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Construction activities – hazards and control

16.1 Introduction

The construction industry covers a wide range of activities from large-scale civil engineering projects to very small house extensions. The construction industry has approximately 200 000 firms, of whom only 12 000 employ more than seven people – many of these firms are much smaller. The use of sub-contractors is very common at all levels of the industry.

It is most likely that everybody will be aware or involved with some aspect of the construction industry at their place of work – either in terms of the repair and modification of existing buildings or a major new engineering project. It is, therefore, important that the health and safety practitioner has some basic knowledge of the hazards and health and safety legal requirements associated with construction.

Over many years, the construction industry has had a poor health and safety record. In 1966, there were 292 fatalities in the industry and by 1995 this figure had reduced to 62, but by 2000/2001 the figure had increased to 106. These figures include deaths of members of the public, including children playing on construction sites. Most of these fatalities (over 70%) were caused by falls from height.

At a conference, organized by the Health and Safety Commission in February 2001, to address the problem, it was noted that at least two construction workers are being killed each week. Targets were set to reduce the number of fatalities and major injuries by 40% over a 4-year period.

Due to the fragmented nature of the industry and its accident and ill-health record, the recent construction industry legal framework has concentrated on hazards

associated with the industry, welfare issues and the need for management and control at all stages of a construction project. In addition to the Health and Safety at Work Act 1974 and its associated relevant regulations, there are three sets of specific construction regulations which provide this legal framework, as follows:

- Construction (Head Protection) Regulations
- Construction (Design and Management) Regulations
- Work at Height Regulations

A summary of these regulations is given in Chapter 17.

16.2 The scope of construction

The scope of the construction industry is very wide. The most common activity is general building work which is domestic, commercial or industrial in nature. This work may be new building work, such as a building extension or, more commonly, the refurbishment, maintenance or repair of existing buildings. Larger civil engineering projects involving road and bridge building, water supply and sewage schemes and river and canal work all come within the scope of construction.

The work could involve hazardous operations, such as demolition or roof work, or contact with hazardous materials, such as asbestos or lead. Construction also includes the use of woodworking workshops together with woodworking machines and their associated hazards, painting and decorating and the use of heavy machinery. It will often require work to take place in confined spaces, such as excavations and underground chambers.

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Finally, at any given time, there are many young people receiving training on site in the various construction trades. These trainees need supervision and structured training programmes.

16.3 Construction hazards and controls

The Construction (Design and Management) (CDM) Regulations 2007 deal with many of the hazards likely to be found on a building site. In addition to these specific hazards, there will be the more general hazards (e.g. working at height, manual handling, electricity, noise, etc.) which have been discussed in more detail in earlier chapters. The hazards and controls identified in the CDM 2007 and Work at Height Regulations are as follows.

16.3.1 Safe place of work

Safe access to and egress from the site and the individual places of work on the site are fundamental to a good health and safety environment. This clearly requires that all ladders, scaffolds, gangways, stairways and passenger hoists are safe for use. It further requires that all excavations are fenced, the site is tidy and proper arrangements are in place for the storage of materials and the disposal of waste. The site needs to be adequately lit and secured against intruders, particularly children, when it is unoccupied. Such security will include:

- secure and locked gates with appropriate notices posted

- a secure and undamaged perimeter fence with appropriate notices posted
- all ladders either stored securely or boarded across their rungs
- all excavations covered
- all mobile plant immobilized and fuel removed, where practicable, and services isolated
- secure storage of all inflammable and hazardous substances
- visits to local schools to explain the dangers present on a construction site. This has been shown to reduce the number of child trespassers
- if unauthorized entry persists, then security patrols and closed circuit television may need to be considered.

16.3.2 Work at height

Work at height accounts for about 50–60 deaths – more than any other workplace activity – and 4000 injuries each year. This is being addressed by the introduction of the Work at Height Regulations which apply to all operations carried out at height, not just construction work, so that they are also relevant to, for example, window cleaning, tree surgery, maintenance work at height and the changing of street lamps. The Work at Height Regulations affect approximately 3m workers where working at height is essential to their work.

The Work at Height Regulations have no minimum height requirement for work at height. They include all work activities where there is a need to control a risk of falling a distance liable to cause personal injury. This is regardless of the work equipment being used, the duration of the work at height involved, or the height at



Figure 16.1 Secure site access gate.

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which the work is performed. It includes access to and egress from a place of work. It would therefore include:

- Working on a scaffold or from a mobile elevated work platform (MEWP)
- Sheeting a lorry or dipping a road tanker
- Working on the top of a container in docks or on a ship or storage area
- Tree surgery and other forestry work at height
- Using cradles or rope for access to a building or other structure like a ship under repair
- Climbing permanent structures like a gantry or telephone pole
- Working near an excavation area or cellar opening if a person could fall into it and be injured
- Painting or pasting and erecting bill posters at height
- Work on staging or trestles. e.g. for filming or events
- Using a ladder/stepladder or kick stool for shelf filling, window cleaning and the like
- Using manriding harnesses in ship repair, off-shore or steeple jack work
- Working in a mine shaft or chimney
- Work carried out at a private house by a person employed for the purpose, e.g. painter and decorator (but not if the private individual carries out work on their own home).

However it would not include:

- Slips trips and falls on the same level
- Falls on permanent stairs if there is no structural or maintenance work being done
- Work in the upper floor of a multi storey building where there is no risk of falling (except separate activities like using a stepladder).

At the centre of the regulations (Regulation 6), the employer is expected to apply a three stage hierarchy to all work which is to be carried out at height. The three steps are the avoidance of work at height, the prevention of workers from falling and the mitigation of the effect on workers of falls should they occur.

The regulations require that:

- work is not carried out at height when it is reasonably practicable to carry the work out safely other than at height (e.g. the assembly of components should be done at ground level)
- when work is carried out at height, the employer shall take suitable and sufficient measures to prevent, so far as is reasonably practicable, any person falling a distance liable to cause injury (e.g. the use of guard rails)

- the employer shall take suitable and sufficient measures to minimize the distance and consequences of a fall (collective measures, e.g. air bags or safety nets, must take precedence over individual measures, e.g. safety harnesses).

The risk assessment and action required to control risks from using a kick stool to collect books from a shelf should be simple (e.g. not overloading, not overstretching, etc). However, the action required for a complex construction project would involve significantly greater consideration and assessment of risk. A summary of the Regulations is given in Chapter 17.

16.3.3 Protection against falls from work at height

The Work at Height Regulations require that guard rails on scaffolds are at a minimum of 950 mm and the maximum unprotected gap between the toe and guard rail of a scaffold is 470 mm. This implies the use of an intermediate guard rail although other means, such as additional toe boards or screening, may be used. It also specifies requirements for personal suspension equipment and means of arresting falls (such as safety nets).

When working at height, a hierarchy of measures should then be followed, to prevent falls from occurring. These measures are:

- avoid working at height, if possible
- the provision of a properly constructed working platform, complete with toe boards and guard-rails
- if this is not practicable or where the work is of short duration, suspension equipment should be used and only when this is impracticable
- collective fall arrest equipment (air bags or safety nets) may be used.
- where this is not practicable individual fall restrainers (safety harnesses) should be used
- only when none of the above measures are practicable, should ladders of step ladders be considered.

16.3.4 Fragile roofs and surfaces

Work on or near fragile surfaces is also covered by the Work at Height Regulations (see summary in Chapter 17). Roof work, particularly work on pitched roofs, is hazardous and requires a specific risk assessment and method statement (see later under the management of construction activities for a definition) prior to the commencement of work. Particular hazards are fragile roofing materials, including those materials which deteriorate and become more brittle with age and exposure to sunlight, exposed edges, unsafe access equipment



Figure 16.2 Proper precautions must always be taken when working on or near fragile roofs.

and falls from girders, ridges or purlins. There must be suitable means of access such as scaffolding, ladders and crawling boards. Suitable barriers, guard rails or covers where people work near to fragile materials and roof lights. Suitable warning signs indicating that a roof is fragile, should be on display at ground level.

There are other hazards associated with roof work – overhead services and obstructions, the presence of asbestos or other hazardous substances, the use of equipment such as gas cylinders and bitumen boilers and manual handling hazards.

It is essential that only trained and competent persons are allowed to work on roofs and that they wear footwear having a good grip. It is a good practice to ensure that a person does not work alone on a roof.

16.3.5 Protection against falling objects

Also now covered by the Work at Height Regulations (see summary of Chapter 17). Both construction workers and members of the public need to be protected from the hazards associated with falling objects. Both groups should be protected by the use of covered walkways or suitable netting to catch falling debris. Waste material should be brought to ground level by the use of chutes or hoists. Waste should not be thrown and only minimal quantities of building materials should be stored on working platforms. The Construction (Head Protection) Regulations 1989 virtually mandates employers to supply head protection (hard hats) to employees whenever there is a risk of head injury from falling objects. (Sikhs wearing turbans are exempted from this requirement.) The employer is also responsible for ensuring that hard hats are properly maintained and replaced when they are damaged in any way. Self-employed workers must supply and maintain their own head protection. Visitors to construction sites should always be supplied with

head protection and mandatory head protection signs displayed around the site.

16.3.6 Demolition

Demolition is one of the most hazardous construction operations and is responsible for more deaths and major injuries than any other activity. The management of demolition work is controlled by the Construction (Design and Management) Regulations and requires a planning supervisor and a health and safety plan (see the next section of this chapter).

The principal hazards associated with demolition work are:

- falls from height or on the same level
- falling debris
- premature collapse of the structure being demolished
- dust and fumes
- the silting up of drainage systems by dust
- the problems arising from spilt fuel oils
- manual handling
- presence of asbestos and other hazardous substances
- noise and vibration from heavy plant and equipment
- electric shock
- fires and explosions from the use of flammable and explosive substances
- smoke from burning waste timber
- pneumatic drills and power tools
- the existence of services, such as electricity, gas and water
- collision with heavy plant, and
- plant and vehicles overturning.

Before any work is started, a full site investigation must be made by a competent person to determine the

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hazards and associated risks which may affect the demolition workers and members of the public who may pass close to the demolition site. The investigation should cover the following topics:

- construction details of the structures or buildings to be demolished and those of neighbouring structures or buildings
- the presence of asbestos, lead or other hazardous substances
- the location of any underground or overhead services (water, electricity, gas, etc.)
- the location of any underground cellars, storage tanks or bunkers, particularly if flammable or explosive substances were previously stored
- the location of any public thoroughfares adjacent to the structure or building.

