural, renewable substance used to make mortar. Unlike cement mortar, lime-based mortar can be removed when a structure is knocked down, which means that bricks can be recycled. Lime can also be used in **rendering**.

continued

Table 1.4 continued

Material	Sustainability
Cedar	This is a type of wood used for cladding. It has natural resistance to moisture and humidity, and gives excellent insulation.
Softwoods	These are used to construct timber-frame buildings, softwoods include the Douglas fir and pine. These softwoods can be grown quickly in a sustainable way.
Straw	Straw bales can be used to build walls and even entire houses.
Sheep's wool	This can be used as insulation. It is more sustainable than most artificially made insulation materials.
Aluminium	This is a soft metal that is easily melted down and recycled. It can be used instead of PVC to make guttering and downpipes.

Did you know?

The Forest Stewardship Council (FSC) is the organisation that aims to make sure our forests can meet our needs in a sustainable way.

Just checking

1 List two ways to make a window weather resistant.
2 How does a cavity wall give both strength and stability?
3 List three methods to give sound insulation in a building.

Assessment practice 1.7

Identify any four elements of a sustainable building. [4]

Common structural forms for low-rise construction

Introduction

In this topic, you will learn about the most common parts or structural forms of low-rise buildings. You will learn the terminology (industry-specific words) associated with each part or component, as well as their advantages and disadvantages.

Link

Sketching is a really good way to learn about the different elements in buildings. See *Unit 5: Construction Drawing Techniques* for more about drawings in construction.

Traditional cavity wall construction

In a traditional cavity wall construction:

- the walls and foundations are usually the loadbearing elements of the construction

- the external walls are normally constructed as cavity walls while internal walls are solid or partition walls
- the external cavity walls have an outer skin of brickwork and an inner skin of blockwork
- the outer skin can also be rendered to provide extra insulation.

Discussion

Why do you think cavity walls are used as external walls?

Assessment practice 1.8

Sketch and label the cross-section through an external cavity wall. [4]

Cross-wall construction

In cross-wall construction, the front and back of the building is constructed as non-loadbearing, while loadbearing walls are at right angles to these walls. This leads to the name cross-wall. The floor between these cross-walls is connected to all four walls and provides lateral restraint.

This form is suitable for blocks of flats or apartments, as it is ideal for creating similar floors. They are quick to construct as components such as whole walls can be made off-site.

However, there can be problems where the non-loadbearing claddings and the cross-walls meet, as these junctions might not be weatherproof.

Key term

Lateral restraint – when movement of building elements is stopped sideways.

Did you know?

If both walls and floors are made using reinforced concrete, series of 'boxes' are formed. This is called box frame construction.

Structurally Insulated Panels (SIPS)

These are insulated timber panels that are strong enough to take loads. They have a central layer of insulation, with a plywood face on each side. SIPS construction is similar to timber-framed construction but is faster and large panels can be made to speed up the process. The method provides a lighter frame, is thermally efficient and helps to reduce site waste. Because the panels are wooden, fire resistance could be an issue.

Finishes can be applied directly to the panels. These include exterior brickwork, blockwork, tiling and rendered finishes, as well as more sustainable finishes such as timber cladding and hemp rendering.

Link

For more about sustainable finishes, see *Unit 11: Sustainability in Construction.*

Research

Using the internet, research the use of SIPS. Look out for:

- the advantages and disadvantages of using SIPS
- different types of buildings that have used SIPS.

Timber-framed construction

Timber framing is commonly used in houses. The frames are made of softwood and faced (or covered) with plywood. Loadbearing timber walls are made up of small timbers called studs. Short timber pieces called noggins are placed between them to give stability.

Key terms

uPVC cladding – a covering made of uPVC (unplasticised polyvinyl chloride).

Shingles – a roofing material, generally made of cedar wood.

Timber-framed construction is a sustainable form of construction. It can be constructed with a high level of accuracy and in less time than traditional construction. Frames provide space for the services and are thermally efficient. Timber frames are finished using a variety of secondary finishes, including brickwork, rendered blockwork, cedar cladding, tile hanging, **uPVC cladding** and **shingles**.

