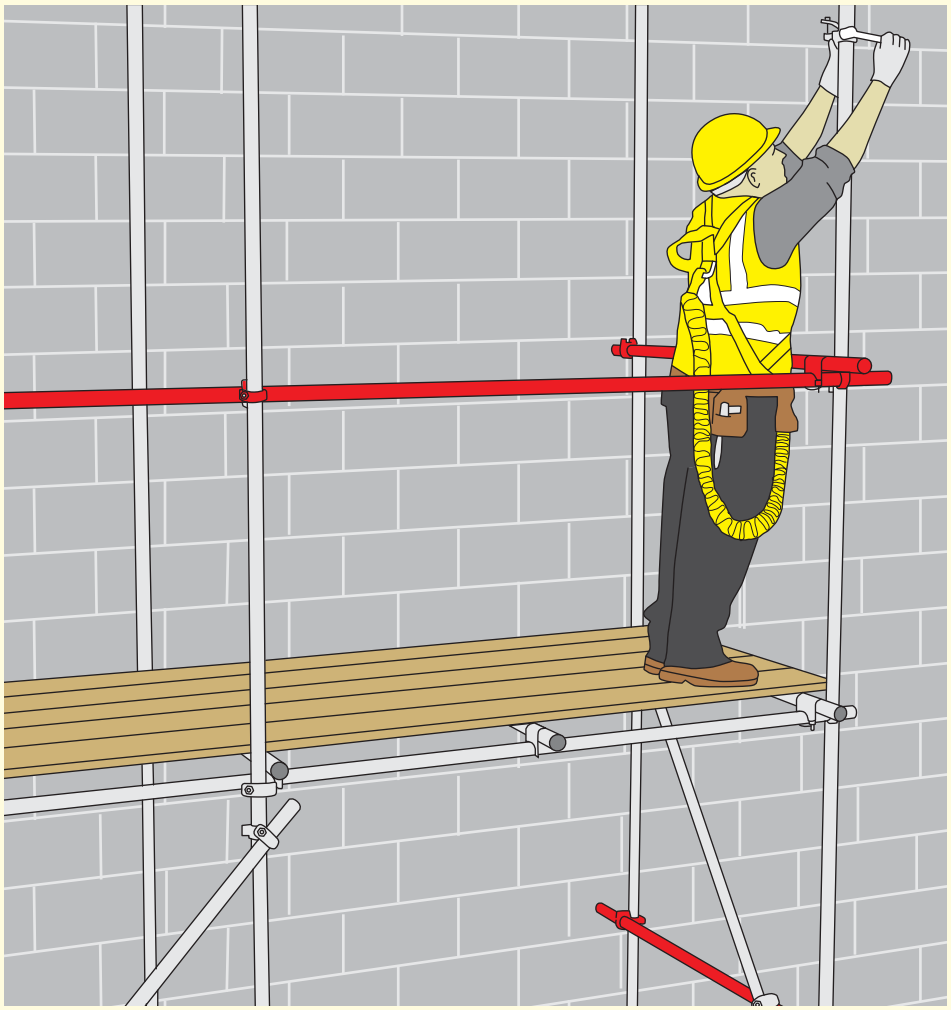
# SG4:15

## Preventing Falls in Scaffolding Operations

NASC

National Access & Scaffolding Confederation



BUILDUK Trade Association Member

NASC

*November 2015*

# Preventing Falls in Scaffolding Operations

Safety Guidance 4: 2015

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This guide takes the form of recommendations and guidance. It should not be quoted as if it were a specification. It does not purport to include all the necessary provisions for a contract and users are responsible for their application.

The guide has been written on the assumption that the execution of its provisions is entrusted to appropriately qualified and experienced people and that construction and supervision of scaffolds will be carried out by capable and experienced organisations.

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Amendments issued since publication

Amd. No.

Date

Comments

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# Preface

Since SG4's inception, the true impact of this flagship guidance can be seen by the 82% reduction in the frequency rate of falls from height by NASC member operatives. This single statistic alone is extremely positive news, but I believe an even greater benefit derived from the publication of this guidance has been the change in mind set of scaffolding operatives across large parts of the industry. SG4 has played no small part in the scaffolding industry becoming a far more professional trade, both in the minds of our clients and also those who work in what was once considered a 'colourful industry' by many.