The CDM co-ordinator, who is responsible for notifying the Health and Safety Executive of the proposed demolition work, must ensure that a written risk assessment is made of the design of the structure to be demolished and the influence of that design on the demolition method proposed. This risk assessment will normally be made by the project designer who will also plan the demolition work. A further risk assessment should then be made by the contractor undertaking the demolition – this risk assessment will be used to draw up a method statement for inclusion in the health and safety plan. A written method statement will be required before demolition takes place. The contents of the method statement will include the following:

- details of method of demolition to be used, including the means of preventing premature collapse or the collapse of adjacent buildings and the safe removal of debris from upper levels
- details of equipment, including access equipment, required and any hazardous substances to be used
- arrangements for the protection of the public and the construction workforce, particularly if hazardous substances, such as asbestos or other dust, are likely to be released
- details of the isolation methods of any services which may have been supplied to the site and any temporary services required on the site
- details of personal protective equipment which must be worn
- first aid, emergency and accident arrangements
- training and welfare arrangements
- arrangements for waste disposal
- names of site foremen and those with responsibility for health and safety and the monitoring of the work
- COSHH and other risk assessments (personal protective equipment, manual handling, etc.) should be appended to the method statement.

There are two forms of demolition:

- piecemeal – where the demolition is done using hand and mechanical tools such as pneumatic drills and demolition balls
- deliberate controlled collapse – where explosives are used to demolish the structure. This technique should only be used by trained, specialist competent persons.

A very important element of demolition is the training required by all construction workers involved in the work. Specialist training courses are available for those concerned with the management of the process, from the initial survey to the final demolition. However, induction training, which outlines the hazards and the required control measures, should be given to all workers before the start of the demolition work. The site should be made secure with relevant signs posted to warn members of the public of the dangers.

16.3.7 Excavations

This topic will be covered in more detail later in this chapter. Excavations must be constructed so that they are safe environments for construction work to take place. They must also be fenced and suitable notices posted so that neither people nor vehicles fall into them as required by the Work at Height Regulations.

16.3.8 Prevention of drowning

Where construction work takes place over water, steps should be taken to prevent people falling into the water and rescue equipment should be available at all times.

16.3.9 Vehicles and traffic routes

All vehicles used on site should be regularly maintained and records kept. Only trained drivers should be allowed to drive vehicles and the training should be relevant to the particular vehicle (fork lift truck, dumper truck, etc.). Vehicles should be fitted with reversing warning systems. HSE investigations have shown that in over 30% of dumper truck accidents, the drivers had little experience and no training. Common forms of accident include driving into excavations, overturning while driving up steep inclines and runaway vehicles which have been left unattended with the engine running. Many vehicles such as mobile cranes require regular inspection and test certificates.

The small dumper truck is widely used on all sizes of construction site. Compact dumper trucks are involved



Figure 16.3 Barriers around excavation by footpath.

in about 30% of construction transport accidents. The three main causes of such accidents are:

- overturning on slopes and at the edges of excavations
- poorly maintained braking systems, and
- driver error due to lack of training and/or inexperience.

Some of the hazards associated with this vehicle are: collisions with pedestrians, other vehicles or structures, such as scaffolding etc. They can be struck by falling materials and tools or be overloaded. The person driving the truck can be thrown from the vehicle, come into contact with moving parts on the truck, suffer the effects of whole body vibrations due to driving over potholes in the roadway and suffer from the effects of noise and dust. The precautions that can be taken to address these hazards include the use of authorized, trained, competent and supervised drivers only. As with so many other construction operations, risks should be assessed, safe systems of work followed and drivers forbidden from taking shortcuts. The following site controls should also be in place:

- designated traffic routes and signs
- speed limits
- stop blocks used when the vehicle is stationary
- proper inspection and maintenance procedures
- procedures for starting, loading and unloading the vehicle
- provision of roll-over protective structures (ROPS) and seat restraints

- provision of falling-object protective structures (FOPS) when there is a risk of being hit by falling materials
- visual and audible warning of approach
- where necessary, hearing protection.

For other forms of mobile construction equipment, such as fork lift trucks (covered in chapter 12), the risk to people from the overturning of the equipment must always be safeguarded. This can usually be achieved by the avoidance of working on steep slopes, the provision of stabilizers and ensuring that the load carried does not affect the stability of the equipment/vehicle. Chapter 14 describes the hazards, safeguards and precautions for several pieces of equipment and machinery used in construction work, such as the cement/concrete mixer and the bench-mounted circular saw.

Traffic routes and loading and storage areas need to be well designed with enforced speed limits, good visibility and the separation of vehicles and pedestrians being considered. The use of one-way systems and separate site access gates for vehicles and pedestrians may be required. Finally, the safety of members of the public must be considered, particularly where vehicles cross public footpaths.

16.3.10 Fire and other emergencies

Emergency procedures relevant to the site should be in place to prevent or reduce injury arising from fire, explosions, flooding or structural collapse. These procedures should include the location of fire points and assembly

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points, extinguisher provision, site evacuation, contact with the emergency services, accident reporting and investigation and rescue from excavations and confined spaces. There also needs to be training in these procedures at the induction of new workers and ongoing for all workers.

16.3.11 Welfare facilities

The Health and Safety Executive has been concerned for some time at the poor standard of welfare facilities on many construction sites. Sanitary and washing facilities (including showers if necessary) with an adequate supply of drinking water should be provided for everybody working on the site. Accommodation will be required for the changing and storage of clothes and rest facilities for break times. There should be adequate first-aid provision (an accident book) and protective clothing against adverse weather conditions.

16.3.12 Electricity

Electrical hazards have been covered in detail earlier in Chapter 12, and all the control measures mentioned apply on a construction site. However, due to the possibility of wet conditions, it is recommended that only 110V equipment is used on site. Where mains electricity is used (perhaps during the final fitting out of the building), then residual current devices should be used with all equipment. Where workers or tall vehicles are working near or under overhead power lines, either the power should be turned off or 'goal posts' or taped markers used to prevent contact with the lines. Similarly, underground supply lines should be located and marked before digging takes place.

16.3.13 Noise

Noisy machinery should be fitted with silencers. When machinery is used in a workshop (such as woodworking machines), a noise survey should be undertaken and, if the noise levels exceed the second action level, the use of ear defenders becomes mandatory.

16.3.14 Health hazards

Health hazards are present on a construction site. These hazards include vibration, dust (including asbestos), cement, solvents and paints and cleaners. A COSHH assessment is essential before work starts with regular updates as new substances are introduced. Copies of the assessment and the related safety data sheets should be kept in the site office for reference after accidents or fires. They will also be required to check that

the correct personal protective equipment is available. A manual handling assessment should also be made to ensure that the lifting and handling of heavy objects is kept to a minimum.

Many of the health hazards (both chemical and biological) are covered in Chapter 14 including silica which is a commonly produced during construction activities. Such activities which can expose workers and members of the public to silica dust include:

- cutting building blocks and other stone masonry work
- cutting and/or drilling paving slabs and concrete paths
- demolition work
- sand blasting of buildings, and
- tunnelling.

In general, the use of power tools to cut or dress stone and other silica containing materials will lead to very high exposure levels while the work is occurring. In most cases, exposure levels are in excess of workplace exposure limits (WELs) by factors greater than 2 and in some cases as high as 12. In response to the growing evidence of ill-health effects of silica inhalation, the HSE has recently revised the workplace exposure limit down from 0.3 mg/m³ to 0.1 mg/m³.

The inhalation of very fine silica dust can lead to the development of silicosis. HSE have produced a detailed information sheet on silica – CIS No 36 (Rev 1).

In addition to silica, there are three additional hazardous substances that are particularly relevant to construction activities – cement dust and wet cement, wood dust and the biological hazard tetanus.

Cement dust and wet cement is an important construction and is also a hazardous substance. Contact with wet cement can cause serious burns or ulcers which will take several months to heal and may need a skin graft. Dermatitis, both irritant and allergic, can be caused by skin contact with either wet cement or cement powder. Allergic dermatitis is caused by an allergic reaction to hexavalent chromium (chromate) which is present in cement. Cement powder can also cause inflammation and irritation of the eye, irritation of the nose and throat, and, possibly, chronic lung problems. Research has shown that between 5% and 10% of construction workers are probably allergic to cement. And plasterers, concreters and bricklayers or masons are particularly at risk. A plasterer, who knelt in wet cement for 5 hours while working, required skin grafts to his legs.

Manual handling of wet cement or cement bags can lead to musculoskeletal health problems and cement bags weighing more than 25kg should not be carried by a single worker. Personal protective equipment in the form of gloves, overalls with long sleeves and full length trousers and waterproof boots must be worn on

all occasions. If the atmosphere is dusty, goggles and respiratory protection equipment must be worn. An important factor in the possibility of dermatitis occurring is the sensitivity of the worker to the chromate in the cement and the existing condition of the skin including cuts and abrasions. Finally, adequate welfare facilities are essential so that workers can wash their hands at the end of the job and before eating, drinking or using the toilet. If cement is left on the skin for long periods without being washed off, the risk of an allergic reaction to hexavalent chromium will increase.

A 2005 amendment to the COSHH Regulations prohibits the supply of cement which has a concentration of more than 2 parts per million of Chromium VI. This measure is designed to prevent allergic contact dermatitis when wet cement comes into contact with the skin. However, since the strong alkalinity of cement will remain, there is still the potential for skin burns.

The Approved Code of Practice gives useful advice on possible control measures by offering two routes for employers to comply with the amended COSHH Regulations. They can either use the generic advice given in COSHH Essentials HSG193 or design a solution themselves with the help of competent advice. In any event, the controls should be proportionate to the health risk. The regulations stress the need to provide adequate washing, changing, eating and drinking facilities.

Wood dust can be hazardous, particularly when it is hard wood dust which is known, in rare cases, to lead to nasal cancer. Composite boards, such as medium-density fibreboard (MDF), are hazardous due to the resin bonding material used which also can be carcinogenic. There are three types of wood based boards available: laminated board, particle board and fibreboard. The resins used to bond the fibreboard together contain formaldehyde (usually urea formaldehyde). It is generally recognised that formaldehyde is 'probably carcinogenic to humans' and is subject to a workplace exposure limit (WEL). At low exposure levels, it can cause irritation to the eyes, nose and throat and can lead to dermatitis, asthma and rhinitis. The main problems are most likely to occur when the MDF is being machined and dust is produced. A suitable risk assessment should be made and gloves and appropriate masks should always be worn when machining MDF. However, it is important to stress that safer materials are available which do not contain formaldehyde and these should be considered for use in the first instance.