The most common parts of timber-framed buildings and their functions are:

- damp-proof course – moisture can penetrate the building from the foundations or under the floors. A damp-proof course (dpc) stops moisture coming in from the foundations, while a damp-proof membrane (dpm) is provided under the floors for the same purpose.
- finishes – timber-framed buildings can be finished like any other type of building and can even be given the look of a traditional building with a brickwork finish. These finishes are attached to the timber frame using flexible wall ties.
- insulation – insulation is provided between the timber studs. Insulation is tied to these studs so that there are no gaps.
- lintels – where openings are provided for windows and doors, a small beam called a lintel is used to direct rainwater away from the opening. Timber studs are also placed around these openings to add strength.
- studs – the timber frame is made of a number of upright timbers called studs.
- moisture resistance – a polythene sheet, called a vapour check, is built in between the internal wall and the insulation to stop moisture penetration.
- plywood sheets – these are attached to the external walls to provide bracing.

Case study

Hui is a joiner's apprentice and is helping to build a timber-framed construction house. He is thinking of important features of timber-framed construction, as well as how to reduce waste using this form of construction.

1 Identify three features of timber-framed construction.

2 List two ways in which waste can be reduced in timber-framed construction.

Assessment practice 1.2

Identify two advantages and two disadvantages of SIPS construction. [4

Learning aim A TOPIC B.1

Pre-construction work

Write as title • Picture of a site.

Introduction

Lots of activities have to be done before work can begin on site. This topic will explore why these are carried out, what has to be provided on a site and how this is done. Sketching is a good way of learning about pre-construction work. Some activities are provided in this section for you to practise sketching.

Desk-based pre-construction

Before work starts on site, a range of activities need to be carried out.

- Some legal requirements have to be fulfilled, such as a construction health and safety plan, method statements and risk assessments. The Health and Safety Executive (HSE) may also need to be informed. Provide to annotate - or sketch
- A scaled site layout plan is prepared. This needs to show site accommodation such as site offices and material storage, and welfare facilities such as toilets and storage accommodation. It also needs to show security fences and temporary roads and services. Fire precaution measures are also considered at this stage. make?
- A document showing the programme of work or schedule of activities is produced. This schedule should also plan out the delivery of resources and materials. Example
- Resources and materials are bought.
- Safety signs are set out and statutory notices are organised. This includes telling people in the local area about any footpath closures. Provide + match up exercise
- Road crossings for plant and deliveries and traffic management are planned.

Link

For more about health and safety in the construction industry, look at Units 6, 7, 8, 9 and 10.

Pre-construction work on the site

This includes all the works carried out on site before construction works can start.

First, the site is cleared of vegetation and trees. Any existing structures are knocked down. Then any existing services (water, gas, electricity) are protected from damage by the building work. Sketch + write this as annotation/title

Next, access and egress (exit) routes into and out of the site are constructed.

Finally, the site is set up, providing site accommodation and temporary services including temporary lighting. Temporary roads and hard standing are put in place. Security arrangements are also installed at this point, including fencing and gates.

Link

If you want to know more about pre-construction works, see *Unit 4: Construction Processes and Operations.*

Activity 1.5

You are setting up a site near a town centre, for a block of flats to be built. Identify:

- two welfare facilities you would need to provide
- three security measures you would need to take
- two factors you would have to consider when planning for materials storage.

Sub-structure groundworks

Introduction

Sub-structure works include activities done below ground level. In this section, safe construction of sub-structures is discussed, including potential hazards. Control of water encountered during groundworks is also looked at. Foundations and floor construction will then be explored.

Why do you think it is so important that people working on foundations follow safe working practices?

Sub-structure involves all the construction works below floor level, including the foundations and associated activities. A very important operation at this stage is excavation. This means digging the ground so that foundations can be constructed.

Hazards associated with groundworks

There is a range of potential hazards when groundworks are carried out. Table 1.5 lists these hazards as well as how they can be controlled.

Table 1.5 Hazards associated with groundworks

Hazard	Risk	Control measure
Gas	Injury or death	Avoiding services such as gas mains.
Collapse of the sides of the excavation (could be due to soil type)	Injury or death	• Trench supports such as timbering is provided to hold back the sides of the excavation. • Physical barriers can be put in place to stop machinery or people putting pressure on weak ground near the edge of the excavation. • A different method could be used, such as trenchfill foundation, which lets foundations be excavated and poured immediately, giving the soil no time to loosen.
Presence of ground water	Flooding or drowning	Pumping out excess water.
Confined space	Crushing or **musculoskeletal** injuries	Using appropriate PPE and reducing the amount of work done in confined spaces.
Existing services such as gas mains, water pipes or electricity cables	Injury, flooding, death or power outages	Locate and protect all existing services before work begins.
Proximity of excavation plant	Injury or death	Barriers stop moving machinery from going too close to excavation.

