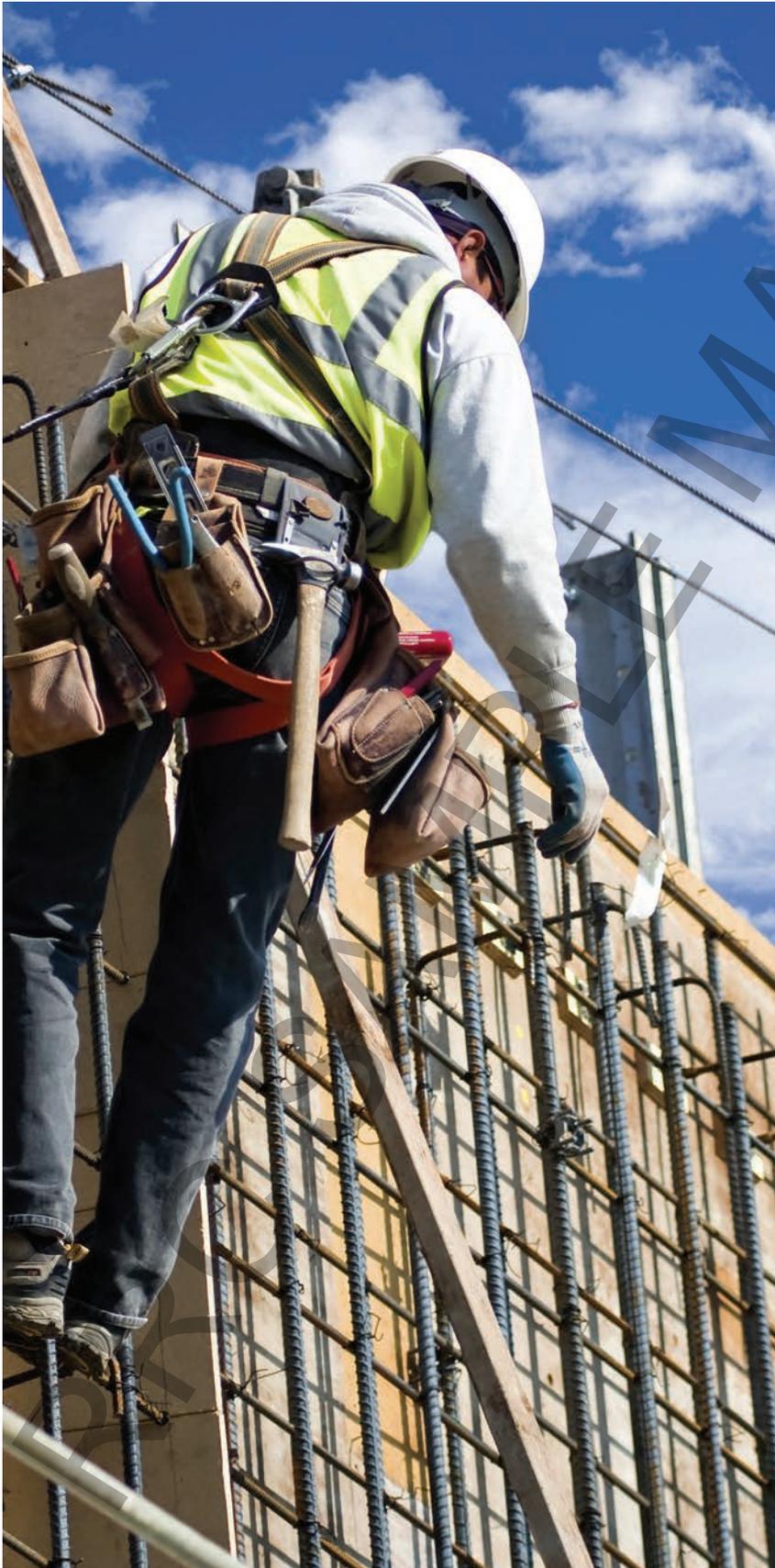


# WORKING AT HEIGHT- HAZARDS AND RISK CONTROL

ELEMENT  
**10**



## LEARNING OUTCOMES

On completion of this element, you should be able to demonstrate understanding of the content through the application of knowledge to familiar and unfamiliar situations. In particular you should be able to:

- 1 Explain the hazards and risks of working at height and the general requirements necessary to control them.  
.....
- 2 Explain safe working practices for access equipment and roof work.  
.....
- 3 Outline the control measures necessary to protect other persons not involved in the work at height.  
.....
- 4 Outline the particular control measures to reduce risk when working over or near to water.  
.....