SG4 works! The NASC accident statistics speak for themselves and in light of these, this revision has been more of a fine tuning exercise rather than trying to 're-invent the wheel' that is clearly turning very well.

The biggest challenges ahead are arguably twofold. Firstly, we must find ways to encourage our clients to be more demanding with regard to compliance levels with this key industry safety guidance on sites they control, and secondly, from those who choose not to comply, we must demand more frequent and robust levels of action from all stakeholders, including client organisations and the enforcing authorities.

With this improved guidance, we expect the number of scaffolding operative falls from height incidents, experienced by member companies, to continue to reduce over time. More importantly, we hope that SG4 can have a positive impact in terms of reducing the unacceptable number of falls from height currently being experienced by scaffolding operatives of some uncontrolled organisations, whose managers, supervisors and employees seem content to accept unnecessarily high levels of risk on a daily basis.

The NASC and its members are continuing their drive to move the industry forward on matters relating to safety and consistency. It is our intention that this revised document will enable scaffolding contractors to continue to operate at the forefront of industry good practice.

Kevin Ward
NASC President

# Introduction

Falls from height account for almost half of the fatal accidents in the construction sector. Falling from height is a significant risk faced by scaffolders when erecting, altering or dismantling scaffolding during most scaffolding operations.

The NASC and HSE acknowledges that scaffolders have to work in hazardous situations, and this guidance note accepts that employers have a responsibility to ensure that adequate measures are provided for employees during scaffolding operations to eliminate or minimise those risks.

In recognition of the significant hazards and risks that scaffolders are exposed to day to day, the NASC have produced this edition of Safety Guidance Number 4 (SG4) as 'scaffolding industry good practice' for work at height. This updated guidance reflects the challenges facing our industry through new fall protection technology, Technical Guidance (TG20) and changing methods of construction and maintenance.

The NASC also recognises that statistics[1] have shown falls from height rarely involve scaffolders from our membership who are working from scaffold structures they have constructed themselves. We also recognise that the instances of fatal and RIDDOR [2] specified injuries resulting from falls of scaffolders have significantly reduced since the introduction of SG4 in the mid-1990s. The revisions of SG4 in 2000, 2005, 2010 and again in 2015 have seen changes to the methods of working that have been adopted by the industry. Since 2000 there has been a 78% reduction in the number of falls recorded from scaffolding operations – from 93 in 1999 to 24 in 2014. This reduction is in spite of a 29% increase in the number of operatives working within the NASC membership, which represents an 82% reduction in the accident frequency rate during this period (*Figure 1*).

Note 1: Figures obtained from NASC members' accident returns and annual safety report 1999-2014.

Note 2: Reporting of injuries, diseases and dangerous occurrences regulations 2013.