Key term

Musculoskeletal – to do with the human frame and muscles that function to give movement.

Did you know?

- A hazard is something that has the potential to cause harm, such as the collapse of the sides of an excavation.
- A risk is the result of any accident or event that happened because of that hazard, such as a broken arm resulting from the collapse of the excavation.

Assessment practice 1.10

You are on a site carrying out groundworks. You are told that there is groundwater in the trenches as well as a gas leak in the confined space of the excavation.

1 Identify two risks for each of the two hazards mentioned above. [4]

2 For each risk named in question 1, list one control measure that could be used. [2]

Control of water

Sub-soil water is the water present below ground. It is also known as groundwater. When designing and constructing sub-structure, by law sub-soil water must not be allowed to enter the building and damage it. There are two different ways of controlling water, one temporary and one permanent.

Depending on the site, sub-soil water and surface water might just need to be controlled temporarily during excavation. This is called simple sump pumping, because the water collects in a sump or pool and is then pumped out.

Some sites might need permanent control of sub-soil water. This is known as land drainage. There are several methods of land drainage.

Link

Foundations are discussed in more detail in *Unit 4: Construction Processes and Operations.*

Remember

Foundations provide stability by spreading the building load over a larger area.

Earthwork support

This is the support of the sides of excavation. There are different methods of earthwork support depending on the needs of the site and the type of soil you are excavating, including:

- steel trench sheets
- timbering
- hydraulic trench supports
- aluminium walling.

Foundations

The function of a foundation

A foundation is designed and constructed to safely transmit the loads of the building to the ground or sub-soil. They should be able to support the loads of the building for its lifespan.

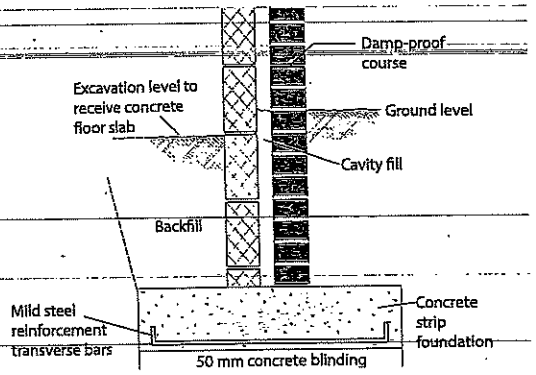
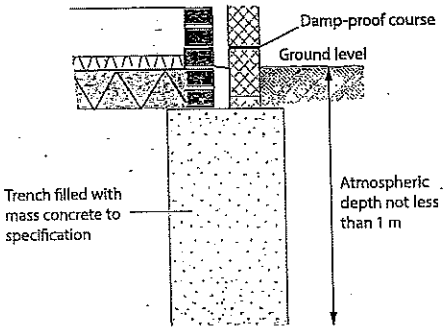
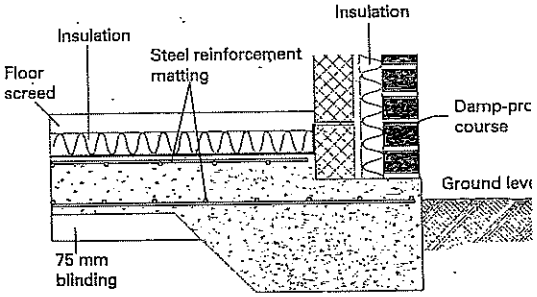
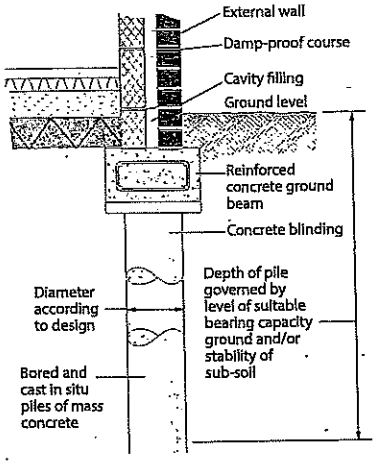
Different kinds of foundation

Various types of foundation are used in low-rise construction. The kind of foundation used depends on the load, type of structure, site requirements and the type of soil. Table 1.6 overleaf shows the advantages and disadvantages of different foundations.