# Contents

<b>WORKING AT HEIGHT - HAZARDS AND RISKS</b>	<b>10-3</b>
Examples of Work Activities Involving a Risk of Injury	10-3
Basic Hazards and Risk Factors	10-3
Methods of Avoiding Working at Height	10-5
Main Precautions to Prevent Falls and Falling Materials	10-5
Emergency Rescue Plans	10-6
Requirements for Head Protection	10-6
Inspection Requirements for Work Equipment	10-6
Revision Questions	10-7
<b>SAFE EQUIPMENT PRACTICES FOR ACCESS EQUIPMENT AND ROOF WORK</b>	<b>10-8</b>
Scaffolding	10-8
Use of Ladders, Stepladders, Trestles, Staging Platforms and Leading Edge Protection Systems	10-22
Other Access to Work at Height Techniques	10-24
Fall Arrest Equipment	10-25
Roofwork	10-26
Revision Questions	10-28
<b>PROTECTION OF OTHERS</b>	<b>10-29</b>
Demarcation, Barriers, Tunnels and Signs	10-29
Marking and Lighting	10-29
Sheeting, Netting and Fans	10-29
Head Protection	10-30
Revision Question	10-30
<b>WORKING OVER OR NEAR WATER</b>	<b>10-31</b>
Prevention of Drowning	10-31
Additional Appropriate Control Measures	10-32
Revision Questions	10-33
<b>SUMMARY</b>	<b>10-34</b>
<b>EXAM SKILLS</b>	<b>10-35</b>

# Working at Height - Hazards and Risks

## KEY INFORMATION

- Work at height accounts for more fatalities than any other construction activity.
- The hazards and factors affecting the risk from working at height include vertical distance of a fall, fragile roofs, roof lights, voids, sloping roofs, deteriorating materials, unprotected edges, unstable or poorly maintained access equipment and adverse weather conditions.
- Work at height should be avoided where possible, or engineering methods used to prevent falls and falling materials, including good design, proper planning and supervision of work, and avoiding work in adverse weather conditions.
- Emergency rescue plans should be in place to facilitate the rescue of trapped or fallen workers.
- Equipment, training and instruction are required to minimise the distance and consequences of a fall.
- Head protection is required when working at height.
- All work equipment used to access work at height should be inspected.

## JARGON BUSTER

### WORK AT HEIGHT

Height is any height (including at or below ground level), from which a fall could cause personal injury.

## EXAMPLES OF WORK ACTIVITIES INVOLVING A RISK OF INJURY

Construction work often exposes people to risks from working at height:

- Steel workers erecting the steel framework of a building.
- Scaffolders erecting or striking (taking down) a scaffold.
- Roofers cladding the roof of a steel-framed building.
- Demolition workers dismantling machinery on the roof of a building.
- Welders working at the side of a deep excavation.
- Pipe fitters fixing pipework to the ceiling in a factory workshop.
- Painters painting a lamp-post or a steel-span footbridge.

Many of these tasks will involve the use of some form of access equipment (e.g. scaffolding or ladders) and those using this equipment are usually familiar with and used to such work, which can lead to complacency. Other workers may not be so used to these tasks at height, and lack competence.

The main risks associated with work at height are:

- The worker falling from height.
- An object falling from height onto someone below.

### Falls from height:

- Account for the largest percentage of annual fatalities in the workplace.
- Can result in:
  - Fatalities.
  - Neck or spinal injury leading to permanent disability or paralysis.
  - Multiple fractures.

**Falling objects** can also cause severe injuries that may result in death, brain damage, paralysis or multiple fractures.

The distance (vertical height) of a fall is not always the deciding factor in the cause of injuries, but is a factor that has to be taken into account, as we will see later.

## BASIC HAZARDS AND RISK FACTORS

### Design

Good design is important in working at height, not only of the existing structures or materials to be worked on, but design and strength/stability of the access equipment used, and the design of the task itself.