Wood dust is produced whenever wood materials are machined, particularly sawed, sanded, bagged as dust from dust extraction units or during cleaning operations especially if compressed air is used. The main hazards associated with all wood dusts are skin disorders, nasal problems, such as rhinitis, and asthma. There is also a hazard from fire and explosion. A COSHH

assessment is essential to show whether the particular wood dust is hazardous. When the wood dust is created inside a woodworking shop a well-designed extraction system is essential. Personal protective equipment in the form of gloves, suitable respiratory protective equipment, overalls and eye protection may also be necessary as a result of the assessment. Finally, good washing and welfare facilities are also essential.

Tetanus is a serious, sometimes fatal, disease caused by a bacterium that lives in the soil. It usually enters the human body through a wound from an infected object, such as a nail, wood splinter or thorn. On entering the wound, it produces a powerful toxin which attacks the nerves that supply muscle tissue. It is commonly known as lockjaw because after an incubation period of approximately a week, stiffness of around the jaw area occurs. Later the disease spreads to other muscles including the breathing system and this can be fatal. The disease has been well controlled with anti-tetanus immunization and it is important that all construction workers are so immunized. Booster shots should be obtained every few years. Any flesh wound should be thoroughly cleaned immediately and an anti-septic cream applied.

Other health hazards which could affect construction workers are noise, vibration, asbestos, solvents, fumes, radiation (particularly from sunlight) and biological hazards, such as leptospirosis from sewer work).

Health surveillance may well be required for some of these hazards (see Chapter 14).

16.3.15 Waste disposal

The collection and removal of waste from a construction site is normally accomplished using a skip. The skip should be located on firm, level ground away from the main construction work, particularly excavation work. This will allow clear access to the skip for filling and removal from site. On arrival on site, the integrity of the skip should be checked. It should be filled either by chute or by mechanical means unless items can be placed in by hand. Skips should not be overfilled and be netted or sheeted over when it is full. Any hazardous waste should be segregated as described in Chapter 14 which also mentioned disposal procedures.

16.4 The management of construction activities

16.4.1 Introduction

The management of construction work, including the selection and control of contractors, is governed by the

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Construction (Design and Management) Regulations 2007 known as the CDM 2007. The CDM Regulations apply to the whole of a construction project, from the initial feasibility study to the hand-over of the completed structure to the customer.

CDM 2007 came into force on 6 April 2007. They replace the Construction (Design and Management) Regulations 1994 (CDM 94) and the Construction (Health, Safety and Welfare) Regulations 1996 (CHSW). The new Approved Code of Practice replaces the ACOP under CDM 94.

The key aim of the of CDM 2007 is to integrate health and safety into the management of the project and to encourage everyone involved to work together to.

CDM 2007 is split into several main Parts:

- Part 2 – covers all construction projects and sets out general management duties
- Part 3 – sets out additional duties where the project is notifiable
- Part 4 – sets out the duties relating to health and safety on construction sites + schedule 2 welfare arrangements (largely the former Construction (Health, safety and welfare) Regulations 1996)

More details of CDM 2007 are given in Chapter 17.

16.4.2 Explanation of terms used in the CDM 2007 and Approved Code of Practice

A CLIENT is an organization or individual for whom a construction project is carried out. Clients only have duties when the project is associated with a business or other undertaking (whether for profit or not). This can include for example, local authorities, school governors, insurance companies and project originators or Private Finance Initiative (PFI) projects. Domestic clients are a special case and do not have duties under CDM 2007.

Designer: Designers are those who have a trade or a business which involves them in:

- Preparing designs for construction work, including variations. This includes preparing drawings, design details, specifications, bills of quantities and the specification (or prohibition) of articles and substances, as well as all the related analysis, calculations, and preparatory work; or
- Arranging for their employees or other people under their control to prepare designs relating to a structure or part of a structure.

It does not matter whether the design is recorded (e.g. on paper or a computer) or not (e.g. it is only communicated orally).

Designers may include:

- architects, civil and structural engineers, building surveyors, landscape architects, other consultants, manufacturers and design practices (of whatever discipline) contributing to, or having overall responsibility for, any part of the design, for example drainage engineers
- anyone who specifies or alters a design, or who specifies the use of a particular method of work or material, such as a design manager, quantity surveyor who insists on specific material or a client who stipulates a particular layout for a new building
- building service designers, engineering practices or others designing plant which forms part of the permanent structure (including lifts, heating, ventilation and electrical systems), for example a specialist provider of permanent fire extinguishing installations
- those purchasing materials where the choice has been left open, for example those purchasing building blocks and so deciding the weights that a brick-layer must handle
- contractors carrying out design work as part of their contribution to a project, such as an engineering contractor providing design, procurement and construction management services
- temporary works engineers, including those designing auxiliary structures, such as formwork, falsework, façade retention schemes, scaffolding and sheet piling
- interior designers, including shop-fitters who also develop the design
- heritage organizations who specify how work is to be done in detail, for example providing detailed requirements to stabilize existing structures, and
- those determining how buildings and structures are altered, e.g. during refurbishment, where this has the potential for partial or complete collapse.

CDM co-ordinator: means the person appointed as the CDM co-ordinator under regulation 14.(1) for notifiable projects only. The CDM Co-ordinator provides clients with a key project advisor in respect of construction health and safety risk management matters. Their main purpose is to help clients to carry out their duties; to co-ordinate health and safety aspects of the design work and to prepare the health and safety file.

Principal contractor: This is the contractor appointed by the client for notifiable projects. The principal contractor can be an organization or an individual, and is the main or managing contractor. A principal contractor's key duty is to co-ordinate and manage the construction phase to ensure the health and safety of everybody carrying out construction work, or who are affected by the work.

Pre-construction health and safety information: The client must provide to designers and contractors and for notifiable projects the CDM co-ordinator specific health and safety information needed to identify the hazards and risks associated with the design and construction work. The information needs to be identified, assembled and sent out in good time, so that those who need it when preparing a bid or preparing for work can decide what resources will be needed to enable design, planning and construction work to be organized and carried out properly.

The topics which should be addressed in the pre-construction information are given in Appendix 16.3.

Construction Phase Health and Safety Plan

Principal Contractors must set out the way in which the construction phase will be managed and the key health and safety issues for the particular project must be set out in writing. The health and safety plan should set out the organization and arrangements that have been put in place to manage risks and co-ordinate the work on site. It should not be a repository for detailed generic risk assessments, records of how decisions were reached or detailed method statements; but it may, for example, set out when such documents will need to be prepared. It should be well focused, clear and easy for contractors and others to understand – emphasizing key points and avoiding irrelevant material. It is crucial that all relevant parties are involved and co-operate in the development and implementation of the plan as work progresses.

The plan must be tailored to the particular project. Generic plans will not satisfy the requirements of Regulation 23. Photographs and sketches can greatly simplify and shorten explanations. It should also be organized so that relevant sections can easily be made available to designers and contractors.

The Construction Phase health and safety plan for the initial phase of the construction work must be prepared before any work begins. Later details may need to be added as work and full designs become available.

See Appendix 16.4 for details of what should be included in the Health and Safety Plan.

Health and safety file This is a record of information for the client to retain which focuses on health and safety. It alerts those who are responsible for the structure and equipment in it of the significant health and safety risks that will need to be dealt with during subsequent use, construction, maintenance, cleaning, repair, alterations, refurbishment and demolition work. See later for further information on the file.

Method statement This is a written document laying out the work procedures and sequences of operations to

ensure health and safety. It results from the risk assessment carried out for the task or operation and the control measures identified. If the risk is low, a verbal statement may suffice.

Notifiable work Construction work (except for a domestic client) is notifiable to the Health and Safety Executive if it lasts longer than 30 working days or will involve more than 500 person days of work, e.g. 50 people working for 10 days. Holidays and weekends do not count if no construction work takes place on those days. The CDM co-ordinator is responsible to make the notification as soon as possible after their appointment for a particular project. The notice must be displayed where it can be read by people working on the site. See Chapter 17 for details of the information required.

16.4.3 Part 1 Non-notifiable Projects Responsibilities of Duty Holders

A summary of duties is shown in table 17.3 in Chapter 17. Also see the flow diagram in Appendix 16.2. The ACOP for CDM 2007 covers the competence of each duty holder in some depth. This is an essential part of the effective management of construction projects. The ACOP should be consulted for further details.

Co-ordination and co-operation is a requirement for all members of the project team. However there is no requirement for the appointment of a CDM co-ordinator, principal contractor or a construction-phase health and safety plan for non-notifiable projects. For low risk projects a low-key approach will suffice. However for higher risk projects, e.g. those involving demolition, a more rigorous approach is required. The architect or lead designer should normally lead the co-ordination of the design work while the main contractor or builder should co-ordinate the construction work.

A brief summary plan may be all that is required in many cases but where the risks are higher, something close to the construction phase plan will be needed. For example where work involves:

- structural alterations
- deep excavations, and those in unstable or contaminated ground
- unusual working methods or safeguards
- ionising radiation or other significant health hazards
- nearby high voltage power-lines
- a risk of falling into water which is, or may become fast flowing
- diving
- explosives
- heavy or complex lifting operations.

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For all **Demolition work** those in control of the work are required to produce a written plan showing how danger will be prevented.

Clients (Non domestic)

Clients are not expected to manage or plan projects themselves. They are not expected to develop substantial expertise in construction health and safety, unless this is central to their business. Clients must ensure that various things are done, but are not normally expected to do them themselves. If help is needed this should be available from the competent person appointed under Regulation 7 of the Management of Health and Safety at Work Regulations 1999. Alternatively clients could seek advice from someone who has acted as a CDM co-ordinator on other projects. (The appointment of a CDM co-ordinator is **not** a requirement for non-notifiable projects.)

The client must make sure that:

- designers, contractors and others who they propose to engage are competent or work under the supervision of competent people, are adequately resourced and appointed early enough to fulfil their duties
- they allow sufficient time for each stage of the project
- they co-operate with others concerned as necessary to allow people to fulfil their duties
- they co-ordinate their own work with others to ensure the safety of those carrying out the construction work
- there are reasonable management arrangements in place throughout the project to ensure the work can be carried out, so far as is reasonably practicable, safely and without risks to health (this does not mean managing the risk themselves as few clients have the expertise)
- contractors have made arrangements for suitable welfare facilities to be provided from the start and throughout the project
- any fixed workplaces which are to be constructed comply with the Workplace (Health Safety and welfare) Regulations
- relevant information (pre-construction information) likely to be needed by designers, contractors or others to plan and manage the work is passed to them.