Research

Research technical drawings of strip and deep strip foundations. Use the information on page 22 or use other books and the internet. Then create your own sketches, remembering to annotate (label) each part of these foundations.

Table 1.6 Advantages and disadvantages of different types of foundation

Type and uses	Advantages	Disadvantages	Structure
Strip – commonly used in low-rise construction such as houses where the soil has the right strength.	• Traditional method understood by site staff • Involves doing brick and blockwork in trenches • Cheap	• Might take longer • Can be hazardous as the soil can get loosened • Might need trench support	
Deep strip or mass fill – used for similar types of buildings, quick to construct.	• No brick or blockwork needed in trenches • Faster methods of construction	• Could be more expensive	
Raft foundation – used where soil does not have the same strength or where heavy loads are expected. These are used for commercial or industrial buildings.	• Provides good foundation where soil is variable • Can be used as a floor • Can be used to fit in services	• Expensive to construct • Can crack if not constructed correctly • Needs formwork	
Short bored piles	• Provides foundations when the soil is weak • Quick to construct	• Expensive • Construction causes lot of noise	
Pad foundations – used for columns.	• Provides foundations for heavy loads • Quick to construct	• Needs formwork • Can move if loads are not balanced around it	

Ground floors

A ground floor is the floor of the lowest level of a building. Ground floors can be either solid or suspended.

Link
Floors are also discussed in Unit 4: Construction Processes and Operations.

A **solid floor** bears directly onto the ground from which it gains its support. It is usually made of solid concrete. Solid floors are made up of:

- hardcore to provide a strong base
- sand blinding – a layer of sand to even off the surface of the hardcore
- damp-proof course (dpc)
- damp-proof membrane (dpm) – this stops moisture transfer from the ground into the building by the overlapping of sheets, the taping of any joints, linking to dpc and by having a certain thickness of membrane
- insulation – this should have good compressive strength.

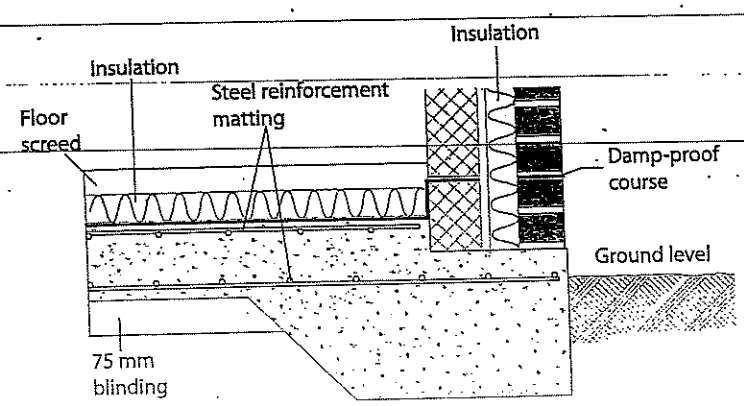


Figure 1.3 Typical solid floor details.

A **suspended floor** is one that is suspended above the ground. It rests on beams spanning between supporting walls. In the modern construction industry, suspended floors are generally built using the beam-and-block method.

Beam-and-block floor

This is a type of suspended floor. It uses precast concrete beams with lightweight concrete blocks as an infill. The method is becoming very popular as it is quick to construct and ensures a high quality.

These floors do not need any preparation and put less of a load on the foundations. As they are precast, they can be laid in bad weather.

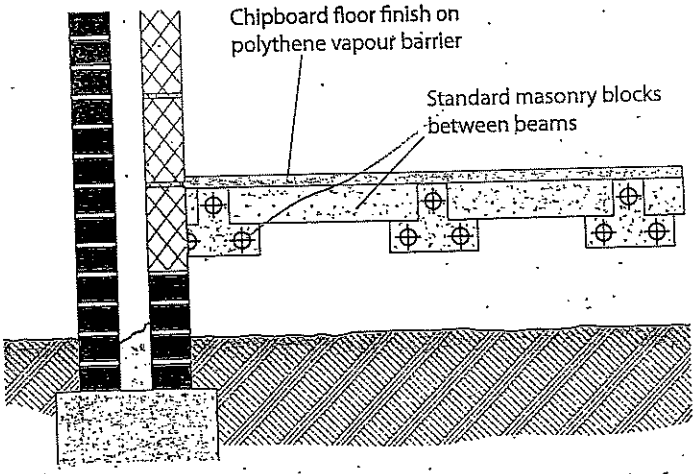


Figure 1.4 A beam-and-block ground floor. The wall below the DPC, often includes an airbrick. This ventilates the empty space below the suspended floor.