Without good design, access equipment may not be specified correctly, may be poorly erected and positioned, and safety features may be absent or missed. Poor design of the task may allow work by unauthorised or untrained operatives, increasing the risk factor greatly.

### Distance of Falls

The distance a person or object can fall will have a direct bearing on the severity of injury or damage it can cause. Where work at height cannot be avoided, the first considerations will be to reduce the distance a person can fall. We will discuss prevention methods later in this element.

# Working at Height - Hazards and Risks

## Roofs

Roofwork includes construction and maintenance of roofs, e.g. replacing tiles, gutter cleaning, chimney repairs and re-pointing. Many accidents occur during small jobs and maintenance work. In addition, maintenance work is often carried out in a hurry, e.g. storm damage repairs.

Particular dangers arise with three types of roof:

- **Fragile Roofs**

A fragile roof is any roofing structure which is not:

- Specifically designed to withstand the weight of a person or a load they may be carrying.
- Strong enough to withstand adverse weather conditions.

Roofing materials such as cement, asbestos, glass, reinforced plastics and light tongued and grooved wood covered with roofing felt are all liable to collapse under the weight of a worker.

All fragile roofs except glass should have a large warning notice displayed on them. However, remember that with multinational workforces, a sign in the national language does not necessarily provide sufficient warning and must be backed up by verbal warnings.

The safe method of working on fragile roofs is by the use of roof ladders or crawling boards laid across the surface, supported by underlying and load-bearing roof members and distributing the load of the worker over a wider area, enabling the roof structure to sustain the load safely.

Roof ladders also provide a good foot-and-hand hold for the worker, and fall arrest equipment should be worn when shown to be required by a risk assessment.

- **Sloping (Pitched) Roofs**

These are roofs with a pitch greater than 10°. Falls from the edges of sloping roofs generally cause serious injury even when the eaves are low, as on a bungalow. If the person has slipped down the roof from the ridge, considerable acceleration can be generated which tends to project them from the eaves, adding to the force of impact with the ground and to the seriousness of the injuries sustained.

- **Flat Roofs**

Work on flat roofs can lead to falls (usually from unprotected edges). These commonly occur:

- From a completed roof.
- From a roof where work is being completed.
- Through openings or gaps (voids).
- Through fragile materials making up part of the roof, e.g. roof-lights.

## Roof Lights

Roof lights are commonly clear sheets built in to a roof to allow light through, and are made of fragile materials (such as plastics) and not always easy to see – they may be covered with dirt and grime, moss or algae, or perhaps painted over. They are often difficult to identify from the surrounding roof materials in bright or very dim light. If they are not covered, guarded or fitted with toeboards, it can be easy to fall through and suffer serious (or fatal) injury.

## Voids

Voids beneath roofs should be treated as confined spaces because of the close, confined nature of the space. This can restrict movement within the void, perhaps leading to postural problems if prolonged. Since voids often remain undisturbed for long periods, dusts settle and will be disturbed by movement, creating a dusty atmosphere which can cause breathing difficulties and lack of light.

The floor within a void is often the ceiling of a room or space below, so access on fragile surfaces can be a major issue, and crawling boards may be required for safe access within the void.

## Deterioration of Materials

The condition of the structure on which people are working should be sound. However, materials deteriorate over time, particularly when exposed to the effects of the weather (heat as well as cold and water) and attack by animals and insects, etc.

Unsound materials represent a hazard in two ways:

- The danger of the material breaking when a person puts his/her weight on it and causing a fall through the surface.
- The danger of materials breaking off and falling to hit people or structures at lower levels. Where they hit lower structures, this may cause a collapse.

It may not always be obvious that deterioration has occurred until it is too late, so care needs to be taken to ensure that footholds are sound and secure.

## Unprotected Edges

Where the edges of surfaces on which people are working are open, the risk of falls or falling objects is greatly increased. This applies to roofs, elevated walkways, scaffolding and access platforms, etc.

We deal with the use of guardrails, toeboards, fencing and other protective boarding required to prevent such accidents later.

## Unstable or Poorly Maintained Access Equipment

Access equipment includes scaffolding, towers, platforms and ladders. There are inherent risks in using such equipment, but these are increased if the equipment is unstable, unsecured and not properly maintained.

