MY REVISION NOTES

HODDER Education

T-LEVELS

THE NEXT LEVEL QUALIFICATION

BUILDING SERVICES ENGINEERING

- Plan and organise your revision
- Reinforce skills and understanding
- Practise exam-style questions

Mike Jones
Stephen Jones
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SUPPORTED BY Boost

HODDER Education

MY REVISION NOTES

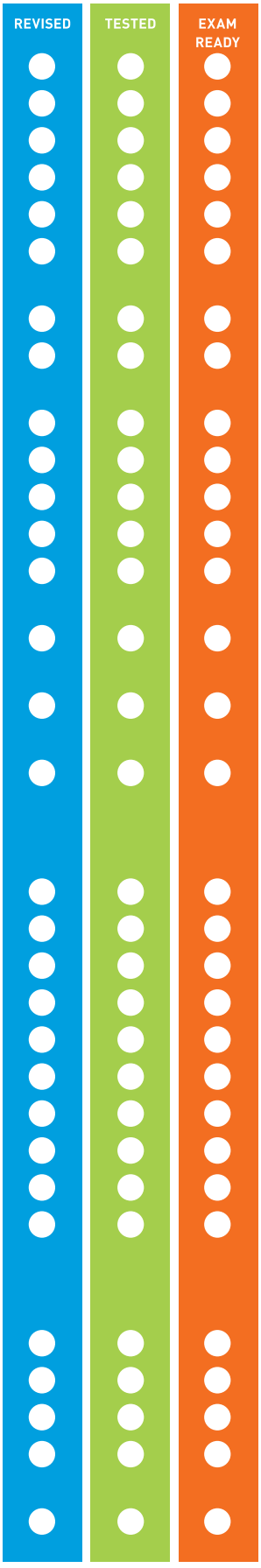
BUILDING SERVICES ENGINEERING

My revision planner

1 Health and safety in construction

2 Construction science principles

3 Construction design principles

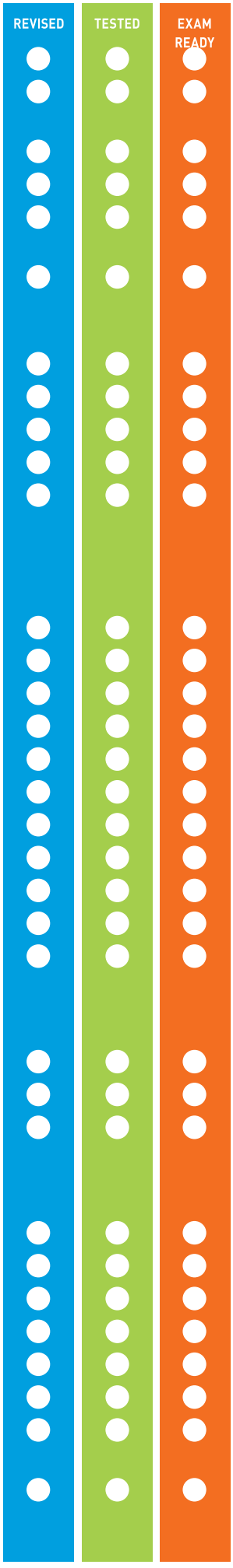


4 Construction and the built environment industry

5 Construction sustainability principles

6 Construction measurement principles

7 Building technology principles

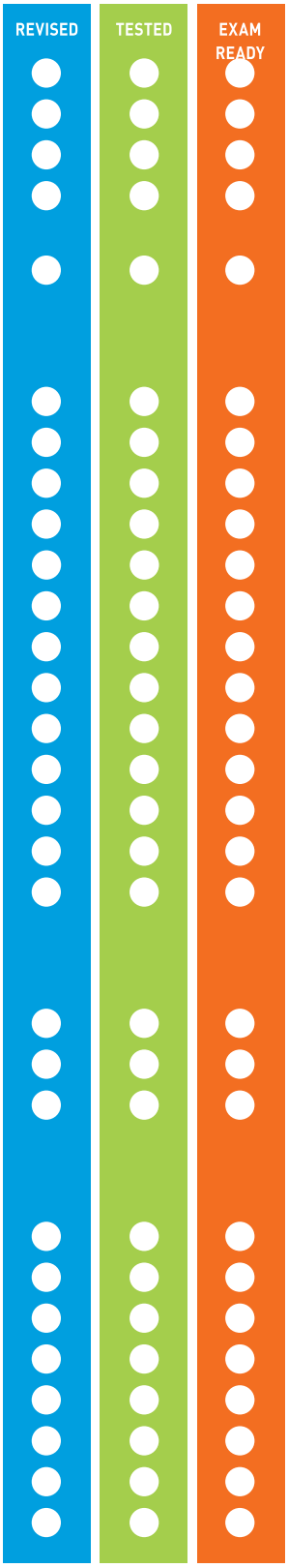


8 Construction information and data principles

9 Relationship management in construction

10 Digital technology in construction

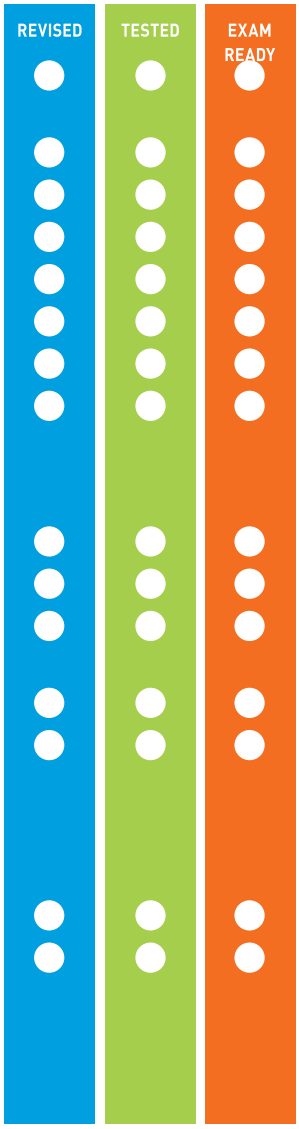
11 Construction commercial/business principles



12 Building services engineering (BSE) systems

13 Maintenance principles

14 Tools, equipment and materials



Countdown to my exams

From September

- Attend class in person or via the internet if necessary.
- Listen and enjoy the subject; make notes.
- Make friends in class and discuss the topics with them.
- Watch the news.

6–8 weeks to go

- Start by looking at the specification – make sure you know exactly what material you need to revise and the style of the exam. Use the revision planner on pages 4–7 to familiarise yourself with the topics.
- Organise your notes, making sure you have covered everything on the specification. The revision planner will help you group your notes into topics.
- Work out a realistic revision plan that will allow you time for relaxation. Set aside days and times for all the subjects that you need to study and stick to your timetable.
- Set yourself sensible targets. Break your revision down into focused sessions of around 40 minutes, divided by breaks. These Revision Notes organise the basic facts into short, memorable sections to make revising easier.