Just checking

1 Name three kinds of earthwork support.
2 List two advantages of deep strip foundations.
3 What sort of soil might need a short bore pile foundation?
4 Why might a beam-and-block floor be better than a solid floor?
5 Describe how a damp-proof membrane (dpm) stops moisture entering a building.

Assessment practice 1.1

A sub-structure engineer needs to identify the component parts of a foundation drawing.

1 Label the components of the foundation cross-section shown opposite. [7]

2 What is the name given to the foundation in the cross-section shown in Figure 1.5? [1]

☐ **A** Deep strip ☐ **C** Ground beam

☐ **B** Raft ☐ **D** Mass fill

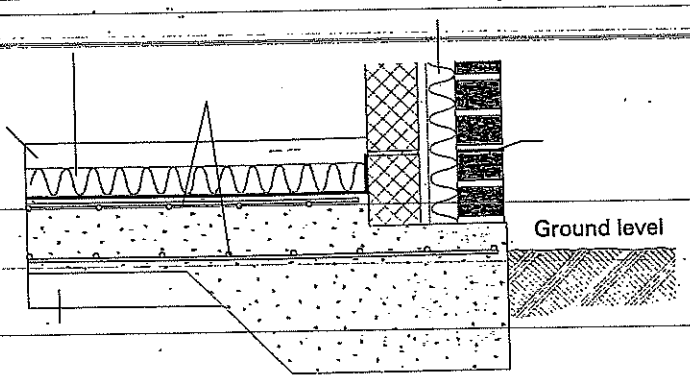


Figure 1.5 Foundation cross-section.

Superstructure – walls

Introduction

The superstructure is everything in a building above ground level. In this topic, you will learn about the construction of walls, the materials used and the finishes applied.

Link

More details on the superstructure can be found in *Unit 4: Construction Processes and Operations.*

A wall performs a number of functions such as:

- resisting heat transfer
- reducing sound transmission
- transferring loads to foundations
- providing shelter and security.

Detailing a wall

This is the process of producing a drawing that contains all the details about the construction of a wall, such as the materials to be used and the wall's size.

Internal partitions are constructed to divide the floor area of a building into smaller and more useful spaces such as an en-suite bathroom. Internal walls can be constructed as timber stud walls, which are similar to timber-framed construction. Internal walls can also be constructed in solid blockwork where concrete blocks are laid in layers or courses. Partitions can also be provided using metal stud walls, generally made of aluminium frame, with glass panes, doors and windows as required.

See pages 7 and 16 for more information on cavity walls.

Materials used

While finishing a wall in brickwork, care must be taken that the colour and appearance of the brickwork does not vary too much, so that the finished look is as pleasing as possible.

Mortar is a mixture of sand and lime, or sand and cement with or without lime. Lime makes the mortar more workable but as it is more porous (letting moisture through), it allows frost to penetrate and cause damage.

Thin joint masonry is a faster method of constructing walls. As the name suggests, the joints between various layers are thin compared with traditional methods. These joints are 2 to 3 mm thick. A fast-setting mortar is used, which can give the required strength very quickly. This masonry depends on the accuracy of block sizes. Generally lightweight blocks are used, which also provide good thermal efficiency.

Did you know?

The most common kind of mortar is general purpose masonry mortar (indicated by the letter G). This may be factory-made or site-made.

Wall finishes

Rendering blockwork is a process similar to plastering, though render can be given different textures.

Facing brickwork usually has various types of joints with **pointing**. Joints improve the weather-proofing and the appearance of the brickwork. Weather-struck and bucket handle joints provide better weather resistance, as water can run off and will not penetrate through the brickwork. Flush and recessed joints give a better appearance.

Key terms

Pointing – filling the joints in brickwork with mortar to improve appearance and weather proofing.

Aesthetics – the appreciation of beauty or the appearance of something.

Wall openings

Openings have to be included in walls to provide:

- ventilation – the circulation of fresh air in a building
- sunlight
- **aesthetics** – the attractiveness of a building.