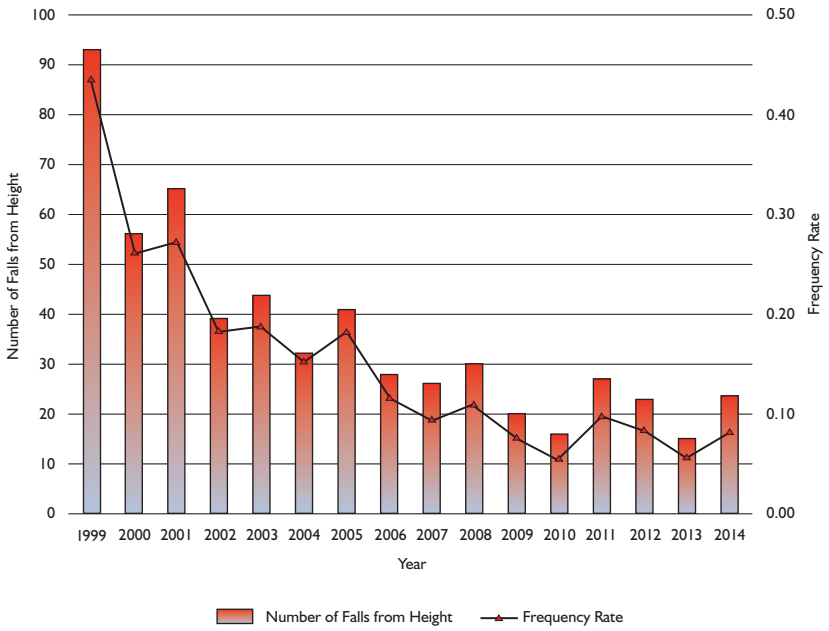



*Figure 1: NASC Members' Falls from Height 1999-2014.*

The aim of this document remains the same and is to illustrate current preventative and protective measures which represent good industry practice that could be utilised when establishing safe systems of work to prevent and protect against falls from height during scaffolding operations. This edition of SG4 continues to focus on the measures scaffolding contractors and scaffolders have to take to create a **scaffolders' safe zone** where they are suitably protected against the risk of falling. The key priority and objective for scaffolders is to establish collective protection by creating a **scaffolders' safe zone** and therefore minimising the time exposed to a fall risk and reliance upon personal fall protection equipment (safety harnesses). The introduction of these collective methods of working will not completely remove the risk of a fall in all situations, therefore the NASC recognises that scaffolders will still be required to wear and use personal fall protection equipment in accordance with this Safety Guidance when working at height.

Employers have legal duties to provide safe systems of work for employees and to carry out suitable and sufficient assessment of the risks to the health and safety of employees. This management guidance note is designed to be used as reference by employers, clients, designers, contractors and enforcing authorities when preparing and reviewing risk assessments for the erection, alteration and dismantling of temporary access and other structures by scaffolders. This guidance note is again supported by a user guide (SG4:You) to provide essential information to scaffolders in a user-friendly format. Other information and training aids are available via the NASC website (www.nasc.org.uk).

The types of structure, nature of work and environmental conditions vary considerably within the scaffolding trade. However within the guidance the NASC has endeavoured to:

- Explain the legal requirements for work at height;
- Identify and explain the significant hazards that scaffolders are exposed to during typical scaffolding operations;
- Highlight the practical solutions available to control the risks that arise from those hazards.

This guidance is not exhaustive and does not feature every scaffolding application. However, it has been designed so that the basic principles contained within this document can be applied as solutions to most scaffolding operations.

# Planning for work at height

'Work at height' is defined by the Work at Height Regulations 2005 as 'work in any place... where, if measures required by these Regulations were not taken, a person could fall a distance liable to cause personal injury'. The Work at Height Regulations do not specify a distance that a person could fall before specific precautions must be taken.
Before scaffolders undertake work at height, it is essential to consider the work to be performed, taking account of any foreseeable hazards arising from that work and establish control measures to be implemented. This will ensure the safety of scaffolders and others that may be affected by scaffolding operations. It is essential that a competent person carries out a suitable risk assessment and prepares the method statement. For guidance reference should be made to NASC Safety Guidance 7 (SG7) Risk Assessments and Method Statements (RAMS). The more complex or hazardous the scaffolding structure, then the more detail needs to be identified within the planning and preparation of the RAMS.

Planning for work at height must consider the hierarchy of preventative and protective measures that are central to the Work at Height Regulations (WAHR), summarised as follows:

## I. Avoid work at height

There are few options available to the scaffolding industry which enable the task to be performed without working at height e.g. fixing guardrails to precast stair sections at ground level before craning them into place, thus avoiding the need for the scaffolder to work at height (*Figure 2*).

However, there is greater opportunity to eliminate the need to work at height at the design and planning stages of a project by designers and principal contractors e.g. the pre-assembling of guardrails to steel beams prior to being installed by the steel erectors will eliminate the need for scaffolders to install them at height (*Figure 3*).

If avoiding work at height is not possible then you must consider the next stage of the hierarchy – prevent falls.

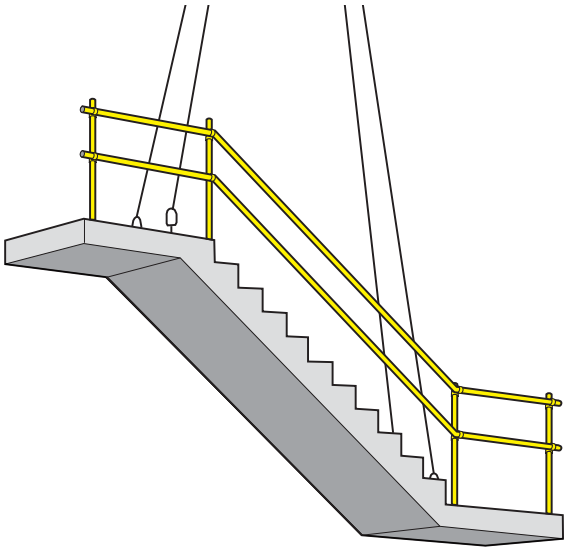


*Figure 2: Guardrails attached to pre-cast concrete staircase sections before being lifted into place.*