REVISED

2–6 weeks to go

- Read through the relevant sections of this book and refer to the exam tips, exam checklists, typical mistakes and key terms. Tick off the topics as you feel confident about them. Highlight those topics you find difficult and look at them again in detail.
- Test your understanding of each topic by working through the 'Now test yourself' questions in this book. Look up the answers online at **www.hoddereducation.co.uk/myrevisionnotesdownloads**
- Make a note of any problem areas as you revise, and ask your teacher to go over these in class.
- Look at past papers. They are one of the best ways to revise and practise your exam skills. Write or prepare planned answers to the exam-style questions provided in this book. Check your answers online at **www.hoddereducation.co.uk/myrevisionnotesdownloads**
- Use the revision activities to try out different revision methods. For example, you can make notes using mind maps, spider diagrams or flash cards.
- Track your progress using the revision planner and give yourself a reward when you have achieved your target.

REVISED

One week to go

- Try to fit in at least one more timed practice of an entire past paper and seek feedback from your teacher, comparing your work closely with the mark scheme.
- Check the revision planner to make sure you haven't missed out any topics. Brush up on any areas of difficulty by talking them over with a friend or getting help from your teacher.
- Attend any revision classes put on by your teacher. Remember, your teacher is an expert at preparing people for exams.

REVISED

The day before the exam

- Flick through these Revision Notes for useful reminders, for example the exam tips, exam checklists, typical mistakes and key terms.
- Check the time (is it morning or afternoon?) and place of your exam. Keep in touch with other students in your class.
- Make sure you have everything you need for the exam – pens, highlighters and water.
- Allow some time to relax and have an early night to ensure you are fresh and alert.

REVISED

My exams

Paper 1

Date: .....

Time: .....

Location: .....

Paper 2

Date: .....

Time: .....

Location: .....

1 Health and safety in construction

1.1 Legislation and regulations

The role of legislation and regulations in the construction industry

REVISED

Health and safety **legislation** and **regulations** are laws established to protect the health, safety and welfare of people who may be affected by work activities.

The Health and Safety Executive (HSE) is an independent regulator that enforces health and safety legislation and regulations in the UK.

Legislation Current primary laws, sometimes known as Acts, created by UK legislative bodies (the UK Parliament, Scottish Parliament, Welsh Parliament and Northern Ireland Assembly)

Regulations Secondary laws made under the authority of the UK legislative bodies that created the primary laws; formal guidelines used to apply the principles of primary laws

Exam tip

It is unlikely that an examiner will expect you to know the dates when health and safety legislation and regulations were last revised. However, you should know the abbreviations for key Acts and regulations, for example the Health and Safety at Work etc. Act 1974 (HASAWA).

How legislation impacts employers, employees and construction projects

REVISED

The primary health and safety legislation in the UK is the Health and Safety at Work etc. Act 1974 (HASAWA). All employers and employees have responsibilities under the HASAWA to protect people from work activities. The main objectives of HASAWA are to:

- secure the health, safety and welfare of people at work
- protect people other than those at work from risks to health and safety arising out of or in connection with work activities
- control the possession and use of highly flammable, explosive and dangerous substances.

Regulations relating to the provision of welfare facilities during construction work

REVISED

Under HASAWA, employers have a duty to provide welfare facilities for employees at their place of work. The Construction (Design and Management) (CDM) Regulations 2015 outline the minimum facilities that should be provided:

- drinking water
- toilets
- washing facilities
- rest facilities with heating
- changing rooms with lockers, seating and facilities to dry and store clothing (separate rooms must be provided for men and women)
- facilities for pregnant women or nursing mothers to rest lying down.

Exam tip

You will be expected to describe the difference between health and safety legislation (for example HASAWA) and regulations (for example RIDDOR).

Bodies responsible for maintaining and updating legislation and regulations

REVISED

Health and safety legislation and regulations are regularly reviewed and updated. Changes are often made with the guidance and support of:

- employers
- unions
- trade associations
- professional bodies
- academics.

Exam tip

The examiner will expect you to be able to list some trade associations related to building services engineering in construction.

The implications of not adhering to legislation and regulations

REVISED

When legislation and regulations are not adhered to by **duty holders** in the workplace, the risk of a near-miss incident, an injury, ill health or death to workers and others increases.

When people suffer loss or injury because of an accident at work, they may seek compensation.

Failure to comply with **statutory law** is a criminal offence.

HSE inspectors have the power to enforce health and safety law by:

- entering a workplace without notice
- investigating when a complaint has been made or an accident has occurred
- speaking to employers and workers
- examining equipment and machinery
- taking samples, for example of sound and dust levels
- taking photographs and measurements
- making copies of records or other documentation
- removing substances and dismantling and removing articles.

If an HSE inspector believes that an employer has breached the law, they may issue:

- a simple caution
- an **improvement notice**
- a **prohibition notice**.

Failure to comply with improvement or prohibition notices can result in prosecution, fines and imprisonment.

Duty holders People with legal responsibilities under health and safety law

Statutory law Written law made by the UK Parliament; also known as an Act of Parliament

Improvement notice Legal document issued by the HSE to an employer, instructing them to put right within a specific period of time any health and safety faults identified

Prohibition notice Legal document issued by the HSE to an employer that prevents work from continuing when there has been a serious breach of the law and people are at risk of immediate harm

Statutory and non-statutory documents in construction

REVISED

Legislation comprises Acts of Parliament and regulations (statutory legislation), which have legal status and must be complied with.

However, there are also many non-statutory guidance documents that offer advice on good practice and compliance with the law, but unless stated they do not need to be followed.

One example of this is an **Approved Code of Practice (ACOP)**.

Approved Code of Practice (ACOP) Document providing advice and guidance on how to comply with health and safety law, published by the HSE

Regulations and guidance documents

REVISED

The overarching guidance documents (ACOPs) for working in the building services engineering sector are covered in section 1.3.

In addition to this guidance, British Standard BS 7671 sets the national wiring standards for electrical installations. Although this is not a statutory document, it is considered good industry practice.

The main regulations that control health, safety and welfare in construction are:

- Control of Substances Hazardous to Health (COSHH) Regulations 2002
- Control of Asbestos Regulations 2012
- Provision and Use of Work Equipment Regulations (PUWER) 1998
- Manual Handling Operations Regulations (MHOR) 1992
- Personal Protective Equipment (PPE) at Work Regulations 1992
- Work at Height Regulations 2005
- Control of Noise at Work Regulations 2005
- Control of Vibration at Work Regulations 2005
- Confined Spaces Regulations 1997
- Management of Health and Safety at Work Regulations 1999
- Electricity at Work Regulations 1989
- Environmental regulations
- Waste management legislation.