Table 1.7 Components of wall openings and their functions

Component	Function
Lintel	A horizontal support across the top of a wall opening, such as over a door or a window.
Sill	A piece of material below a door or window to allow rainwater to run off, away from the opening.
Threshold	A strip of material forming the bottom of a doorway.
Cavity tray	A damp-proof course inside a cavity wall, which funnels moisture out of the cavity through weepholes.
Cavity closer	This closes off the cavity around a wall opening, reducing heat loss.
Weep hole	A small opening in brickwork which allows moisture to escape.

Assessment practice 1.12

1 Identify three components of a wall opening. [3]

2 The function of wall openings is to provide: [1]

☐ **A** ventilation, fresh air and water ☐ **C** aesthetics, light and weep holes

☐ **B** ventilation, light and aesthetics ☐ **D** a view of the landscape.

Superstructure – floors

Introduction

In this section, you will learn about construction of floors in terms of materials used. Finishes applied are also discussed. This topic is covered in more detail in Unit 4.

Link

For more details on floors, see *Unit 4: Construction Processes and Operations.*

Floors are horizontal surfaces that are designed to provide a level surface. They make our buildings able to be lived in and functional. They also reduce sound transmission within a building and transfer loads to the walls.

As discussed on page 23, floors can be constructed as solid floors or as suspended floors.

Materials

Floors are constructed using a wide range of materials. These include:

- concrete – beam-and-block floors use pre-cast concrete beams with lightweight concrete blocks as an infill
- timber – suspended floors can be constructed using different types of timber joists, which are like beams and support the floor load. These can be made of natural timber or man-made timber products. Some joists are not solid and have open areas providing space for services. These are eco-joists and use less timber
- engineered timber – newer buildings may have floors made of applied finishes such as laminate and engineered timber. These need less maintenance and are also less likely to be affected by moisture and defects such as rot.

Floor finishes

Solid floors can be finished in screed, which provides a level and even surface. Additional floor finishes such as carpets can be laid on top of this.

Floors could be finished using ordinary chipboard, moisture-resistant chipboard or softwood. A wooden board called a skirting board is provided along the bottom of the wall. This is used to make the joint between the wall and the floor look more attractive and protects the wall base as well.

Floor components

The floor is made up of joists or beams suspended between supporting walls which support the load from the floor. Joists are supported by the walls. They can either rest on the wall or be connected using special components called hangers. These are attached to the side of a wall and receive the joists.

TOPIC C1

Superstructure – roofs

Introduction

In this section, you will learn about the construction of roofs, the materials used and the finishes applied.

Function of a roof

Roofs are designed and constructed to be able to support their own weight as well as resist loads due to their finishes and other loads such as snow and wind. A roof should also be able to:

- discharge rainfall away from the building, usually through overhanging eaves and guttering
- make the structure waterproof
- provide a recreational area in the case of green roofs (roofs covered with grass and plants)
- be aesthetically pleasing, through the use of attractive roof tiles and finishes
- provide extra accommodation or space.

Link

You can learn more about roofs in *Unit 4: Construction Processes and Operations.*

Details of roofs

A roof can be constructed as flat or pitched. Types of pitched roofs can include lean-to, mono pitch, double pitch, gable end and hipped-end.

As there are lots of different types of roofs, it is important to consider the performance requirements of the building before deciding on which kind of roof to construct. Table 1.8 shows the advantages and disadvantages of flat and pitched roofs.

Table 1.8 Advantages and disadvantages of flat and pitched roof types

Type	Advantages	Disadvantages
Flat roof	• Aesthetically pleasing • Provides parapet feature in the building • Ease of maintenance • Forms recreational areas	• Water run-off may be difficult, causing puddles on the roof • Solar reflective paint required, which needs to be maintained • Extra hardwearing surfaces might be needed
Pitched roof	• Aesthetically pleasing • Creates more floor space or storage space • Better water run-off • Less maintenance needed	• Initial cost higher than flat roof • Takes longer to build • Difficult to access for maintenance

Roofing terminology

Different parts of a roof have names. It is important to know this terminology. Figure 1.6 shows the components of a roof and their names.