Clients should make periodic checks through the life of the project, for example to:

- check there is adequate protection for the client's workers and/or members of the public
- check that adequate welfare facilities have been provided by the contractor
- check that there is good co-operation and communication between designers and contractors

- check that the arrangements which the contractor agreed to make to control key risks on site have been implemented.

Designers

Designers should:

- make sure they are competent and adequately resourced to address the health and safety issues likely to be involved in the design
- check that clients are aware of duties
- when designing the project, avoid foreseeable risks to those involved in the construction and future use of the structure, and in so doing, they should eliminate hazards, so far as is reasonably practicable, and reduce risk associated with the hazards that remain
- provide adequate information about any significant risks associated with the design
- co-ordinate their work with that of others in order to improve the way in which risks are managed and controlled.

Designers need to consider risks to those carrying out the construction work; those cleaning and maintaining the structure (particularly windows or translucent panels); those who use the structure for a workplace; and those who may be affected by the work, e.g. the public or other customers.

Contractors

For all projects contractors must:

- check clients are aware of their duties
- satisfy themselves that they and anyone they employ or engage are competent and adequately resourced
- plan, manage and monitor their own work to make sure that workers under their control are safe from the start of their work
- ensure that any contractor who they appoint or engage to work on the project is informed of the minimum amount of time which will be allowed for them to plan and prepare before starting work
- provide workers under their control (whether employed or self-employed) with any necessary information, including about relevant aspects of other contractors' work, and site induction which they need to work safely, to report problems or to respond appropriately in an emergency
- ensure that any design work they do complies with the requirements on designers in Regulation 11
- comply with any relevant requirement in Part 4 and schedule 2 of the regulations regarding health and safety on construction sites
- co-operate with others and co-ordinate their own work with others working on the project

Construction activities – hazards and control

- Obtain specialist advice where necessary when planning high risk work, e.g. alterations that could result in a structural collapse or is on contaminated ground.

16.4.4 Notifiable projects – additional responsibilities of duty holders

Clients

For notifiable projects the client has the following additional duties:

- Appoint a CDM co-ordinator to advise and assist with their duties and to co-ordinate the arrangements for health and safety during the planning phase
- Appoint a principal contractor to plan and manage the construction work – preferably early enough for them to work with the designer on issues relating to buildability, usability and maintainability
- Ensure that the construction phase does not start until the principal contractor has prepared a suitable health and safety plan and made arrangements for suitable welfare facilities to be present from the start of the work
- Make sure the health and safety file is prepared, reviewed, or updated ready for handover at the end of the construction work. This must be kept available for any future construction work or to pass onto a new owner.

Early appointments are essential as the client is likely to have to rely on the advice from the CDM co-ordinator on the competence of appointees and the adequacy of the arrangements. If a client does not make these appointments they are liable for the work of the CDM co-ordinator and the principal contractor as well as not making the appointment.

CDM co-ordinators

CDM co-ordinators must:

- give suitable and sufficient advice and assistance to clients in order to help them to comply with their duties, in particular:
 - the duty to appoint competent designers and contractors; and
 - the duty to ensure that adequate arrangements are in place for managing the project
- notify the HSE about the project
- co-ordinate design work, planning and other preparation for construction where relevant to health and safety
- identify and collect the pre-construction information and advise the client if surveys need to be commissioned to fill significant gaps

- promptly provide in a convenient form to those involved with the design of the structure; and to every contractor (including the principal contractor) who may be or has been appointed by the client, such parts of the pre-construction information which are relevant to each
- manage the flow of health and safety information between clients designers and contractors
- advise the client on the suitability of the initial construction phase plan and the arrangements made to ensure that welfare facilities are on site from the start
- produce or update a relevant, user friendly, health and safety file suitable for future use at the end of the construction phase.

Designers

For notifiable projects designers have the following additional duties:

- ensure that the client has appointed a CDM co-ordinator and notified HSE
- ensure that they do not start design work other than initial design work unless a CDM co-ordinator has been appointed
- co-operate with the CDM co-ordinator, principal contractor and with any other designers or contractors as necessary for each of them to comply with their duties. This includes providing any information needed for the pre-construction information pack or health and safety file.

The Principal contractor

Principal contractors must:

- satisfy themselves that clients are aware of their duties, that a CDM co-ordinator has been appointed and HSE notified before work starts
- make sure that they are competent to address the health and safety issues likely to be involved in the management of the construction project phase
- ensure that the construction phase is properly planned, managed and monitored, with adequately resourced, competent site management appropriate to the risk and activity
- ensure that every contractor who will work on the project is informed of the minimum amount of time which they will be allowed for planning and preparation before they begin work on site
- ensure that all contractors are provided with the information about the project that they need to enable them to carry out their work safely and without risks to health. Requests from contractors for information should be met promptly

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- ensure that a suitable construction phase health and safety plan is:
 - prepared before construction work begins
 - developed in discussion with, and communicated to, contractors affected by it
 - implemented, and
 - kept up to date as the project progresses.
 - satisfy themselves that the designers and contractors they engage are competent and adequately resourced
 - ensure suitable welfare facilities are provided from the start of the construction phase
 - take reasonable steps to prevent unauthorized access to the site; prepare and enforce any necessary site rules
 - provide (copies of or access to) relevant parts of the health and safety plan and other information to contractors including the self-employed in time for them to plan their work
 - liaise with the CDM co-ordinator on design carried out during the construction phase, including design by specialist contractors, and its implications for the health and safety plan
 - provide the CDM co-ordinator promptly with any information relevant to the health and safety file
 - ensure that all the workers have been provided with suitable health and safety induction, information and training
 - ensure that the workforce is consulted about health and safety matters
 - display the project notification.
- clients, designers, principal contractors and other contractors must supply the information necessary for compiling or updating the file
 - clients must keep the file to assist with future construction work, and
 - everyone providing information should make sure that it is accurate, and provided promptly.

The client should make sure that the CDM co-ordinator compiles the file. What is needed should be agreed in advance so that designers and contractors can produce the relevant documents as their work progresses.

The file is a key part of the information that a client or their successors will need for future construction projects and so should be kept up-to-date after any relevant surveys or work.

A file must be produced or updated (if one already exists) as part of all notifiable projects. CDM 2007 allows one file to be maintained for a site and then updated after subsequent projects have been completed.

The information which should be included where they are relevant to the health and safety of any future construction project, is given in Chapter 17.

16.4.6 Selection and control of contractors

It is important that health and safety factors are considered as well as technical or professional competence when potential contractors are being short listed or employed. The following items will give a guide to health and safety attitudes:

16.4.5 The health and safety file

The health and safety file is a record of relevant information for the client or his customer. It will be developed as the construction progresses with various designers or contractors adding information as it becomes available.

The file should be useful to:

- clients who have a duty to provide information about their premises to those who carry out work there
- designers during the development of further designs or alterations
- CDM co-ordinators preparing for construction work
- principal contractors and contractors preparing to carry out or manage such work.

A number of people have legal duties with respect to the health and safety file:

- CDM co-ordinators must prepare review, amend or add to the file as the project progresses, and give it to the client at the end of the project

- registration with either the HSE or Environmental Health Department of a Local Authority
- a current health and safety policy
- details of any risk assessments made and control measures introduced
- any method statements required to perform the contract
- details of competence certification, particularly when working with gas or electricity may be involved
- details of insurance arrangements in force at the time of the contract
- details of emergency procedures, including fire precautions, for contractor employees
- details of any previous accidents or incidents reported under RIDDOR
- details of accident reporting procedure
- details of previous work undertaken by the contractor
- references from previous employers or main contractors
- details of any health and safety training undertaken by the contractor and his employees.

Construction activities – hazards and control

On being selected, contractors should be expected to:

- familiarize themselves with those parts of the health and safety plan which affect them and their employees and/or sub-contractors
- cooperate with the principal contractor (or main if non-notifiable project) in their health and safety duties to contractors
- comply with their legal health and safety duties.

On arrival at the site, sub-contractors should ensure that:

- they report to the site office on arrival on site and report to the site manager
- they abide by any site rules, particularly in respect of personal protective equipment
- the performance of their work does not place others at risk
- they are familiar with the first aid and accident reporting arrangements of the principal contractor
- they are familiar with all emergency procedures on the site
- any materials brought onto the site are safely handled, stored and disposed of in compliance, where appropriate, with the current Control of Substances Hazardous to Health Regulations
- they adopt adequate fire precaution and prevention measures when using equipment which could cause fires
- they minimize noise and vibration produced by their equipment and activities
- any ladders, scaffolds and other means of access are erected in conformance with good working practice and the Work at Height Regulations
- any welding or burning equipment brought onto the site is in safe operating condition and used safely with a suitable fire extinguisher to hand
- any lifting equipment brought onto the site complies with the current Lifting Operation and Lifting Equipment Regulations
- all electrical equipment complies with the current Electricity at Work Regulations
- connections to the electricity supply is from a point specified by the principal contractor and is by proper cables and connectors. For outside construction work, only 110V equipment should be used
- any restricted access to areas on the site is observed
- welfare facilities provided on site are treated with respect
- any vehicles brought onto the site observe any speed, condition or parking restriction.

The control of sub-contractors can be exercised by monitoring them against the criteria listed above and by regular site inspections. On completion of the contract,

the work should be checked to ensure that the agreed standard has been reached and that any waste material has been removed from the site.

16.5 Working above ground level or where there is a risk of falling

16.5.1 Hazards and controls associated with working above ground level

The significance of injuries resulting from falls from height, such as fatalities and other major injuries, have been dealt with earlier in the chapter as has the importance and legal requirements for head protection. Also covered were the many hazards involved in working at height, including fragile roofs and the deterioration of materials, unprotected edges and falling materials. Additional hazards include the weather and unstable or poorly maintained access equipment, such as ladders and various types of scaffold.