The Management of Health and Safety at Work Regulations 1999 regulations explain what employers need to do to manage health and safety at their place of work under HASAWA. For example, lone working can be hazardous, therefore employers have responsibilities to assess the risks, provide information and training, and to plan for emergencies. The main requirement is for employers to complete a risk assessment and record significant findings when they have five or more employees.

Lone working Employees working by themselves or without direct or close supervision

Typical mistake

Many students misunderstand the difference between legislation, regulations and guidance. Make sure you learn the definition of each term and how they are distinct from each other.

Revision activity

Create a table with two columns. List as many regulations as you can in the first column, then try to recall the purpose of each in the second column. Check your answers with the regulations covered in this chapter.

Now test yourself TESTED

1 What is the role of the HSE?

2 What actions will an HSE inspector take if they believe that an employer has breached health and safety law?

1.2 Public liability and employers' liability

The implications of public and employers' liability

REVISED

Public liability means employers have a legal responsibility to protect the public from injury, illness and death as a result of work activities.

Liability To have a legal responsibility for something

Employers' liability refers to the responsibility of employers to protect their employees from harm in the workplace.

If a person is injured or suffers a loss in the workplace, they may seek financial compensation from the employer.

Under the Employers' Liability (Compulsory Insurance) Act 1969, all employers are required by law to insure against any liability for injury or disease to their employees.

There is no legal requirement for employers to have public liability insurance. However, it is recommended if the public are likely to be affected by work activities.

Legal action can be taken against an employer under public and employers' liability to cover any loss of income, medical costs and compensation.

Revision activity

Create a table with two columns to show the costs of a workplace accident to an employer and to an injured person.

Typical mistake

Claims for compensation should be made by the injured person – they are not made by the HSE.

1.3 Approved construction codes of practice

The use, purpose and legal status of ACOPs

REVISED

The HSE publishes documents online that contain information and guidance for duty holders, with practical ways to comply with the law.

The HSE's Legal (L) Series publications (also referred to as the CDM Series) comprise Approved Codes of Practice (ACOPs) that describe preferred methods and standards. However, ACOPs only have a semi-legal status and, unless stated, they do not have to be followed. If another practical method is used, it must meet or exceed the standards in the ACOP.

Typical mistake

There is no legal requirement for employers to follow ACOPs unless it is stated that they must do so. HSE guidance legal status is recorded on the Health and Safety Executive's website: www.hse.gov.uk/legislation/legal-status.htm.

Exam tip

You will not be expected to know all the ACOPs published by the HSE, but you should have a good understanding of those most relevant to building services engineering in construction.

Now test yourself

3 What is another name for the HSE's L Series?

TESTED

1.4 Development of safe systems of work

How safe systems of work are developed and used

REVISED

The HSE favours that employers use the following approach:

- Plan – for specific health and safety objectives
- Do – implement the plan
- Check – that the plan is working and measure performance
- Act – learn from any mistakes and put them right.

The Management of Health and Safety at Work Regulations 1999 contain a schedule known as the 'General principles of prevention'. This provides a hierarchy of control measures to manage risks to health and safety in the workplace (see Figure 1.1).

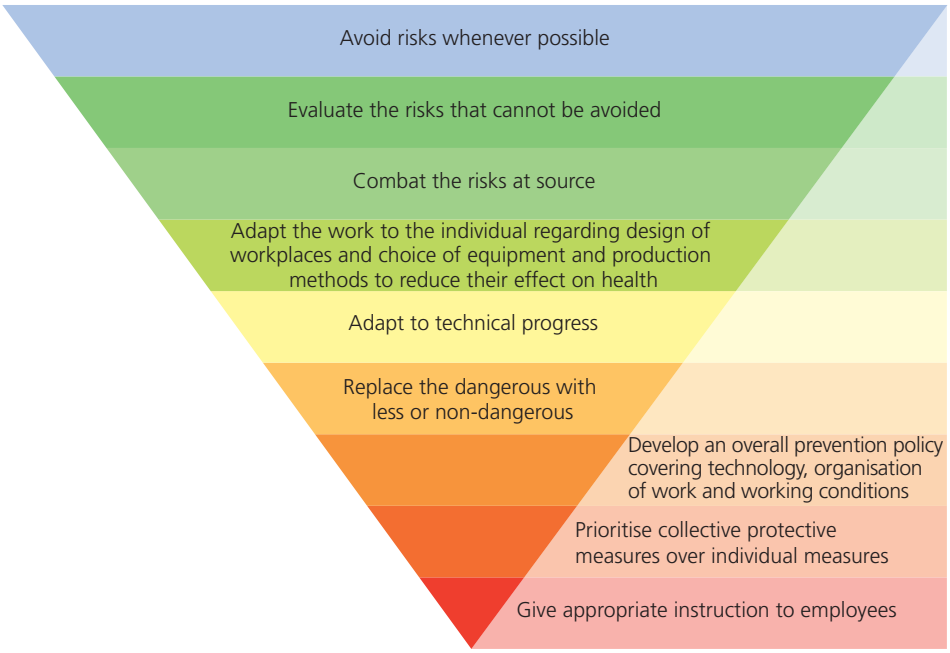


Figure 1.1 Hierarchy of control measures for managing health and safety risks (source: www.legislation.gov.uk)

Risk assessment

REVISED

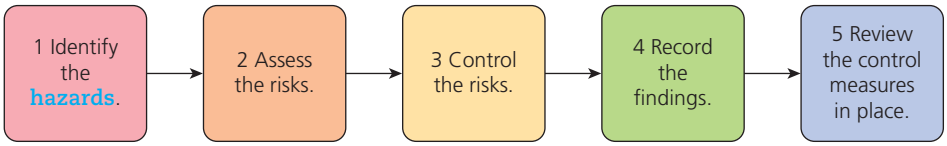


Figure 1.2 Steps for completing a **risk assessment**

Risk assessment Process used to identify, control and record hazards in the workplace

Hazard Something with the potential to cause harm

Exam tip

When preparing for your exam, make sure you understand the general principles of prevention – this will help you when answering questions about risk assessments and method statements.

COSHH assessment

REVISED

The steps for completing a **COSHH assessment** are as follows:

1. Identify the hazardous substance, who is likely to be harmed by it and how this may occur.
2. Evaluate the risk of the hazard causing harm by considering the frequency of exposure to the substance and what effects it could have.
3. Decide what measures are necessary to prevent or control exposure to the hazard and how these will be maintained, and plan for emergencies.
4. Record the assessment.
5. Decide if, and when, the assessment needs to be reviewed, and by whom.