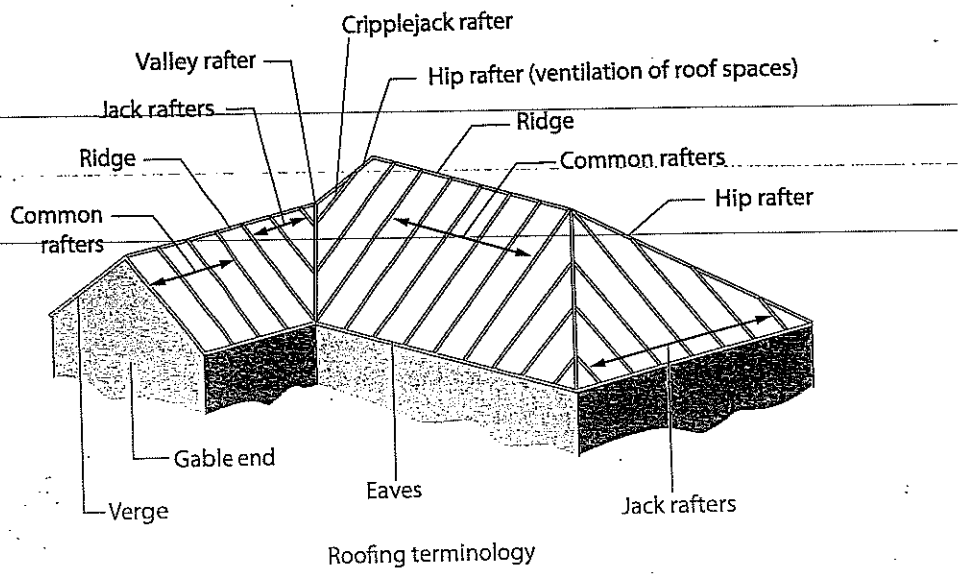


Figure 1.6 Different parts of a pitched roof. What advantages do you think a pitched roof has over a flat roof?

Components and materials

A roof is made of components that support the load or weight of the structure. These can be made of timber, concrete or steel. Insulating materials and materials to provide resistance to moisture are also used. Pitched roofs are finished using a variety of tiles such as natural slates, clay and concrete tiles.

A flat roof is finished using waterproofing materials. Both flat and pitched roofs drain rainwater away through a system of drainage pipes.

Assessment practice 1.13

1 Describe one advantage and one disadvantage of two kinds of pitched roof. [4
2 Identify four components of a pitched roof. [4

WorkSpace

Dom Goodwill

Trainee quantity surveyor

I'm a trainee quantity surveyor with a firm of chartered surveyors. At first, my job involved estimating quantities of materials, but soon I got involved in all sorts of activities, from the submission of tenders to variations and claims. In a normal day, I will use my knowledge of construction technology to prepare estimates and price work to be done.

My supervisor and mentor is a professionally qualified senior surveyor. She helps me to think about my future career in quantity surveying, so now I know what I need to do in order to reach my goals.

Sketching is really important in my job. It really helps you to understand how something is constructed. I often use it in front of clients to explain technical details which would be difficult to explain in words. My job also involves interpreting drawings and sketches, so I need to keep up to date with Building Regulations, new materials and methods.

If you think you know what career you want in the construction industry, then construction technology may not seem relevant right away. However, knowing how buildings are constructed will be useful in any job in the construction industry.

Think about

1. How do you think having a mentor helps Dom?
2. How do you think understanding drawings helps Dom to prepare estimates and price work?
3. Which job roles need knowledge of construction technology?

BTEC
Assessment Zone

How you will be assessed

You will take a paper-based examination. The examination paper will have a maximum of 50 marks. The number of marks available for each part of a question will be shown in brackets, e.g. [2], with the total for each question being shown at the end of the question.

There will be different types of question in the examination:

Disclaimer: These practice questions and sample answers are not actual exam questions. They are provided as a practice aid only and should not be assumed to reflect either the format or coverage of the real external test.

A Questions where the answers are available and you have to choose the correct answer(s).

Tip: Always make sure that you read the instructions carefully. Sometimes you may need to identify more than one correct answer.

Examples:

Which **one** of the following is an example of a dead load? [1]

A Wind load
B Weight of people
C Weight of the structure
D All of above

Answer: C

Which **one** of the statements below best describes a strip foundation? [1]

A It is used for large structures
B It is used where soil is weak
C It is mostly used in domestic construction
D It is expensive to construct

Answer: C

B Questions where you are asked to produce a short answer worth 1 or 2 marks.

Tip: Look carefully at how the question is set out to see how many points need to be included in your answer.

Examples:

Construction materials are tested before their use in a building. State two such tests performed on **two** different construction materials. [2]

Answers: Concrete – slump test. Timber – stress grading.