Any access equipment that is not positioned correctly, is poorly constructed or poorly secured, will be unstable. Conditions such as overloading of the equipment, high winds or overreaching can then cause a catastrophic collapse or topple.

Equipment not properly maintained can suffer damage from rust, physical damage, broken or damaged treads and fittings, and platform boards that rot through the timber.

## Weather

The weather can increase the risks associated with working at height:

- Rain or freezing conditions can increase the risk of slipping.
- High winds can make access equipment unstable, blow loose materials off (and in extreme conditions, workers).
- Cold conditions can cause loss of manual dexterity and can lead to an increase in muscle injuries.

## Falling Materials

Objects falling from a height are capable of causing considerable damage to both people and other materials that they hit. The objects themselves may be:

- Loose structural material, e.g. tiles, bricks and timbers.
- Waste materials, e.g. stone chippings or off-cuts of wood.
- Equipment or tools which are dropped.

Circumstances which contribute to the likelihood of falling materials include:

- Deterioration of structures causing crumbling brickwork or loose tiles.
- Bad storage of materials, e.g. at the edges of scaffold platforms, or in unstable stacks.
- Poor housekeeping leading to accumulations of waste and loose materials.
- Gaps in platform surfaces or between access platforms and walls.
- Open, unprotected edges.
- Incorrect methods of getting materials, equipment or tools from ground level to the working area.
- Incorrect methods of getting materials down to ground level, e.g. throwing.

## METHODS OF AVOIDING WORKING AT HEIGHT

All work at height should be assessed. The best way to manage the risks inherent with working at height is to eliminate the need to work at height altogether. This can be achieved by:

- Modifying a work process, e.g. cleaning windows from the ground by pole cleaning rather than off ladders.
- Modifying a design, e.g. erecting guardrails or steelwork at ground level and then craning the steel and guardrails into place.

In most instances in the construction industry, avoidance will not be possible and control measures for working at height will be required.

## TOPIC FOCUS

The work at height **risk prevention hierarchy**:

- Avoid work at height.
- Use work equipment or other measures to prevent falls where work at height cannot be avoided.
- Use work equipment or other measures to minimise the distance and consequences of a fall where the risk of a fall cannot be eliminated.

## MAIN PRECAUTIONS TO PREVENT FALLS AND FALLING MATERIALS

A simple hierarchy can be followed to **prevent falls**:

- Avoid work at height.
- Carry out work from an existing place of work.
- Provide a safe working platform with guardrails, fences, toeboards, etc. that are strong enough to prevent a fall.
- Where this is not possible, provide properly installed personnel equipment such as rope access or boatswain's chairs (see later).
- If this is not possible and a worker can approach an unprotected edge, provide equipment which will restrain or arrest falls, e.g. safety harnesses or safety nets.

A similar hierarchy can help to **prevent falling objects**:

- Not stacking materials near edges, and particularly unprotected edges.
- Close boarding of working platforms to minimise the gaps between scaffold boards, or placing sheeting over the boards so that material cannot fall through.
- Avoiding carrying materials up or down ladders, etc. by using hoists and chutes to move materials.
- Prevent materials from falling by using physical safeguards such as toeboards and brickguards.
- Where a risk remains, use physical safeguards to prevent falling objects hitting people below, e.g. debris netting, fans (wooden shielding angled to catch debris) and covered walkways (tunnels).

Guardrails, toeboards and brickguards are described later in this element.

# Working at Height - Hazards and Risks

## Good Design

Good design is important in working at height, not only of the existing structures or materials to be worked on, but design and strength/stability of the access equipment used, and the design of the task itself.

Important design factors include the safety features of the access equipment (handrails, toeboards, fall arrest or restraint connections, etc.) and how access equipment is erected and positioned, so as to be stable on secure, firm level ground, away from vehicles and pedestrians. Task design also includes the methods used to lift and lower equipment and materials to and from work at height locations, and the security of the access equipment in difficult weather conditions.