COSHH assessment Process for controlling the use of hazardous substances in the workplace

Typical mistake

Personal protective equipment (PPE) is the least effective method of controlling hazards. The most effective way is to avoid a hazard altogether, whenever possible.

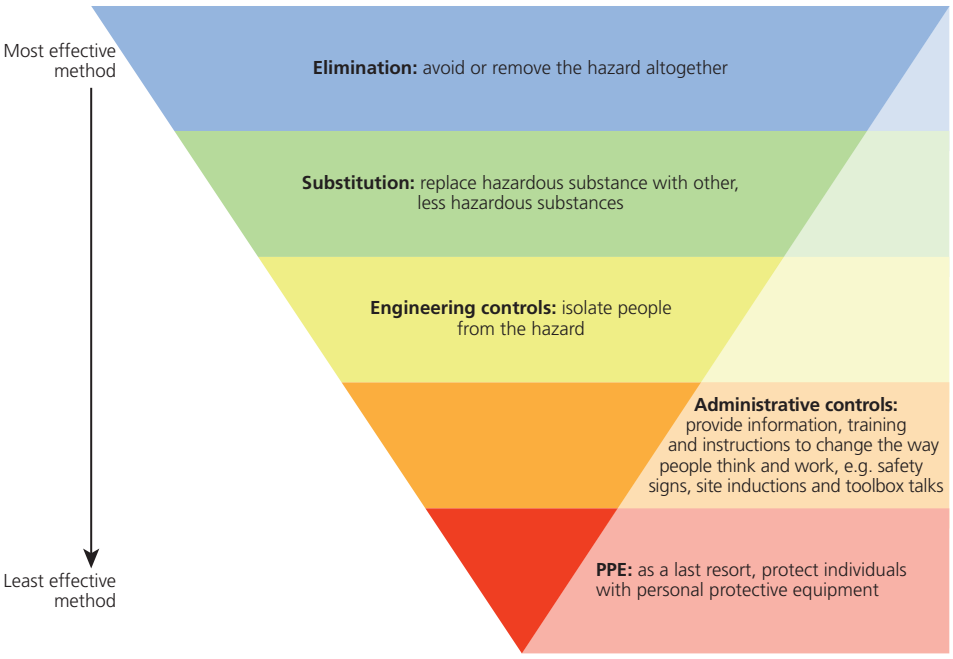


Figure 1.3 Hierarchy of control measures to prevent harm from exposure to hazardous substances

Method statements

REVISED

Method statements are documents prepared by employers that describe a logical sequence of steps to complete a work activity in a safe manner. A typical method statement describes:

- hazards identified
- safe access and egress (exit)
- supervision needed
- hazardous substances and how to control them
- permit-to-work systems (if applicable)
- personal protective equipment

- emergency procedures
- environmental controls
- health and safety monitoring
- workforce details.

Exam tip

You should be able to distinguish between a risk assessment and a method statement and understand their importance in ensuring a safe system of work.

Typical mistake

There is no legal requirement for employers to write method statements, but it is recommended as part of a good management system.

How to apply CDM

REVISED

Under the Construction (Design and Management) (CDM) Regulations 2015, principal contractors must engage with workers about their health, safety and welfare, and provide a site-specific induction and any other information and training they need.

Principal contractors Contractors appointed by a client to take the lead in planning, managing, monitoring and co-ordinating health and safety in a project involving more than one contractor

Permit to work

REVISED

Employers may adopt a permit-to-work system to manage high-risk activities on construction sites. This authorises people to carry out specific work tasks within a given timeframe and sets out the precautions required to complete the work safely.

Construction site signage

REVISED

The Health and Safety (Safety Signs and Signals) Regulations 1996 state that safety signs should be used when:

- there is a significant risk to health and safety that cannot be controlled in other ways
- they can reduce a risk further.

See section 1.14 for categories of safety sign.

Certification schemes and qualifications

REVISED

Construction Skills Certification Scheme (CSCS)

The Construction Skills Certification Scheme (CSCS) is accredited by the Construction Industry Training Board (CITB). CSCS cards prove that the card holder has a satisfactory level of health and safety awareness. They also show the card holder's relevant qualifications for their role on site.

Site Management Safety Training Scheme (SMSTS)

People with planning, organising, controlling and monitoring responsibilities are usually required by principal contractors and clients to hold this level of qualification.

Site Supervision Safety Training Scheme (SSSTS)

This qualification is designed for people with supervisory responsibilities or those preparing to start in this role.

Revision activity

Use a risk assessment template from the HSE's website to write a manual handling risk assessment for your place of work.

Now test yourself

4 List the **five** steps for completing a risk assessment.

5 What is the purpose of a method statement?

TESTED

1.5 Safety-conscious procedures

The benefits of safety-conscious procedures

REVISED

Safety consciousness is an awareness of the presence of hazards and alertness to potential harm.

Safety-conscious procedures aim to promote and support safety consciousness within construction environments to keep people safe from harm.