The principal means of preventing falls of people or materials includes the use of fencing, guardrails, toe boards, working platforms, access boards, ladder hoops, safety nets and safety harnesses. Safety harnesses arrest the fall by restricting the fall to a given distance due to the fixing of the harness to a point on an adjacent

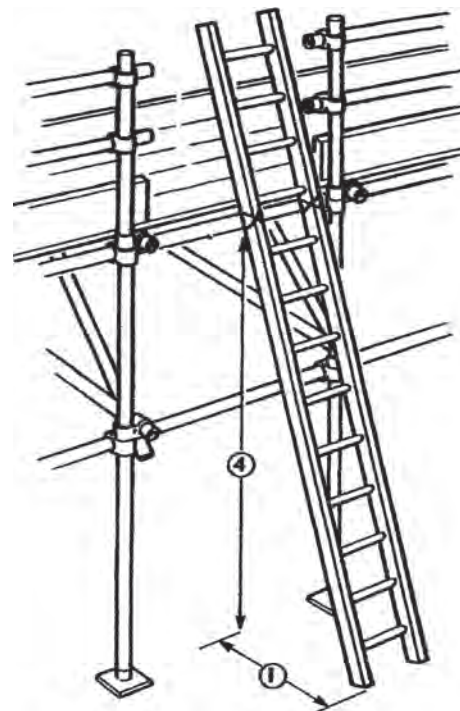


Figure 16.4 Ladders should be correctly angled one out for every four up.

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rigid structure. They should only be used when all other possibilities are not practical.

16.5.2 Access equipment

There are many different types of access equipment, but only the following four categories will be considered here:

- ladders
- fixed scaffold
- prefabricated mobile scaffold towers
- mobile elevated work platforms.

Ladders

The main cause of accidents involving ladders is ladder movement while in use. This occurs when they have not been secured to a fixed point, particularly at the foot. Other causes include over-reaching by the worker, slipping on a rung, ladder defects and, in the case of metal ladders, contact with electricity. The main types of accident are falls from ladders.

There are three common materials used in the construction of ladders – aluminium, timber and glass fibre. Aluminium ladders have the advantage of being light but should not be used in high winds or near live electricity. Timber ladders need regular inspection for damage and should not be painted since this could hide cracks. Glass fibre ladders can be used with near electrical equipment and in food processing areas.

The following factors should be considered when using ladders:

- ensure that the use of a ladder is the safest means of access given the work to be done and the height to be climbed
- the location itself needs to be checked. The supporting wall and supporting ground surface should be dry and slip free. Extra care will be needed if the area is busy with pedestrians or vehicles
- the ladder needs to be stable in use. This means that the inclination should be as near the optimum as possible (1 in 4 ratio of distance from the wall to distance up the wall). The foot of the ladder should be tied to a rigid support. Weather conditions must be suitable (no high winds or heavy rain). The proximity of live electricity should also be checked. (This last point is important when ladders are to be carried beneath power lines)
- there should be at least 1 m of ladder above the stepping off point
- the work activity must be considered in some detail. Over-reaching must be eliminated and consideration given to the storage of paints or tools which are to be used from the ladder and any loads to be carried

up the ladder. The ladder must be matched to work required

- workers who are to use ladders must be trained in the correct method of use and selection. Such training should include the use of both hands during climbing, clean non-slippery footwear, clean rungs and an undamaged ladder
- ladders should be inspected (particularly for damaged or missing rungs) and maintained on a regular basis and they should only be repaired by competent persons
- the transportation and storage of ladders is important since much damage can occur at these times. They need to be handled carefully and stored in a dry place
- when a ladder is left secured to a structure during non-working hours, a plank should be tied to the rungs to prevent unauthorized access to the structure.

Certain work should not be attempted using ladders. This includes work where:

- a secure hand hold is not available
- the work is at an excessive height
- where the ladder cannot be secured or made stable
- the work is of long duration
- the work area is very large
- the equipment or materials to be used are heavy or bulky
- the weather conditions are adverse
- there is no protection from passing vehicles.

There have been several rumours that the Work at Height Regulations have banned the use of ladders. This is **not** true. Ladders may be used for access and it is legal to work from ladders. Ladders may be used when a risk assessment shows that the risk of injury is low and the task is of short duration or there are unalterable features of the work site and that it is not reasonably practicable to use potentially safer alternative means of access. More information on ladders and their use within the requirements of the Work at Height Regulations is available from the British Ladder Manufacturers' Association. Ladders for industrial work in the UK should be marked to:

- Timber BS1129: Kite marked Class 1 Industrial
- Aluminium BS2037: 1994 Kite Marked Class 1 Industrial
- Glass fibre BSEN131: 1993 Kite marked Industrial
- Step stools BS7377: 1994.

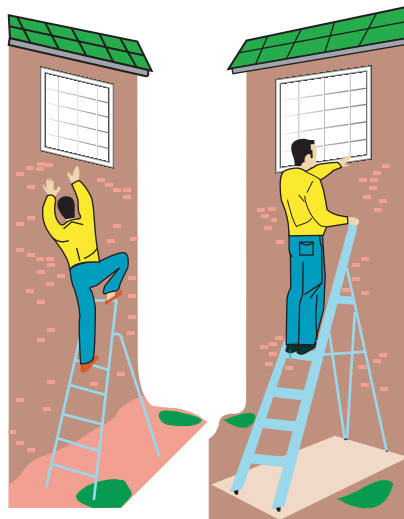
Stepladders, trestles and staging

Many of the points discussed for ladders apply to step ladders and trestles, where stability and over-reaching are the main hazards.

Construction activities – hazards and control

✗ Wrong Way

- ✗ Stepladder too short
- ✗ Hazard overhead
- ✗ Over-reaching up and sideways
- ✗ No grip on ladder
- ✗ Sideways-on to work
- ✗ Foot on handrail
- ✗ Wearing slippers
- ✗ Loose tools on ladder
- ✗ Slippery and damaged steps
- ✗ Uneven soft ground
- ✗ Damaged stiles
- ✗ Non-slip rubber foot missing



Right way ✓

- Steps at right height ✓
- No need to over-reach ✓
- Good grip on handrail ✓
- Working front-on ✓
- Wearing good flat shoes ✓
- Clean undamaged steps ✓
- Firm level base ✓
- Undamaged stiles ✓
- Rubber non-slip feet all in position ✓
- Meets British or European standards ✓

Figure 16.5 Working with Stepladders.

All equipment must be checked by the supervisor before use to ensure that there are no defects and must be checked at least weekly whilst in use on site. If a defect is noted, or the equipment is damaged, it must be taken out of use immediately. Any repairs must only be carried out by competent persons.

Supervisors must also check that the equipment is being used correctly and not being used where a safer method should be provided.

Where staging, such as a 'Youngmans' staging platform, is being used in roof areas, supervisors must ensure that only experienced operatives are permitted to carry out this work and that all necessary safety harnesses and anchorage points are provided and used.

The main hazards associated with stepladders, trestles and staging are:

- unsuitable base (uneven or loose materials)
- unsafe and incorrect use of equipment (e.g. the use of staging for barrow ramps)
- overloading
- use of equipment where a safer method should be provided
- overhang of boards or staging at supports ('trap ends')
- use of defective equipment.

Stepladders and trestles must be:

- manufactured to a recognized industrial specification
- stored and handled with care to prevent damage and deterioration

- subject to a programme of regular inspection (there should be a marking, coding or tagging system to confirm that the inspection has taken place)
- checked by the user before use
- taken out of use if damaged – and destroyed or repaired;
- used on a secure surface, and with due regard to ensuring stability at all times
- kept away from overhead cables and similar hazards.

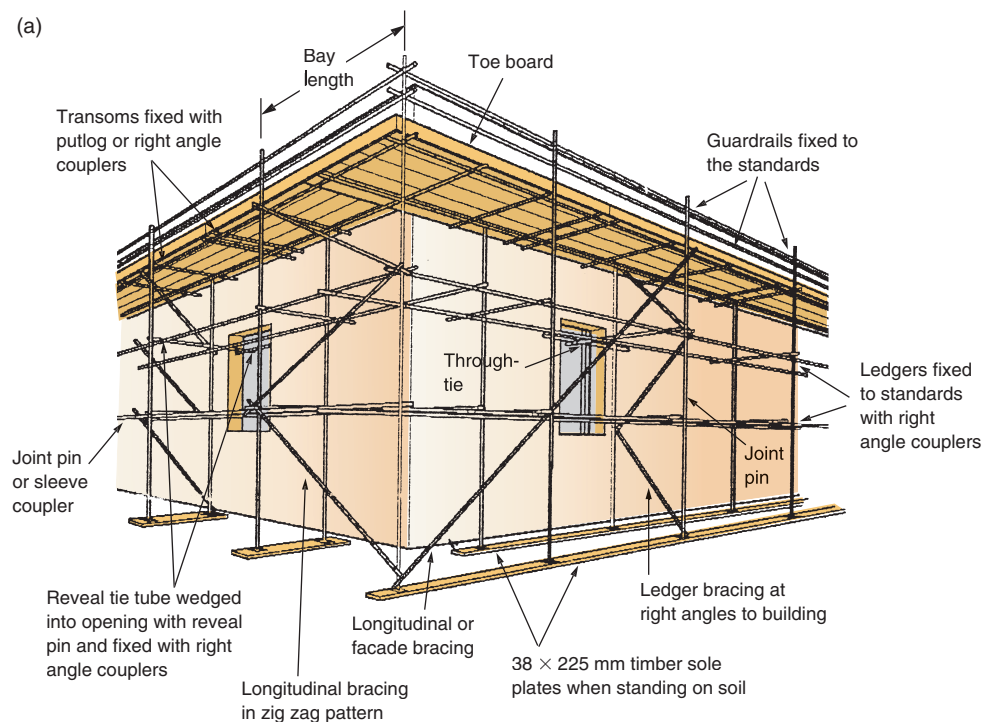
The small platform fitted at the top of many stepladders is designed to support tools, paint pots and other working materials. It should not be used as a working place unless the stepladder has been constructed with a suitable handhold above the platform. Stepladders must not be used if they are too short for the work being undertaken, or if there is not enough space to open them out fully.

Platforms based on trestles should be fully boarded, adequately supported (at least one support for each 1.5 m of board for standard scaffold boards) and provided with edge protection when there is a risk of falling a distance liable to cause injury.