## Planning and Supervision of Work

Work at height should be planned in advance, with careful consideration given to the selection and use of work equipment. A safe system of work should be set up which takes account of:

- Levels of supervision of workers required, e.g. fall arrest equipment will require a higher level of supervision than work on a mobile scaffold tower.
- Weather conditions, e.g. carrying out maintenance on an icy roof or working in rainy conditions on a slippery surface.
- Emergency or rescue arrangements that may be required, e.g. if workers fall while using a fall arrest system. It is not acceptable just to rely on the emergency services; this needs to be covered in the risk assessment and planned beforehand.

## Avoidance of Work in Adverse Weather

If adverse weather such as icy, rainy or windy conditions greatly increases the risk of working at height (e.g. carrying a wide roof sheet in high wind), the work should be postponed until conditions are satisfactory. Getting a daily weather forecast is a suitable precaution.

This stipulation does not apply for emergency services acting in the event of an emergency.

## EMERGENCY RESCUE PLANS

Emergency procedures should be in place to cover reasonably foreseeable circumstances, e.g. stuck access equipment or deployed fall arrest, in order that people can be rescued.

Methods selected need to be proportionate to the risk:

- There should be no reliance on the emergency services.
- Simple systems may be appropriate (e.g. putting a ladder up to a net and allowing a fallen person to climb down).
- More detailed systems may be required (e.g. the use of other work equipment such as mobile elevating work platforms (MEWPs) or proprietary rescue systems).

Employers must ensure that those involved are trained in the procedures and that the equipment required is available.

## Provision of Equipment, Training and Other Measures to Minimise Distance and Consequences of a Fall

As we saw earlier, where work at height cannot be avoided we must minimise the distance a person can fall, and if not, the consequences of a fall. As we will see a bit later in this element, equipment such as fall restraint or fall arrest can be used, or soft-landing systems such as safety nets or air bags.

In all such cases operatives must receive adequate training and instruction to appreciate the dangers of working at height, the service and use of the equipment, and the correct (and incorrect) methods of use.

## REQUIREMENTS FOR HEAD PROTECTION

Construction sites almost always have a risk of someone being struck by falling or moving objects, so should be mandatory hard hat (safety helmet) areas. Hard hats offer protection against small falling objects, e.g. rubble or hand tools, but will not protect against heavy impact from a large object (e.g. a scaffold pole) or something dropped from really high (e.g. a spanner from ten floors up). Other controls should be used to prevent objects from falling.

For head protection from injuries incurred in falls from height, a climbing helmet may be more appropriate as it has:

- Impact strength against:
  - Falling objects.
  - Hitting the head in a fall.
- A four-point chin strap to secure it (a safety helmet usually has only two).

## INSPECTION REQUIREMENTS FOR WORK EQUIPMENT

The **International Labour Organisation Code of Practice C167 1998** requires work equipment (including access equipment for working at height) to be maintained and inspected to ensure its continuing safety. This would generally require:

- Visual or more rigorous inspection by a competent person for safety purposes.
- Testing where appropriate.

Work equipment includes guardrails, toeboards, barriers and similar collective means of protection. This encompasses all working platforms (including scaffolding), nets and airbags, personal fall protection systems, work positioning systems, fall arrest systems and work restraint systems. Ladders are also considered to be work equipment.

Each work at height location should be checked each time it is used, including the surface parapets and permanent rails. An inspection should be made after the equipment has been assembled and as often as is necessary to ensure safety. Pay special attention to potential deterioration of materials.

Any platform used in construction higher than two metres must be inspected in its place of use before being used. The inspection is only valid for seven days. For mobile platforms, inspection at the site is sufficient without inspection again every time it is relocated on that site.

## TOPIC FOCUS

An **inspection report** for platforms should be kept for three months after completion, and should contain:

- Name and address of person for whom inspection is carried out.
- Location of equipment inspected.
- Description of equipment inspected.
- Time and date of inspection.
- Details of problems found.
- Details of action taken.
- Future action required.
- Name and position of competent person.

The report must be given to the person responsible for managing the site within 24 hours of completion.

## REVISION QUESTIONS

1. What is the hierarchy of measures for working at height?
2. What are the safe methods of working on a fragile roof?
3. Where can falls occur from a flat roof?
4. What measures should be taken to prevent materials falling from a height?
5. When should a platform used for construction work where a person could fall more than two metres be inspected?

(Suggested Answers are at the end.)