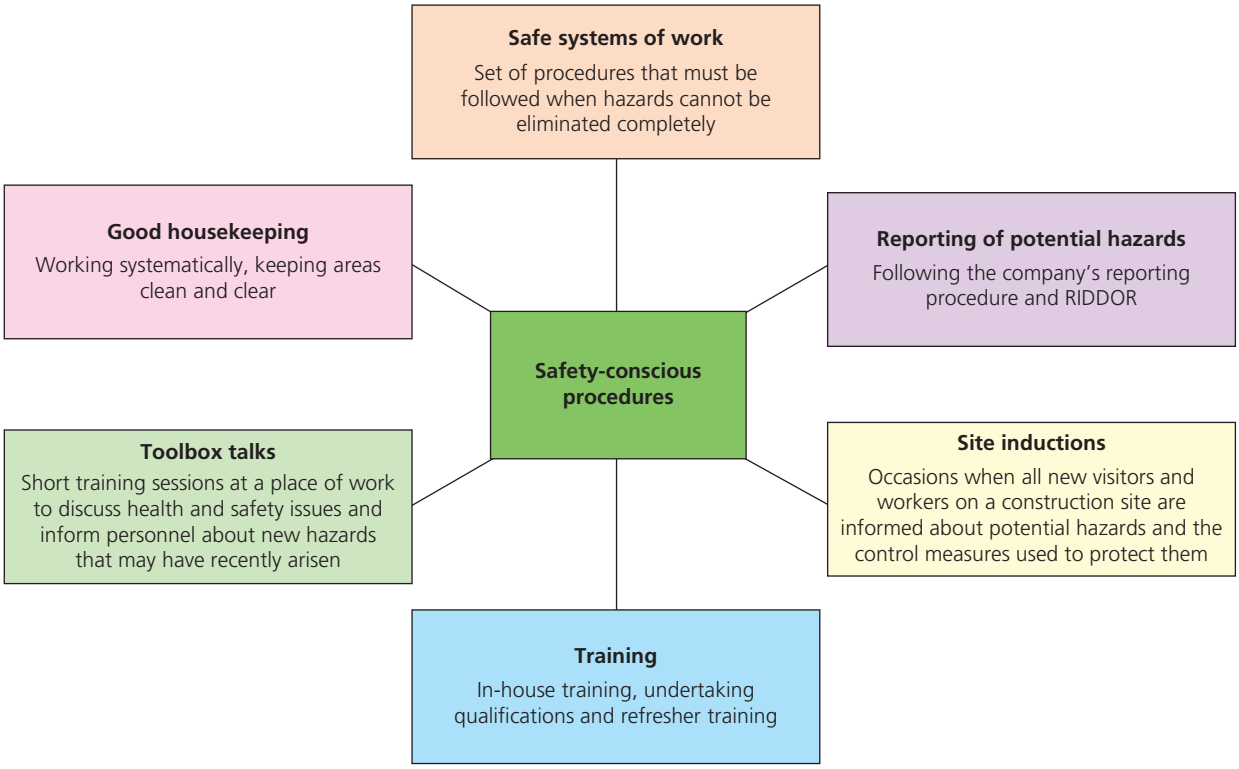


Figure 1.4 Safety-conscious procedures

The importance of safety-conscious procedures

REVISED

When legal responsibilities under HASAWA are not followed, duty holders are essentially breaking the law and could be putting themselves, and others, at risk of harm. Employers are at risk of prosecution by the HSE and compensation claims by the injured person.

If an accident or a near-miss incident occurs, it may also result in:

- project timescales slipping
- financial penalties due to missed deadlines
- damaged company reputation
- loss of business
- difficulties retaining staff and recruiting
- increased insurance premiums.

Exam tip

The examiner will expect you to know the difference between a hazard, a risk and a near-miss incident. You should also be able to list the hierarchy of control measures used to protect people from harm.

Typical mistake

A prohibition notice to close a construction site is not necessary every time a reportable accident occurs. For example, the HSE could issue a prohibition notice to prevent hazardous scaffolding being used until the faults have been rectified.

Now test yourself

6 What is a toolbox talk?

TESTED

1.6 Safety inspection of a work environment

Recording documents (risk assessments and method statements – RAMS)

REVISED

If an employer has five or more employees, risk assessments must be recorded in writing.

There is no legal requirement for employers to produce method statements, however this is recommended as part of a good management system.

Typical mistake

It is still recommended that employers complete risk assessments when they have fewer than five employees. However, there is no legal duty for them to be written down.

Methods used to inspect a workplace

REVISED

Employers have a responsibility to monitor health and safety arrangements in the workplace. Two types of monitoring system are typically used:

- active monitoring – completed before an accident or incident occurs
- reactive monitoring – completed after an incident has taken place.

Several types of health and safety inspection can be implemented in the workplace. These include:

- health and safety audits (inspections of health and safety documentation)
- safety sampling (used to focus on a representative sample of a workplace standard)
- safety surveys (detailed investigations on a particular topic or issue)
- safety tours (scheduled full inspections)
- incident inspections (carried out after an accident, a near-miss or a case of ill health reported to the HSE)
- visual or sensory inspections (unscheduled inspections of the work area, not restricted by a checklist or template).

Some regulations place specific duties on employers to review a work area, a process or resources, for example lifting equipment and PPE. The HSE provides information and guidance on these regulations. It also publishes documents that can be used to record the results of inspections, such as HSE forms F2534 and F2533.

Exam tip

The examiner will expect you to demonstrate a sufficient depth and breadth of understanding in your answers. You could show this by explaining the different types of health and safety inspection.

1.7 Implications for those working within the BSE industry of not following health and safety legislation

Table 1.1 summarises the possible impacts of failing to follow health and safety legislation.

Table 1.1 Impacts of failing to follow health and safety legislation

Impacts on client/customer/general public/employees	Impacts on employer/business
+ Accidents + Injuries + Ill health + Fatalities + Slips, trips and falls + Near-miss incidents + Loss of wages/financial hardship + Rehabilitation + Inability to work (short and long term) + Stress/poor mental health	+ Improvement notices + Prohibition notices + Downtime + Fines + Imprisonment + Compensation claims + Damaged reputation + Business closure + Environmental damage

Typical mistake

Accidents do not just affect employers and their employees – they can also impact clients and customers, the general public and the business itself.

Health and Safety Executive powers of prosecution

REVISED

If an employer does not follow health and safety legislation, the HSE may enforce HASAWA with its powers of prosecution, as outlined in section 1.1.

Revision activity

Research the HSE website for examples of cases when the powers of prosecution have been used.

1.8 Safe working practices for the safe isolation of systems

Methods to safely isolate services/systems

REVISED

Water (hot and cold)

Isolation valves turn off (isolate) either complete systems, parts of systems or individual appliances. At the point of isolation, a warning notice should be displayed, informing people that the system is out of order and not to use it.

Hot-water systems should be drained down to prevent scalding.

Methods of safe isolation of hot- and cold-water systems are shown in Table 1.2.

Table 1.2 Methods of safe isolation of hot- and cold-water systems

System type	Method of safe isolation
Unvented hot-water systems	Isolate at the service valve on the cold-water supply to the cylinder
Where hot water in a property is supplied from a combination boiler or water heater	Isolate at the service valve located under the boiler (remember to isolate the electricity supply)
Vented hot-water systems	Isolate at the gate valve
Direct cold-water systems	Isolate at the main stop valve
Indirect cold-water systems	Isolate at the gate valve located on the distribution pipe connected to the cold-water storage cistern

Gas

Isolation of a gas supply is only permitted in the event of an emergency, unless you are a Gas Safe registered engineer.

The emergency control valve (ECV) is located at the inlet of the gas meter and is used to isolate the supply to a property when moved to the 'off' position.

Electrical supplies

The process below must be followed when isolating electrical systems:

1. Obtain permission.
2. Locate circuit or equipment.
3. Identify means of isolation.
4. Ensure isolation of circuit or equipment by switching off and:
   - withdrawing fuses
   - locking off
   - isolating switches or circuit breakers
   - fitting warning notice at point of isolation.
5. Select approved test lamp or voltage-indicating device.
6. Verify device is functioning correctly.
7. Verify circuit to be worked on is dead.
8. Recheck voltage-indicating device is functioning correctly.
9. Begin work.

Locking off Using a physical lock to prevent accidental use of an electrical system being worked on

When water, gas or electricity services are safely isolated for maintenance, repair or inspection, service users may experience disruption. If the service isolation unavoidably results in downtime affecting users over an extended timescale, a back-up service provision should be made.

Exam tip

Read questions carefully to ensure your response refers to isolation of the right type of system.