Fixed scaffolds

It is quicker and easier to use a ladder as a means of access, but it is not always the safest. Jobs, such as painting, gutter repair, demolition work or window replacement, are often easier done using a scaffold. Unless the work can be completed comfortably using ladders, then a scaffold should be considered. Scaffolds must be capable of supporting building workers, equipment, materials,

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tools and any accumulated waste. A common cause of scaffold collapse is the 'borrowing' of boards and tubes from the scaffold, thus weakening it. Falls from scaffolds are often caused by badly constructed working platforms, inadequate guardrails or climbing up the outside of a scaffold. Falls also occur during the assembly or dismantling process.

There are two basic types of external scaffold:

- **independent tied** – these are scaffolding structures which are independent of the building but tied to it often using a window or window recess. This is the most common form of scaffolding
- **putlog** – this form of scaffolding is usually used during the construction of a building. A putlog is a scaffold tube which spans horizontally from the scaffold into the building – the end of the tube is flattened and is usually positioned between two brick courses.

The important components of a scaffold have been defined in a guidance note issued by the HSE as follows (Figure 16.6(a)).

Standard an upright tube or pole used as a vertical support in a scaffold.

Ledger a tube spanning horizontally and tying standards longitudinally.

Transom a tube spanning across ledgers to tie a scaffold transversely. It may also support a working platform.

Bracing tubes which span diagonally to strengthen and prevent movement of the scaffold.



Figure 16.6 (a) Typical independent tied scaffold. (b) fixed scaffold left in place to fit the gutters.

Guardrail a horizontal tube fitted to standards along working platforms to prevent persons from falling.

Toe boards these are fitted at the base of working platforms to prevent persons, materials or tools falling from the scaffold.

Construction activities – hazards and control

The following factors must be addressed if a scaffold is being considered for use for construction purposes:

- scaffolding must only be erected by competent people who have attended recognized training courses. Any work carried out on the scaffold must be supervised by a competent person. Any changes to the scaffold must be done by a competent person
- adequate toe boards, guardrails and intermediate rails must be fitted to prevent people or materials from falling
- the scaffold must rest on a stable surface, uprights should have base plates and timber sole plates if necessary
- the scaffold must have safe access and egress
- work platforms should be fully boarded with no tripping or tripping hazards
- the scaffold should be sited away from or protected from traffic routes so that it is not damaged by vehicles
- lower level uprights should be prominently marked in red and white stripes
- the scaffold should be properly braced, secured to the building or structure
- overloading of the scaffold must be avoided
- the public must be protected at all stages of the work
- regular inspections of the scaffold must be made and recorded.

Prefabricated mobile scaffold towers

Mobile scaffold towers are frequently used throughout industry. It is essential that the workers are trained in their use since recent research has revealed that 75% of lightweight mobile prefabricated tower scaffolding is either erected, used, moved or dismantled in an unsafe manner (Figure 16.7).

The following points must be considered when mobile scaffold towers are to be used:

- the selection, erection and dismantling of mobile scaffold towers must be undertaken by competent and trained persons with maximum height to base ratios not being exceeded
- diagonal bracing and stabilizers should always be used
- access ladders must be fitted to the narrowest side of the tower or inside the tower and persons should not climb up the frame of the tower
- all wheels must be locked while work is in progress and all persons must vacate the tower before it is moved
- the tower working platform must be boarded, fitted with guardrails and toe boards and not overloaded
- towers must be tied to a rigid structure if exposed to windy weather or to be used for work such as jet blasting

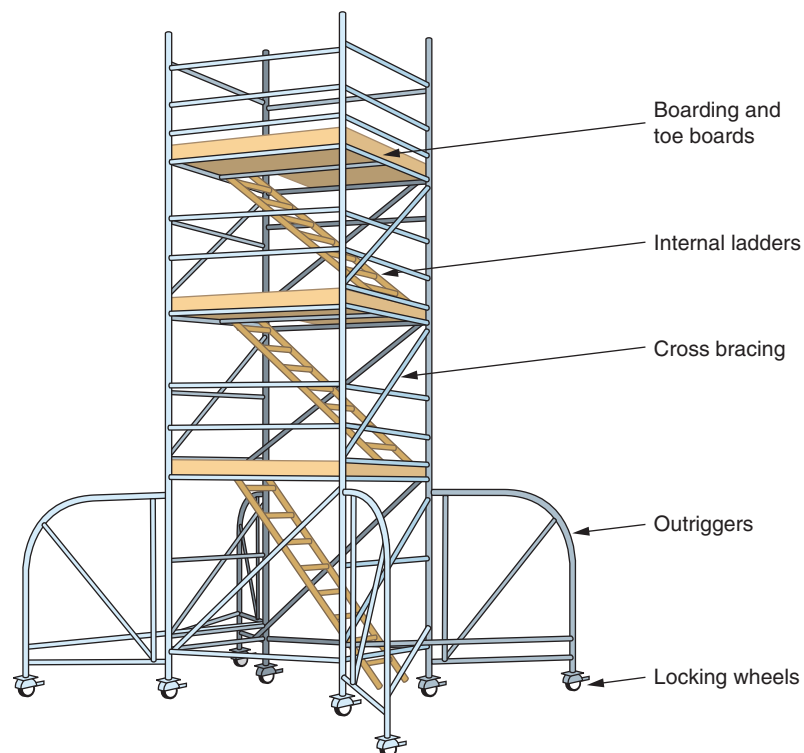


Figure 16.7 Typical prefabricated tower scaffold.

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- persons working from a tower must not over-reach or use ladders from the work platform
- safe distances must be maintained between the tower and overhead power lines both during working operations and when the tower is moved
- the tower should be inspected on a regular basis and a report made.

Mobile elevated work platforms

Mobile elevated work platforms are very suitable for high level work such as changing light bulbs in a warehouse. The following factors must be considered when using mobile elevated work platforms:

- the mobile elevated work platform must only be operated by trained and competent persons
- it must never be moved in the elevated position
- it must be operated on level and stable ground with consideration being given for the stability and loading of floors
- the tyres must be properly inflated and the wheels immobilized
- outriggers should be fully extended and locked in position
- due care must be exercised with overhead power supplies obstructions and adverse weather conditions
- warning signs should be displayed and barriers erected to avoid collisions

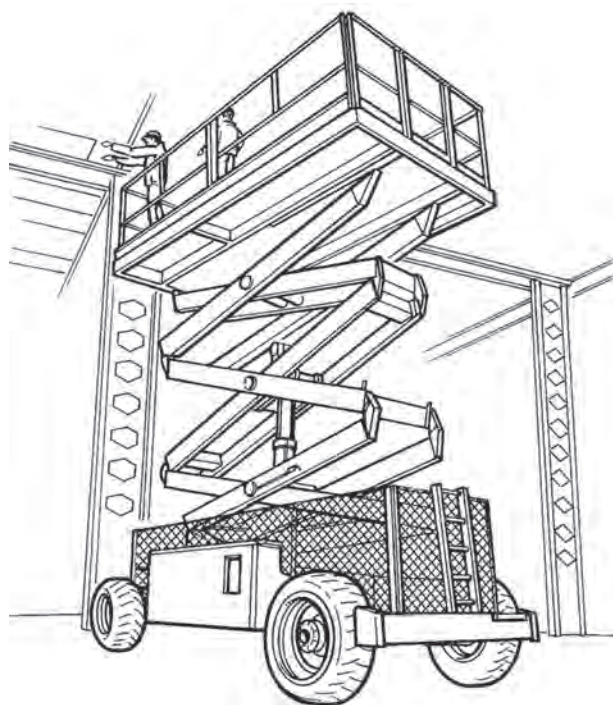


Figure 16.8 Mobile elevating work platform – one type of a wide range.

- it should be maintained regularly and procedures should be in place in the event of machine failure; and
- drivers of MEWPs must be instructed in emergency procedures particularly to cover instances of power failure.

When working on a MEWP, there is a danger that the operator may become trapped against an overhead or adjacent object and preventing him from releasing the controls. There have also been accidents caused when a MEWP is reversed into areas where there is poor pedestrian segregation and the driver has limited visibility. During any manoeuvring operation, a dedicated banksman should be used.

16.5.3 Inspection and maintenance

Inspection

Equipment for work at height needs regular inspection to ensure that it is fit for use. A marking system is probably required to show when the next inspection is due. Formal inspections should not be a substitute for any pre-use checks or routine maintenance. Inspection does not necessarily cover the checks that are made during maintenance although there may be some common features. Inspections need to be recorded but checks do not.

Under the Work at Height Regulations weekly inspections are still required for scaffolding used in construction, as required by the Construction (Design and Management) Regulations where a person could fall 2m or more. The requirements for inspection are set out in the regulations as follows:

- The name and address of the person for whom the inspection was carried out
- The location of the work equipment inspected
- A description of the work equipment inspected
- The date and time of the inspection
- Details of any matter identified that could give rise to a risk to the health or safety of any person
- Details of any action taken as a result of any matter identified in paragraph 5
- Details of any further action considered necessary
- The name and position of the person making the report.

Appendix 16.1 shows the inspection format under the CDM Regulations which still covers the essential items under the Work at Height Regulations and has been slightly adapted to suit.

Maintenance

Inspections and even thorough examinations are not substitutes for properly maintaining equipment. The information gained in the maintenance work, inspections

and thorough technical examinations should inform one another. A maintenance log should be kept and be up to date. The whole maintenance system will require proper management systems. The frequency will depend on the equipment, the conditions in which it is used and the manufacturers' instructions.

16.6 Excavations

16.6.1 Hazards associated with excavations

There are about seven deaths each year due to work in excavations. Many types of soil, such as clays, are self-supporting but others, such as sands and gravel, are not. Many excavations collapse without any warning resulting in death or serious injury. Many such accidents occur in shallow workings. It is important to note that, although most of these accidents affect workers, members of the public can also be injured. The specific hazards associated with excavations are as follows:

- collapse of the sides
- materials falling on workers in the excavation
- falls of people and/or vehicles into the excavation
- workers being struck by plant
- specialist equipment such as pneumatic drills
- hazardous substances particularly near the site of current or former industrial processes
- influx of ground or surface water and entrapment in silt or mud
- proximity of stored materials, waste materials or plant
- proximity of adjacent buildings or structures and their stability

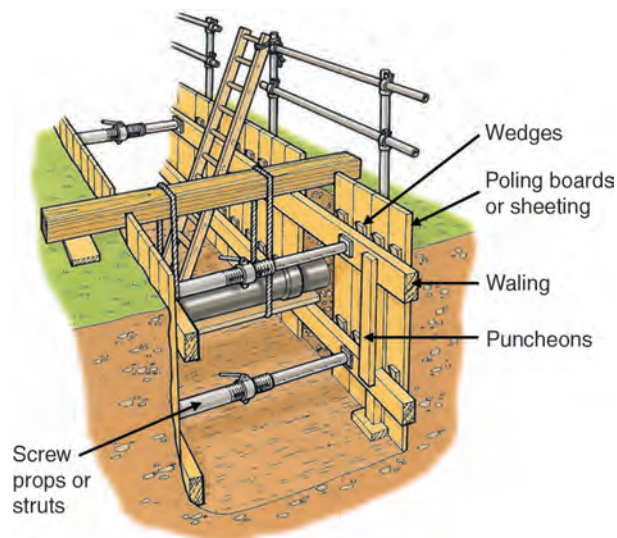


Figure 16.9 Timbered excavation with ladder access and supported services (guard removed on one side for clarity).