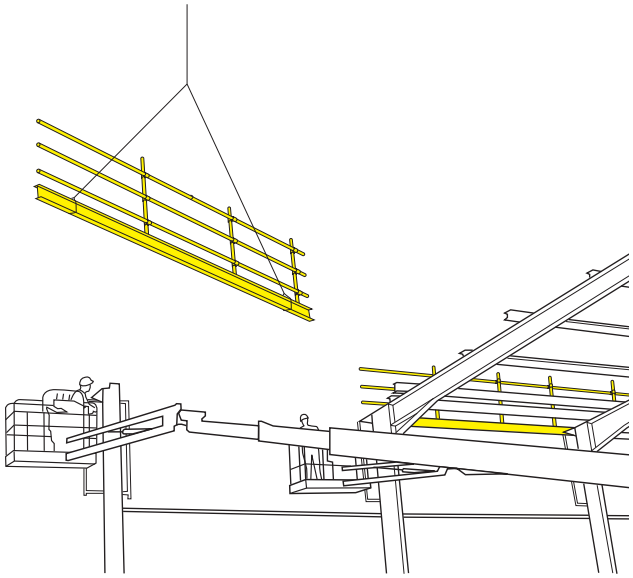


*Figure 3: Pre-assembled guardrails – fixed to structural steelwork ('I' beams) prior to craning into position.*

## II. Prevent falls

Scaffolding contractors should consider measures that create a safe zone (see section 3 The **scaffolders' safe zone**) by preventing falls from height, such as providing adequate work platforms with suitable guardrails or other collective measures, before resorting to personal fall protection equipment (i.e. harnesses). Scaffolders are not permitted to work at height while being exposed to a risk of a fall, without taking appropriate actions to prevent or protect against a fall from height.

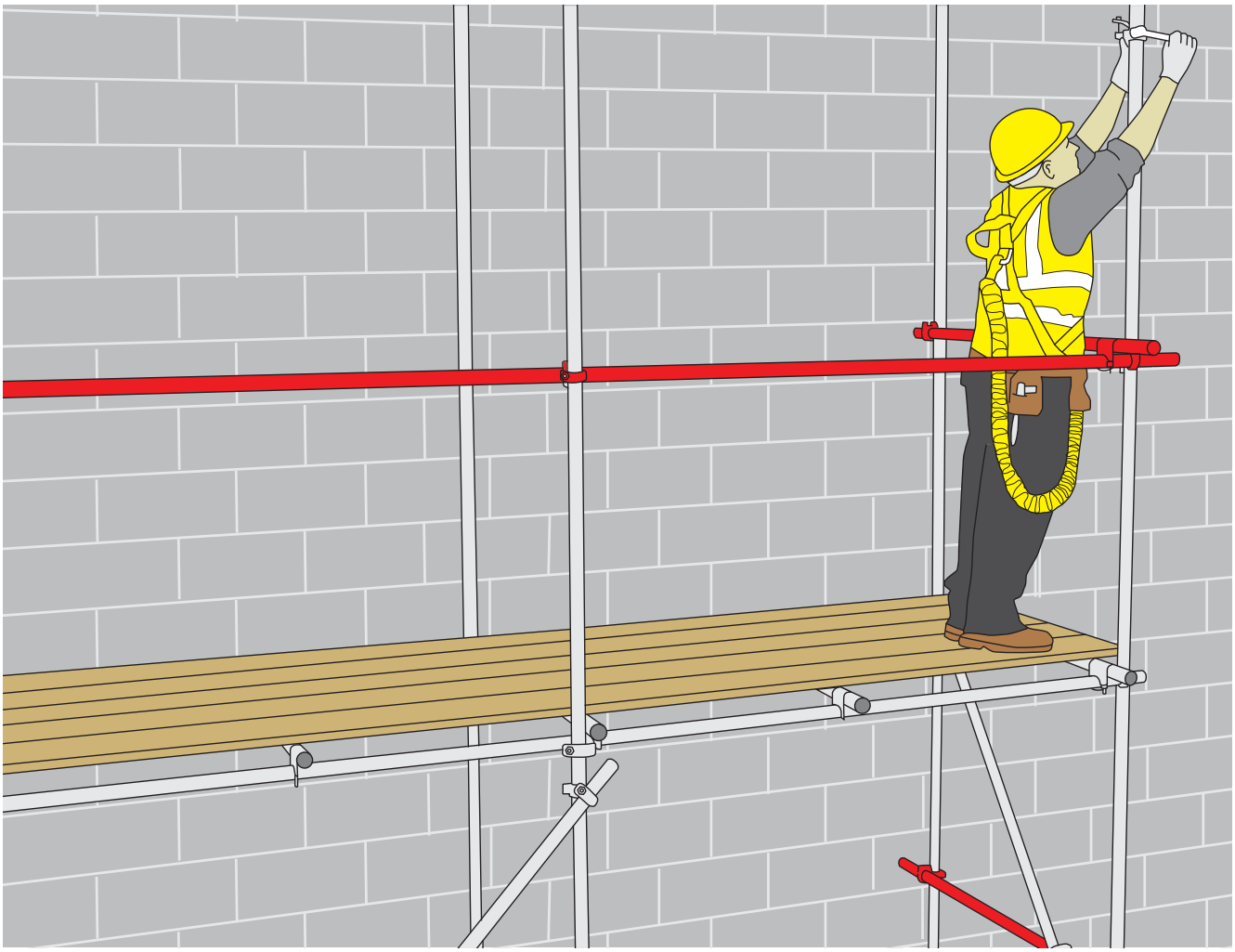
## III. Mitigate the distance and consequences of a fall