1.9 Implications of poor health and safety on building performance and individual stakeholders

The implications of poor health and safety on building performance and individual stakeholders is covered in section 1.7.

1.10 Recording and reporting of safety incidents and near misses

Recording and reporting

REVISED

Workplace accidents and incidents must be reported following the employer's reporting policies. This ensures that they are dealt with properly and investigated to reduce the risk of them reoccurring.

Employers must record the details of any accident in an accident book and keep accident records for at least three years.

Accident book Formal document used to record details of accidents that occur in the workplace, whether to an employee or a visitor

RIDDOR puts duties on employers, the self-employed and people in control of work premises to report certain serious workplace accidents, occupational diseases and specified dangerous occurrences (near misses).

Typical mistake

Not all accidents need to be reported to the HSE – however, they must be logged in an accident book and records must be kept for three years.

Self-employed State of working for oneself rather than an employer; a self-employed person is responsible for paying their own tax and National Insurance contributions on any earnings

Dangerous occurrences Incidents that could have caused harm, injury or ill health

Now test yourself TESTED

7 Under which regulations do certain types of incident need to be reported to the HSE?

Revision activity

Research RIDDOR on the HSE website. List the different types of injury, disease and dangerous occurrence that are reportable under RIDDOR.

Exam tip

Make sure you understand the definition of dangerous occurrences, so that you can provide examples if necessary.

1.11 Emergency procedures for unsafe situations

Unsafe situations

REVISED

Under the CDM Regulations, employers have a duty to plan for emergencies on construction sites.

Under the Regulatory Reform (Fire Safety) Order 2005, employers also have a duty to plan for emergencies on other sites such as offices, factories and warehouses.

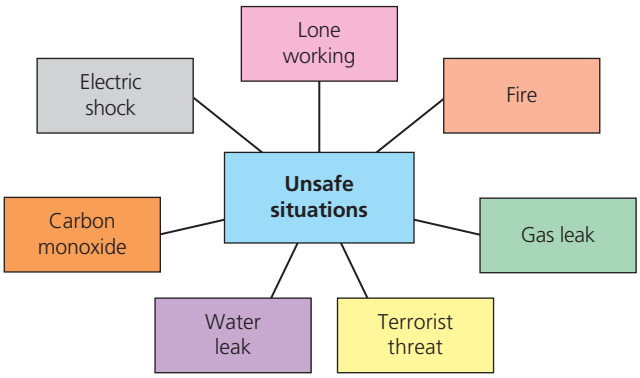


Figure 1.5 Examples of unsafe situations

Emergency procedures to follow if unsafe situations occur

REVISED

Gas leak

The Gas Industry Unsafe Situations Procedure (GIUSP) and Gas Safety (Installation and Use) Regulations (GSIUR) 1998 state that the following actions should be taken in the event of a gas leak:

- Turn off the emergency control valve (ECV).
- Open doors and windows.
- Call the national gas emergency number.
- Do not turn any power or light switches on or off.
- Do not light any sort of flame.
- Do not use any appliances.

Evacuations

Safe evacuation of the site should follow the designated emergency escape route to the assembly point. A register of workers in attendance must be completed.

Electric shock

Assess the situation, isolate the supply and call for help.

Injuries

- Check that you and the injured person are not in any danger and, if possible, make the situation safe.
- Call for help.
- Carry out basic first aid.

Fire

In the event of a fire in the workplace, workers must follow their employer's procedures. The main steps are as follows:

1. Raise the alarm and inform others.
2. Walk quickly, following the directional signs, to the closest available emergency exit. Make sure you close all the fire doors behind you. Do not use any lifts between floors.
3. Only attempt to tackle a small fire if it is blocking your safe exit and if you are trained to use the equipment.
4. Report to the assembly point and stay there until you are told to leave.
5. Call the emergency services.

Fire extinguishers and their uses are summarised in Table 1.3.

Table 1.3 Fire extinguishers and their uses

Type of extinguisher	Colour of label	Fire classification
Water	Red	Class A
Dry powder	Blue	Class A Class B Class C Class D Electrical
Foam	Cream	Class A Class B
Carbon dioxide (CO_2)	Black	Class B Electrical
Wet chemical	Yellow	Class A Class F

Exam tip

There are several different types of regulations mentioned in this section – make sure you can distinguish between them.

Typical mistake

Foam extinguishers should not be used on electrical or Class F fires.

Now test yourself

8 What classification of fires can a wet chemical extinguisher be used on?

TESTED

1.12 Types of PPE

Purpose and correct use of PPE

REVISED

When the principles of prevention are applied to mitigate (reduce) the risk of harm, personal protective equipment (PPE) is always considered a last resort because it only protects the user.

Types of PPE

REVISED

Table 1.4 summarises the types of PPE and the hazards they protect against.

Table 1.4 Types of PPE

Body part protected	Hazards	Types of PPE	Correct use
Ears	Noise	+ Ear defenders + Ear muffs + Ear plugs + Canal caps/semi-insert earplugs	Ear protection should reduce noise levels so that you are still able to communicate while wearing it. Ear protectors are manufactured with a single number rating (SNR) system, which allows the acoustic pressure on your ears to be calculated. Disposable foam ear plugs should be fully inserted in the ear to work properly and disposed of after each use.
Eyes	+ Sparks + Dust + Chemicals + Debris	+ Goggles + Safety spectacles + Face screens + Face shields + Full-face visors + Sunglasses	Eye protection should be: + compatible with other PPE worn + adjustable + stored correctly to prevent damaging the lenses.
Feet and legs	+ Slips + Falling objects + Objects (for example nails) penetrating the sole	+ Safety trainers, shoes, boots and Wellingtons with toecaps and protective mid-soles + Chainsaw and foundry boots + Knee pads + Kneeling pads	Footwear should: + have a good grip for different surfaces + be replaced when it becomes damaged. The risk assessment will identify which footwear should be worn.
Hands and arms	+ Cuts and abrasions + Impacts + Chemicals + Temperature extremes + Biological agents + Vibration	+ Anti-vibration gloves + Nitrile foam coated gloves + Gloves with cuffs + Gauntlets + Protective arm sleeves + Elbow pads	Care should be taken to select the correct type of gloves to protect against hazards. They must not create further risks, such as entanglement in machinery, when used.
Head and neck	+ Falling objects + Hair entanglement + Chemicals + Adverse weather	+ Hard hats + Bump caps + Snoods + Hair nets	Hard hats should be square on your head with the peak facing forwards. Avoid wearing caps or beanies underneath hard hats. Avoid marking hats with paint or pens (the chemicals may damage them). Bump caps should only be worn when there is a very low risk of bumping your head.
Lungs (respiratory system)	+ Dust + Vapours + Mists + Gases + Atmospheres with low or no oxygen	Respiratory protective equipment (RPE): + disposable half-mask respirators/dust masks + reusable half-mask respirators/dust masks with a filter + full-face mask respirators/dust masks + powered respirators with a mask/hood or helmet + breathing apparatus (BA)	Masks should form a good seal around the user's face to protect them properly. The type of masks and filters used should reflect the hazards. Employees should understand when and how to replace respirator filters. Masks should be stored correctly to prevent them being contaminated with hazardous substances.