- contact with underground services
- access and egress to the excavation
- fumes, lack of oxygen and other health hazards (such as Weil's disease).

Clearly, alongside these specific hazards, more general hazards, such as manual handling, electricity, noise and vibrations, will also be present.

16.6.2 Precautions and controls required for excavations

The following precautions and controls should be adopted:

- at all stages of the excavation, a competent person must supervise the work and the workers given clear instructions on working safely in the excavation
- the sides of the excavation must be prevented from collapsing either by digging them at a safe angle (between 5° and 45° dependent on soil and dryness) or by shoring them up with timber, sheeting or a proprietary support system. Falls of material into the workings can also be prevented by not storing spoil material near the top of the excavation
- the workers should wear hard hats
- if the excavation is more than 2 m deep, a substantial barrier, consisting of guardrails and toe boards should be provided around the surface of the workings
- vehicles should be kept away as far as possible using warning signs and barriers. Where a vehicle is tipping materials into the excavation, stop blocks should be placed behind its wheels
- it is very important that the excavation site is well lit at night
- all plant and equipment operators must be competent and non-operators should be kept away from moving plant
- personal protective equipment must be worn by operators of noisy plant
- nearby structures and buildings may need to be shored up if the excavation may reduce their stability. Scaffolding could also be de-stabilized by adjacent excavation trenches
- the influx of water can only be controlled by the use of pumps after the water has been channelled into sumps. The risk of flooding can be reduced by the isolation of the mains water supply.
- the presence of hazardous substances or health hazards should become apparent during the original survey work and, when possible, removed or suitable control measures adopted. Any such hazards found after work has started, must be reported and noted in the inspection report and remedial measures taken. Exhaust fumes can be dangerous and petrol

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or diesel plant should not be sited near the top of the excavation

- the presence of buried services is one of the biggest hazards and the position of such services must be ascertained using all available service location drawings before work commences. Since these will probably not be accurate, service location equipment should be used by specifically trained people. Only hand tools should be used in the vicinity of underground services. Overhead services may also present risks to cranes and other tall equipment
- safe access by ladders is essential, as are crossing points for pedestrians and vehicles. Whenever possible, the workings should be completely covered outside working hours, particularly if there is a possibility of children entering the site
- finally, care is needed during the filling in process.

16.6.3 Inspection and reporting requirements

The duty to inspect and prepare a report only applies to excavations which need to be supported to prevent accidental fall of material. Only persons with a recognized and relevant competence should carry out the inspection and write the report. Inspections should take place at the following timing and frequency:

- after any event likely to affect the strength or stability of the excavation
- before work at the start of every shift
- after an accidental fall of any material.

Although an inspection must be made at the start of every shift, only one report is required of such inspections every seven days. However, reports must be completed following all other inspections. The report should be completed before the end of the relevant working period and a copy given to the manager responsible for the excavation within 24 hours. The report must be kept on site until the work is completed and then retained for 3 months at an office of the organization which carried out the work.

A suitable form is shown in the Appendix to this chapter.

16.7 Practice NEBOSH questions for Chapter 16

1. **Outline** a hierarchy of measures to be considered when a construction worker is likely to fall while working at height.
2. **Outline EIGHT** precautions that should be considered to prevent accidents to children who might be tempted to gain access to a construction site.
3. A contractor has been engaged to undertake building maintenance work in a busy warehouse.
Outline the issues that should be covered in an induction programme for the contractor's employees.
4. The exterior paintwork of a row of shops in a busy high street is due to be repainted. **Identify** the hazards associated with the work and **outline** the corresponding precautions to be taken.
5. **Outline** the precautions to be taken when carrying out repairs to the flat roof of a building.
6. **Outline** the precautions to be taken when repair work is to be carried out on the sloping roof of a building.
7. **Outline** the precautions to be taken to ensure the safety of workers required to undertake repair work on a fragile roof.
8. (a) **Explain** the meaning of the term 'hazard'
(b) **Outline** the main hazards that may be present during the demolition of a multi-storey building.
9. (a) **Outline** the possible causes of a dumper truck overturn on a construction site
(b) **Identify** the design features of a dumper truck intended to minimize the risk of, or severity of injury from, an overturn.
10. A manufacturing company is to relocate to premises that require refurbishment before equipment and staff can be moved. **Outline** the sanitary and washing facilities that should be considered when planning the refurbishment.
11. **Outline** the health and safety requirements relating to the provision of welfare, fire prevention and first-aid facilities on construction sites.
12. (a) **Outline** the main duties of a CDM coordinator under the Construction (Design and Management) Regulations
(a) **Identify FOUR** items of information in the health and safety file for an existing building that might be needed by a contractor carrying out refurbishment work.
13. With reference to the Construction (Design and Management) Regulations:
(i) **Identify** the circumstances under which a construction project must be notified to an enforcing authority

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- (ii) **Outline** the duties of the client under the Regulations.
- 14. **Outline FOUR** duties of each of the following persons under the Construction (Design and Management) Regulations:
 - (i) the CDM coordinator
 - (ii) the principal contractor.
- 15. **Explain** the issues that would need to be addressed if work is to be carried out safely from a ladder.
- 16. **Outline** the main dangers and the corresponding precautions that should be taken with the use of ladders.
- 17. **Identify** the ways in which accidents may be prevented when using ladders as a means of access.
- 18. **Outline** the precautions that might be taken in order to reduce the risk of injury when using stepladders.
- 19. **Outline THREE** causes of a scaffold collapse.
- 20. Mobile tower scaffolds should be used on stable, level ground.
List EIGHT additional points that should be considered to ensure safe use of a mobile tower scaffold.
- 21. **Identify** measures that should be adopted in order to protect against the dangers of people and/or materials falling from a mobile tower scaffold.
- 22. **Give** reasons that may cause a mobile tower scaffold to become unstable.
- 23. **Outline** the precautions to be taken when using a mobile elevating platform (MEWP) to reach a high point such as a streetlight.
- 24. Fluorescent tubes in the roof space of a busy warehouse are to be replaced by maintenance workers using a mobile elevating working platform (MEWP).
 - (i) **Identify** the potential hazards associated with the task
 - (ii) **Outline** the measures to be taken to ensure the safety of the maintenance workers and others who may be affected by the work.
- 25. **Identify** the main hazards associated with excavation work on construction sites.
- 26. **Outline** the main precautions to be taken when carrying out excavation work.
- 27. The water main supplying a school is to be replaced. The work will be carried out in a 1.5 metre deep excavation, which will be supported in order to ensure the safety of the employees working in the excavation.
 - (i) **Identify** when the **THREE** statutory inspections of the supported excavation must be carried out by the competent person
 - (ii) **State** the information that should be recorded in the excavation inspection report
 - (iii) Other than the provision of supports for the excavation, **outline** additional precautions to be taken during the repair work in order to reduce the risk of injury to the employees and others who may be affected by the work.
- 28. **Identify EIGHT** possible health hazards to which construction workers may be exposed **AND** in **EACH** case **give** an example of a likely source.
- 29. (a) **Identify FOUR** possible ill-health effects that can be caused from working with cement
(b) **Outline** ways in which the ill-health effects in (a) can be prevented.
- 30. (a) **Identify** the three types of asbestos commonly found in buildings
(b) **Explain** where asbestos is likely to be encountered in a building during renovation work.

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Appendix 16.1 Inspection report

Report of results of every inspection made in pursuance of Construction (Design and Management) Regulations 2007 or the Work at Height Regulations 2005

1. Name and address of person for whom inspection was carried out.
2. Site address
3. Date and time of inspection.
4. Location and description of workplace (including any plant, equipment or materials) inspected.
5. Matters which give rise to any health and safety risks.
6. Can work be carried out safely? Y/N
7. If not, name of person informed.
8. Details of any other action taken as a result of matters identified in 5 above.
9. Details of any further action considered necessary.
10. Name and position of person making the report.
11. Date report handed over.

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Inspection reports: Notes

Place of work requiring inspection	Timing and frequency of inspection					
	Before being used for the first time.	After substantial addition, dismantling or alteration.	After any event likely to have affected its strength or stability.	At regular intervals not exceeding 7 days.	Before work at the start of every shift.	After accidental fall of rock, earth or any material.
Any working platform or part thereof any personal suspension equipment.	✓	✓	✓	✓		
Excavations which are supported in pursuit of paragraphs (1), (2) or (3) of regulation 12 of construction regs.			✓		✓	✓
Cofferdams and caissons.			✓		✓	

NOTES

General

1. The inspection report should be completed before the end of the relevant working period.
2. The person who prepares the report should, within 24 hours, provide either the report or a copy to the person on whose behalf the inspection was carried out.
3. The report should be kept on site until work is complete. It should then be retained for three months at an office of the person for whom the inspection was carried out.

Working platforms only

1. An inspection is only required where a person is liable to fall more than 2 metres from a place of work.
2. Any employer or any other person who controls the activities of persons using a scaffold shall ensure that it is stable and of sound construction and that the relevant safeguards are in place before his employees or persons under his control first use the scaffold.
3. No report is required following the inspection of any mobile tower scaffold which remains in the same place for less than 7 days.
4. Where an inspection of a working platform or part thereof or any personal suspension equipment is carried out:
 - i. before it is taken into use for the first time; or
 - ii. after any substantial addition, dismantling or other alteration; not more than one report is required for any 24 hour period.