Name **two** pieces of equipment used to provide fire resistance in buildings. [2]

Answers: Smoke detectors and sprinkler system.

C Questions where you are asked to provide a longer answer – these can be worth up to 8 marks.

Tips: make sure that you read the question in full, and answer all of the parts of the question which you are asked. It is a good idea to plan your answer so that you do not forget anything and remember to check your answer once you have finished.

Example:

A construction firm is planning to construct fifty houses and a sports centre near a large industrial estate. The firm wishes to use construction methods which will have the least impact upon the environment.

Advise the construction firm regarding sustainable construction methods, giving reasons for your suggestions. [8]

Answer: The company's choice of site is important. They could construct on brownfield sites. This will save green areas and will also save the energy required to develop greenfield sites. They should also use the site so the buildings will get maximum sunlight, which can reduce the amount of electricity the buildings use.

Materials also need to be thought about in a sustainable way. Using local materials will reduce transportation costs and carbon emissions. Ordering the right quantities of materials will help reduce wastage of materials. Another way of reducing waste is using pre-fabricated components, because the materials do not need to be cut on site.

The company could also make sure that they use materials from renewable sources, like FSC-certified timber. This means that we will not run out of resources in future.

Recycling and reusing materials reduces waste as well as saving the energy required to make new materials. Using materials which have consumed less energy during their production also helps ensure that the buildings are constructed using the least energy possible.

Finally, the company could make sure that the buildings are well insulated. This ensures that the buildings will use less energy when in use.

Hints and tips

Use the time before the test – make sure that you have got everything you will need. Check that your pen works and that you read the instructions on the front of your examination paper. Try to make yourself feel comfortable and relaxed.

Keep an eye on the time – the examination will last one hour. You should be able to see the clock in the examination room so that you will know how long you have got left to complete the paper. Allow roughly one minute for every mark on the paper, so that a question worth 5 marks takes you about 5 minutes to answer.

Read the questions fully – it is easy to misread a question and then write an answer which is wrong. Always check you are doing what you have been asked to do.

Plan your answers – when answering longer questions, spend a minute or two writing down the key points that you want to include in your answer. If you are being asked to evaluate, remember to include positive and negative points in your plan and answer.

Check your answers – once you have answered all of the questions on the paper, you will probably have a few minutes to spare. Use this time to check your answers, especially the longer ones. Fill in any blanks which you have left. Try to answer every question on the paper.

Make sure you have completed the front of the paper – once the examination has finished, check that you have written your name and candidate number on the front of the paper.

How to improve your answer

Read the two student answers below, together with the feedback.
Try to use what you learn here when you answer questions in your examination.

Question

You are working in a construction firm which is currently working on a housing project. The architect has suggested using beam and block floors instead of solid floors and you agree.

Your manager wants to know the reasons for your preference. Describe **three** advantages of beam-and-block floors. [6]

Student 1's answer

Advantage 1 – no curing required

Advantage 2 – lightweight

Advantage 3 – can be built in bad weather

Feedback:
Although the advantages listed are correct, there is no attempt to explain them. This student would get 1 mark for mentioning each advantage, for instance because beam and block floors are lightweight. However, no reason is given to back up these advantages, for instance why a lightweight floor is an advantage. This means that this student will achieve 3 marks in total rather than 6 marks.

Student 2's answer

Advantage 1 – No curing period is required for beam and block floors. This means that they can be built straight away and hence reduces the construction time.

Advantage 2 – These floors are lightweight which means that they will put less load on the foundations

Advantage 3 – Because beam and block floors are pre-cast, these can be constructed even when weather conditions are bad.

Feedback:
This student has identified three advantages of beam and block floors and backed up these advantages with clear reasons why this is an advantage over solid floors. This student will achieve 6 marks in total.

Assess yourself

Question 1

Which **one** of the following will provide stability to a cavity wall? [1]

A Damp proof course

B Mortar

C Wall ties

D Damp-proof membrane

Question 2

A site plan is made before construction work starts.

It contains details of accommodation, welfare facilities and security arrangements.

List **two** welfare facilities a site plan should have. [2]

Question 3

An architect is designing a large office building. She is trying to decide which type of roof should be used.

Evaluate whether she should choose a flat or a pitched roof. [8]

For further practice, see the Assessment Practice questions on pages 7, 8, 10, 11, 13, 16, 18, 21, 24, 26, and 28.