Body part protected	Hazards	Types of PPE	Correct use
Whole body	+ Chemicals + Temperature extremes + Adverse weather + Dust + Metal splashes + Falling from height	+ Aprons + Overalls + Boiler suits + Chemical suits + High-visibility clothing + Harness	Whole-body protective equipment must be worn according to the manufacturer's instructions and should not cause a risk of entanglement with equipment or machinery. Contaminated PPE should be cleaned or disposed of properly and never mixed with personal clothing.

Typical mistake

Although employers are responsible for providing PPE free of charge, it is employees who are responsible for taking care of it and informing their employer when it needs to be replaced.

1.13 First-aid facilities

First-aid facilities in the work area

REVISED

The Health and Safety (First Aid) Regulations 1981 place legal duties on all employers to provide adequate and appropriate first-aid equipment, facilities and people to assist their employees if they are injured or fall ill at work.

Employers must:

+ carry out a workplace-specific first-aid assessment to determine their needs
+ provide first-aid kits for their workers (including lone workers)
+ appoint a person to take charge of their first-aid arrangements and to call the emergency services when necessary
+ appoint a trained first-aider
+ provide staff training, information and instruction.

Exam tip

The examiner will expect you to understand the arrangements for first aid beyond a first-aid kit.

Typical mistake

Medicine should not be kept in a first-aid kit.

1.14 Warning signs for the main groups of hazardous substance

Categories of safety signs

REVISED

The main categories of safety sign are listed in Table 1.5.

Table 1.5 Categories of safety sign

Type of safety sign	Description
Mandatory 	Tells you that something *must* be done, for example eye protection must be worn
Safe condition 	Shows directions to areas of safety and medical assistance in case of emergency

Type of safety sign	Description
Prohibition 	Tells you that something *must not* be done, for example do not extinguish with water
Warning 	Makes you aware of nearby danger, for example overhead load
Fire fighting 	Marks the location of fire-fighting equipment and fire-alarm activation points

Typical mistake

Students often confuse prohibition and mandatory signs:

- Prohibition signs are red and forbid certain types of behaviour, for example 'No access for unauthorised persons'.
- Mandatory signs are blue and prescribe specific behaviour, for example 'Safety harness must be worn'.

CLP Regulations safety signs

REVISED

Manufacturers, importers, distributors and other users of chemicals have legal duties under the Classification, Labelling and Packaging (CLP) Regulations 2010 to use appropriate safety signs for labelling and packaging of hazardous substances and waste – as shown in Table 1.6.

Table 1.6 CLP Regulations safety signs

Safety sign	Meaning	Encountered when using …
Explosive 	Explosive, self-reactive	Gas
Flammable 	+ Flammable gases, solids, liquids and aerosols + Self-heating, self-reactive + Contact with water creates flammable gas	+ Expanding foam + Nail-gun canisters + Solvent cement + Paint stripper

Safety sign	Meaning	Encountered when using ...
Oxidising 	+ Oxidising gases, liquids and solids + May cause fire or explosion + May intensify fire	Chemicals
Gas under pressure 	+ Contains gas under pressure + May explode if heated + Contains refrigerated gas which may cause cryogenic burns	Carbon-dioxide cylinders used in welding
Corrosive 	+ Corrosive to metals + Causes severe skin burns and eye damage	+ Portland cement + Hydrated lime + Brick cleaner + Batteries
Acute toxicity 	+ Toxic from single or multiple exposure + Toxic/fatal if swallowed, in contact with skin or inhaled	+ Materials containing formaldehyde + Hazardous air pollutants
Health hazard/hazardous to the ozone layer 	+ May cause respiratory, eye or skin irritation + May cause drowsiness or dizziness + Harmful if swallowed, inhaled or in contact with skin + Harms the environment by destroying the ozone layer	+ Expanding foam + Grab adhesive + Wood adhesive + Solvent cement + Portland cement + Paint stripper
Hazardous to the environment 	Toxic to the surrounding natural environment, especially aquatic life	+ Wood preservative + White spirit + Diesel, petrol and paraffin oils + Epoxy resin + Bitumen paint
Serious health hazard 	+ May be fatal if swallowed or enters airways + May cause damage to organs + May damage fertility or cause genetic defects + May cause cancer + May cause allergy, asthma or breathing difficulties if inhaled	+ Expanding foam + Grab adhesive + Paint stripper + Wood dust + White spirit + Asphalt + Silica dust

Now test yourself TESTED

9 What colour is a mandatory safety sign?

Exam tip

Focus on learning the different categories of safety sign rather than the different pictograms.

1.15 Safe practices and procedures for the use of access equipment and manual handling

Access equipment

REVISED

If there is a risk of people falling any distance above or below ground that could result in injury, the employer must take the necessary precautions to eliminate the hazard completely or reduce the risk of harm to an acceptable level.

Where a risk remains, employers should use access equipment or other measures to minimise the distance and consequences of a fall, such as safety nets, air bags or PPE.

Access equipment should only be used by trained, competent and authorised people in accordance with the manufacturer's instructions.

The safety aspects associated with different types of access equipment are summarised in Table 1.7.

Access equipment Apparatus specifically designed for working safely at height

Ratio Relationship between two groups or amounts that expresses how much bigger one is than the other

Table 1.7 Safety aspects associated with different types of access equipment

Access equipment	Safety checks	Safe erection	Factors influencing choice of equipment
Ladder	Check the following parts have no visible defects before use: + rungs + stiles + anti-slip safety feet + guides + rung locks + locking mechanism. Check the ladder tag before use to ensure the equipment is safe to use.	Set at an angle of 75° or a **ratio** of 1:4. Place on firm, level ground. Place against a stable surface. Extend 1 m above a working platform. Secure to prevent slipping/moving.	Only use for light work and short durations. The user should always have three points of contact with the ladder and never overreach. The ladder must be secured to prevent slipping.
Mobile scaffold tower	Check the following parts have no visible defects before use: + frame + toe boards + braces + platform + trap doors + castors and brakes + outriggers.	Place on firm, level ground. Erect in accordance with manufacturer's instructions. Do not overload. Use guardrails and toe boards. Apply brakes on castors before use. Correctly position and secure outriggers when needed to gain height. Do not reposition with people, materials or equipment on it.	It can be used by workers with both hands free. Care should be taken around overhead power cables while using or moving a tower. It is relatively quick to erect. It must be dismantled in certain conditions, for example high winds.