Whatever methods of work are chosen, if it is not reasonably practicable to prevent a fall, then both the distance and consequences of a potential fall must be minimised. For example, if a fall arrest harness is used with a fixed length lanyard then it should be attached to a suitable anchor point as high above the working platform as practicable, then should a fall occur the distance would be minimal compared with an attachment at foot level.

## IV. Collective over personal protection

At all stages in the WAHR hierarchy, scaffolding contractors must consider collective protection over personal protection. This means using measures that protect everyone working at height at all times when in place, such as guardrails or safety nets before specifying personal fall arrest equipment that is reliant on being attached. For collective protection in scaffolding operations see section 3 The **scaffolders' safe zone**.

*Figure 4: Scaffolder protected by a guardrail in the **scaffolders' safe zone**.*



## WORK AT HEIGHT REGULATIONS 2005 HIERARCHY OF CONTROLS

### Avoid work at height

**Avoid work at height so far as is reasonably practicable:**

- Not normally an option for the scaffolding contractor.
- Designers and principal contractors should identify opportunities to avoid work at height.
- Scaffolding contractors should promote innovations to their clients that can avoid work at height.

### Prevent falls

GIVE COLLECTIVE PROTECTION PRIORITY OVER PERSONAL PROTECTION

**Where it is not reasonably practicable to avoid work at height you should:**

- Prevent all falls from height where there is a risk of injury, irrespective of the height.
- Consider collective fall protection measures to create a safe zone before resorting to personal fall protection equipment such as harnesses and lanyards.
- Establish a **scaffolders' safe zone** with a boarded platform and guardrail protection, as a priority, to prevent falls occurring.

### Mitigate the distance and consequences of a fall

GIVE COLLECTIVE PROTECTION PRIORITY OVER PERSONAL PROTECTION

**Where it is not reasonably practicable to avoid or prevent falls; then,**

- The distance a person can fall and the consequences (potential injury) must be minimised.
- Collective protection in the form of soft landing systems (e.g. soft landing bags, air-bags and safety nets) are not commonly a practical solution for scaffolding.
- Personal fall protection systems (safety harnesses) **MUST** be worn and attached to a suitable anchor point when at risk of a fall in accordance with this guide.

*Figure 5: This diagram is a simple illustration of how the 'Work at Height Regulations 2005 Hierarchy of Controls' could be interpreted for scaffolding operations.*

## 2.1 Competence and capability

The Work at Height Regulations require that any person who carries out work at height is deemed competent to do so by their employer (Regulation 5). Competence is defined as a combination of relevant practical and theoretical knowledge, training and experience. Scaffolders should be selected who have appropriate attitude, aptitude, fitness, training (Construction Industry Scaffolders' Record Scheme (CISRS Card)), knowledge and experience for the particular work to be completed. CISRS cards should be relevant to the work being undertaken (e.g. Scaffolder or Advanced Scaffolder) and current, as they require renewal every five years (*Figure 6*).