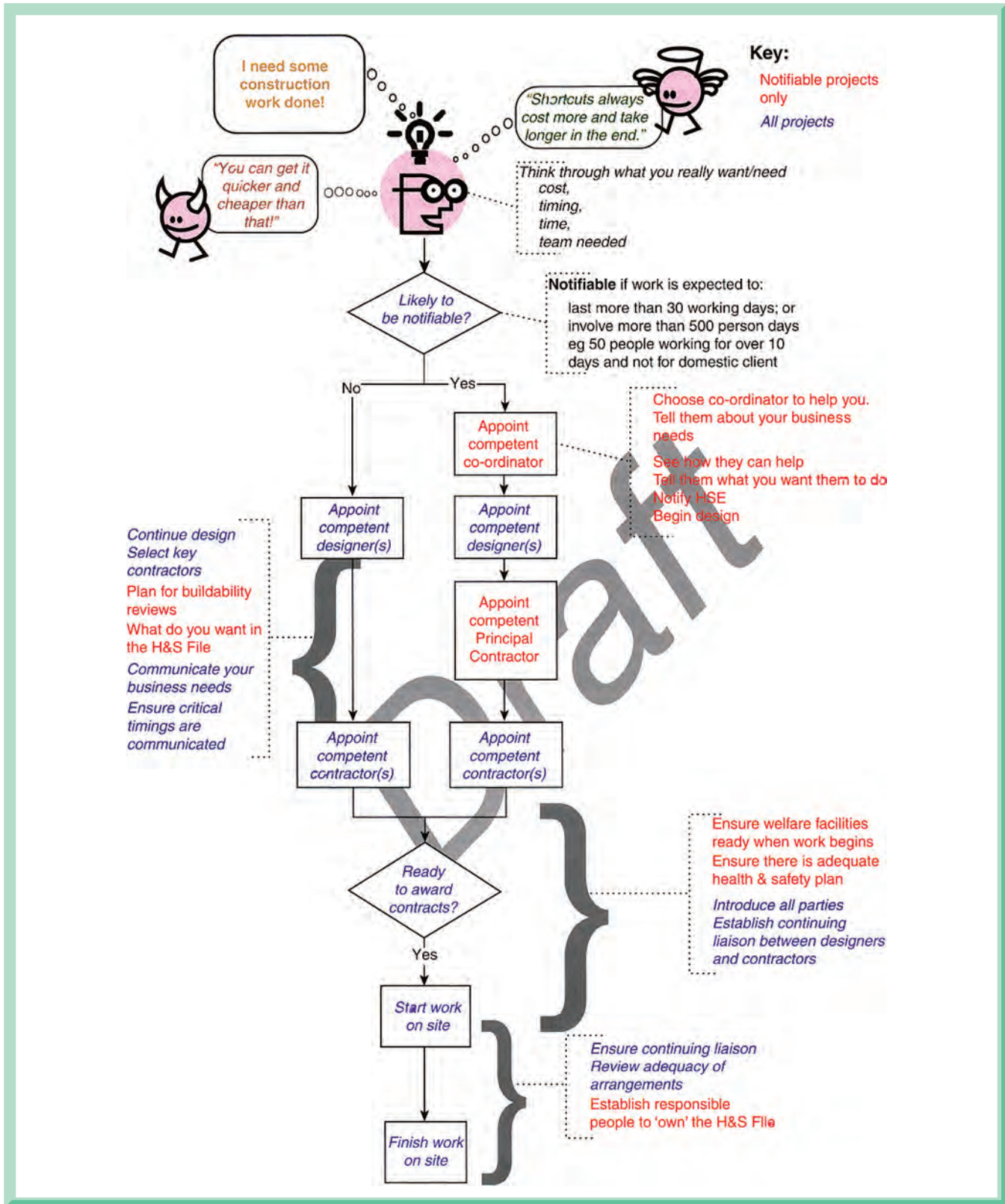
Excavations only

1. The duties to inspect and prepare a report apply only to any excavation which needs to be supported to prevent any person being trapped or buried by an accidental collapse, fall or dislodgement of material from its sides, roof or area adjacent to it. Although an excavation must be inspected at the start of every shift, only one report of such inspections is required every 7 days. Reports must be completed for all inspections carried out during this period for other purposes, e.g. after accidental fall of material.

Checklist of typical scaffolding faults

Footings	Standards	Ledgers	Bracing	Putlogs and transoms	Couplings	Bridles	Ties	Boarding	Guard rails and toe boards	Ladders
Soft and uneven	Not plumb	Not level	Some missing	Wrongly spaced	Wrong fitting	Wrong spacing	Some missing	Bad boards	Wrong height	Damaged
No base plates	Jointed at same height	Joints in same bay	Loose	Loose	Loose	Wrong couplings	Loose	Trap boards	Loose	Insufficient length
No sole plates	Wrong spacing	Loose	Wrong fittings	Wrongly supported	Damaged	No check couplers	Not enough	Incomplete	Some missing	Not tied
Undermined	Damaged	Damaged			No check couplers			Insufficient supports		

Appendix 16.2 Summary of proposed application and notification under CDM 2007



Appendix 16.3 Pre-Construction information

This is taken from Appendix 2 of the ACOP Managing Health and Safety in construction, L144

When drawing up the pre-construction information, each of the following topics should be considered. Information should be included where the topics is relevant to the work proposed. The pre-construction information provides information for those bidding for or planning work, and for the development of the construction phase plan. The level of detail in the information should be proportionate to the risks involved in the project.

Pre-construction information

1. Description of project

- (a) Project description and programme details including:
 - key dates (including planned start and finish of the construction phase), and
 - the minimum time to be allowed between appointment of the principal contractor and instruction to commence work on site.
- (b) Details of client, designers, CDM co-ordinator and other consultants
- (c) Whether or not the structure will be used as a workplace – in which case, the finished design will need to take account of the relevant requirements of the Workplace (Health, Safety and Welfare) Regulations
- (d) Extent and location of existing records and plans.

2. Client's considerations and management requirements

- (a) Arrangements for:
 - planning for and managing the construction work, including any health and safety goals for the project
 - communications and liaison between client and others
 - security of the site
 - welfare provisions.
- (b) Requirements relating to the health and safety of the client's employees or customers or those involved in the project such as:
 - site hoarding requirements
 - site transport arrangements or vehicle movement restrictions

- client permit-to-work systems
- fire precautions
- emergency procedures and means of escape
- 'no-go' areas or other authorizations requirements for those involved in the project
- any areas the client has designated as confined spaces
- smoking and parking restrictions.

3. Environmental restrictions and existing on-site risks

- (a) Safety hazards, including:
 - boundaries and access, including temporary access, e.g. narrow streets, lack of parking, turning or storage
 - any restrictions on deliveries or waste collection or storage
 - adjacent land uses, e.g. schools, railway lines or busy roads
 - existing storage of hazardous materials
 - location of existing services particularly those that are concealed – water, electricity, gas etc.
 - ground conditions, underground structures or water courses where these might effect the safe use of plant, e.g. cranes, or the safety of ground work
 - information about existing structures – stability, structural form, fragile or hazardous materials, anchorage points for fall arrest systems (particularly where demolition is involved)
 - previous structural modifications, including weakening or strengthening of the structure (particularly where demolition is involved)
 - fire damage, ground shrinkage, movement or poor maintenance which may have adversely affected the structure
 - any difficulties relating to plant and equipment in the premises, such as overhead gantries whose height restrict access
 - health and safety information contained in earlier design, construction or 'as-built' drawings, such as details of pre-stressed or post-tensioned structures.

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- (b) Health hazards, including:
 - asbestos, including results of surveys (particularly where demolition is involved)
 - existing storage of hazardous material
 - contaminated land, including results of surveys
 - existing structures containing hazardous materials
 - health risks arising from client's activities.
- 4. **Significant design and construction hazards**
 - (a) Significant design assumptions and suggested work methods, sequences or other control measures
 - (b) Arrangements for co-ordination of on-going design work and handling design changes
 - (c) Information on significant risks identified during design
 - (d) Materials requiring particular precautions.
- 5. **The health and safety file**

Description of its format and any conditions relating to its content.

Appendix 16.4 Construction Phase Plan

This is taken from Appendix 3 of the ACOP Managing health and safety in construction, L144.

When drawing up the construction phase plan, employers should consider each of the following topics: information should be included in the plan where the topic is relevant to the work proposed; the plan sets out how health and safety is to be managed during the construction phase. The level of detail should be proportionate to the risks involved in the project.

Construction phase plan

1. **Description of project**
 - (a) Project description and programme details including key dates
 - (b) Details of client, CDM co-ordinator, designers, principal contractor and other consultants
 - (c) Extent and location of existing records and plans that are relevant to health and safety on site, including information about existing structures when appropriate.
2. **Management of the work**
 - (a) Management structure and responsibilities
 - (b) Health and safety goals for the project and arrangements for monitoring and review of health and safety performance.
 - (c) Arrangements for:
 - regular liaisons between parties on site
 - consultation with the workforce
 - exchange of design information between the client, designers, CDM co-ordinator and contractors on site
 - handling design changes during the project
3. **Arrangements for controlling significant site risks**
 - (a) Safety risks, including:
 - the selection and control of contractors
 - the exchange of health and safety information between contractors
 - site security
 - site induction
 - on site training
 - welfare facilities and first aid
 - the reporting and investigation of accidents and incidents including near misses
 - the production and approval of risk assessments and written systems of work
 - site rules
 - fire and emergency arrangements.
 - (a) Safety risks, including:
 - delivery and removal of materials (including waste) and work equipment taking account of any risks to the public, e.g. during access to and egress from the site
 - dealing with services – water, electricity and gas, including overhead powerlines and temporary electrical installations
 - accommodating adjacent land use
 - stability of structures whilst carrying out construction work, including temporary structures and existing unstable structures
 - preventing falls
 - work with or near fragile materials
 - control of lifting operations
 - the maintenance of plant and equipment

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- work on excavations and work where there are poor ground conditions
 - work on well, underground earthworks and tunnels
 - work on or near water where there is a risk of drowning
 - work involving diving
 - work in a caisson or compressed air working
 - work involving explosives
 - traffic routes and segregation of vehicles and pedestrians
 - storage of materials (particularly hazardous materials) and work equipment
 - any other significant safety risks.
- (b) health risks, including:
- the removal of asbestos
 - dealing with contaminated land
 - manual handling
 - use of hazardous substances, particularly where there is a need for health monitoring
 - reducing noise and vibration
 - working with ionizing radiation; any other significant health risks.
4. The health and safety file
- (a) Layout and format
 - (b) Arrangements for the collation and gathering of information
 - (c) Storage of information.