Access equipment	Safety checks	Safe erection	Factors influencing choice of equipment
Scaffolding	Safety inspections should be carried out after erection and before first use, and weekly thereafter. More frequent inspections will be needed after adverse weather. Scaffold tags (or 'scaftags') should be used to record the date of inspection and person who completed it. Check the following parts have no visible defects before use: + standards + ledgers + transoms + sole plates + handrails + intermediate rails + brick guards + toe boards + working platform/scaffold boards + braces + shoes + couplings and all other fittings.	Scaffolding must: + be designed and erected in accordance with British Standards and the Work at Height Regulations 2005 + have handrails 950 mm high, with no more than a 470 mm gap between guardrails + have toe boards 150 mm high + have platforms kept clean and clear.	Scaffolding must only be erected, inspected, adjusted and dismantled by trained and competent scaffolders. It is slow to erect and dismantle. It can provide a continuous working platform.
Trestles	Check the following parts have no visible defects before use: + toe boards and handrails + intermediate rails + steps/ladders + staging boards/scaffold boards.	Set up on firm, level ground. Erect in accordance with the manufacturer's instructions. Do not overload. Keep staging boards clean and clear. Ensure safe access and egress.	Trestles: + allow operators to work hands-free + are relatively quick to erect and dismantle + are suitable for low-height work.
Steps	Check the following parts have no visible defects before use: + steps or treads + prop + anti-slip safety feet + stiles + stepladder platform + locking mechanism. Check the stepladder tag before use to ensure it is safe to use.	Open the steps fully. Place on firm, level ground. Position facing the work, not sideways.	Only use for light work and short durations. They are quick and simple to erect and dismantle. The user must have three points of contact with the steps at the working position. The manufacturer's maximum safe working loads must not be exceeded.
Podiums	Check the following parts have no visible defects before use: + podium frame + locking mechanisms + elbows/hinges + platform + stabilisers + access ladder/steps + castors + anti-slip safety feet.	Set up on firm, level ground. Erect in accordance with the manufacturer's instructions. Keep the gate locked while working. Apply brakes on the castors before use.	Podiums are preferred to ladders and steps for long-duration work, as operators can work hands-free and have secure handrails. They are slower to set up, dismantle and move compared with ladders/steps.

Access equipment	Safety checks	Safe erection	Factors influencing choice of equipment
Staging boards	Check the staging boards have no visible defects before use. They should also be clean and free from debris when in use.	Staging boards are used in conjunction with other types of access equipment, so they should be erected as instructed by the manufacturer, for example regarding minimum and maximum overhang.	Staging boards are sometimes preferred to scaffold boards with certain types of access equipment, because they provide a wider platform without any trip hazards.
Boom and scissor lifts	Boom and scissor lifts must be set up and inspected ready for use in accordance with the manufacturer's instructions and LOLER Regulations.		Only suitably trained and competent people should use or operate boom or scissor lifts.

Access equipment should be regularly inspected for signs of wear and damage. Records should be kept of weekly, monthly and annual inspections. Some work equipment may be subject to specific requirements regarding inspection, such as the Lifting Operations and Lifting Equipment Regulations (LOLER) 1998.

Typical mistake

Falls from height can be above or below ground. Lanyards and safety nets will not prevent falls from height.

Manual handling

REVISED

Manual handling can be carried out by a single person, as a two-person lift, or using mechanical lifting aids

Employers must take reasonably practicable measures to protect their employees from manual handling injuries. The Manual Handling Operations Regulations 1992 state that this should be done by:

- avoiding manual handling if possible
- assessing the hazards
- reducing the risk as much as is reasonably practicable.

Employers have a duty to make sure that employees have the necessary information, instruction and training to perform manual handling operations. If it is not possible to avoid manual handling, good **kinetic lifting** techniques should be used.

Manual handling Any lifting, carrying, supporting or moving of a load using bodily force

Kinetic lifting Physical act of carrying, moving, lowering, pushing or lifting a load without the use of mechanical means

Exam tip

The best method of preventing musculoskeletal injuries from kinetic lifting is to avoid manual handling.

Now test yourself TESTED

10 At what angle should ladders be placed when in use?

11 What is the best way to prevent manual handling injuries?

1.16 Safe practices and procedures for working in excavations and confined spaces

Dangers associated with excavations

REVISED

Excavations are often created on constructions sites to form trenches and holes for building foundations or to gain access to underground services and drainage.

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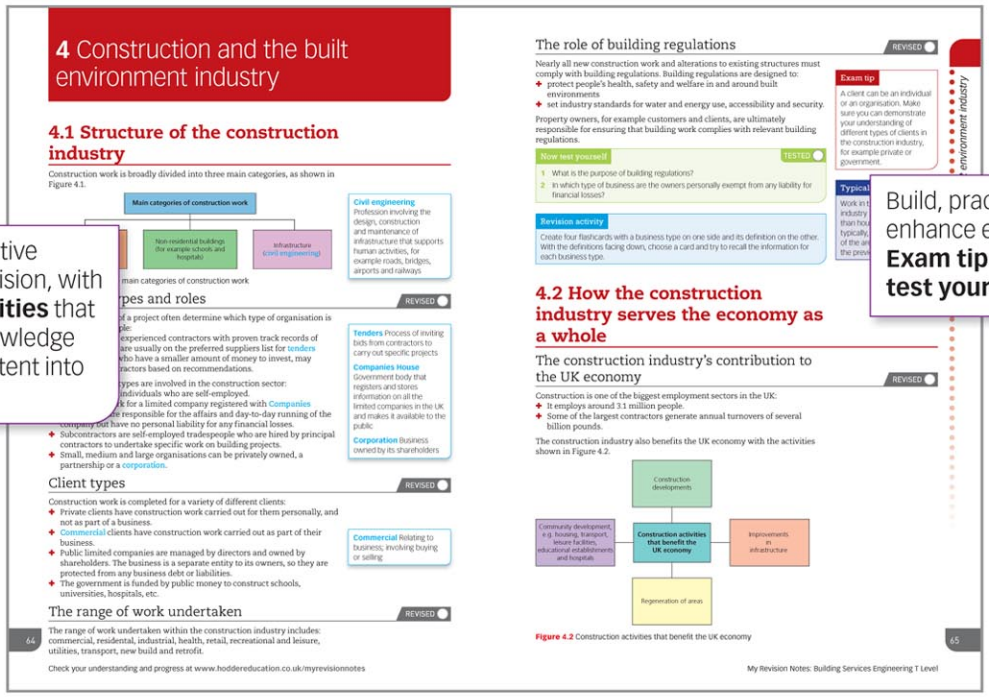

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