*Figure 6: CISRS cards.*

## 2.2 Training and instruction

All scaffolders should have received appropriate and recorded training in the requirements of this work at height guidance, together with any specific instructions to be followed for a particular task (e.g. method(s) for creating the **scaffolders' safe zone**, other protective measures, the rescue plan etc., in accordance with the risk assessment and method statement). Employers must ensure training and instruction is provided for any new fall protection equipment or rescue equipment introduced to the workers. Training should be properly organised and include both theory and practical elements. Line-management responsible for the supervision and monitoring of scaffolding operations also need training to raise their level of awareness of the requirements for work at height. Induction training and toolbox talk programmes should be used by employers to reinforce the requirements of SG4 and maintain levels of awareness with scaffolding operatives. In addition, employers should also ensure that refresher training is provided periodically and records kept. Other operatives supporting scaffolding operations (such as labourers) who are required to work at height must be provided with safe access and egress and safe working platforms complete with guardrails and toeboards to the equivalent standard of a completed scaffold structure. Labourers should receive basic safety awareness training through the CISRS operative training scheme (COTS).

Trainee and apprentice scaffolders may work at height in accordance with the training and instruction received and only under the direct supervision of a competent scaffolder (see supervision below).

## 2.3 Supervision

Employers should ensure appropriate levels of competent supervision are provided considering the nature of the work and competence of the scaffolders involved.

Supervision on site may be full-time or a visiting role. The NASC recognises that the core skills required for supervision in contract scaffolding are covered by the Construction Industry Scaffolders' Record Scheme (CISRS) scaffolding supervisor training course. However, typically the role of a supervisor in scaffolding, due to the peripatetic nature of the industry, is a visiting role where they may look after several sites or gangs which are visited periodically. For example, a supervisor would be responsible for a number of sites or gangs, each gang should have a nominated charge-hand scaffolder, or a large site with a number gangs may have a nominated foreman scaffolder in either a working or non-working capacity. The NASC recommends that records of supervisory visits are retained.

Inexperienced scaffolders require a higher degree of supervision, direction and control. Trainees should be periodically assessed to determine their knowledge, experience and individual capability and must work under the direct supervision of a qualified scaffolder, who must be made aware of any limitations by the chargehand scaffolder, supervisor or manager. For example, a newly appointed trainee scaffolder, in the early stages of their development may be restricted from certain higher risk activites until formal training has been completed and training record updated. For further information on scaffolder training and assessment refer to the CISRS general information booklet (CAP609).

Employers who gain high degrees of employee co-operation and compliance also demonstrate a positive attitude, management commitment to safety and effective supervisory control. Engaging with employees and soliciting their opinion can help encourage support for safety initiatives and greater co-operation.

### Case Study 1

A concerned member of the public sent pictures of scaffolders working unsafely to the HSE.

The subsequent HSE investigation resulted in a prosecution based on the photographic evidence and the blatant safety failings. Magistrates were told there was nothing in place to prevent or mitigate them falling. HSE established that the work was poorly planned and managed, and two of the three-man scaffolding gang were lacking in training and accreditation to prove their competence.

The scaffolding contractor was fined £5,000 and ordered to pay £734 in costs.

*Source: HSE*

### Case Study 2

An unqualified scaffolder lost his leg in a four metre fall from an unprotected platform. He was not wearing a safety harness and the platform he was standing on was only two boards wide. He sustained life-changing injuries, spent almost a year in hospital and underwent several operations. In court it was established that the worker had not been given any training in the safe erection or dismantling of scaffolding. The employer pleaded guilty to breaching the Work at Height Regulations 2005 (amongst other breaches) and was fined £15,000, plus £1,118 costs.

*Source: HSE*

## 2.4 Site inspection and risk assessment

When carrying out a risk assessment, it is recommended that an inspection of the site is undertaken by a suitably competent person before work commences. The purpose of the assessment is to take due account of all foreseeable hazards in the workplace, in addition to any commercial considerations for the job. The risk assessment must identify all of the preventative and protective control measures required to eliminate or reduce the risk of injury. These controls should then be recorded in the scaffolding risk assessment and method statement documents (RAMS).

When selecting the most suitable preventative and protective measures as part of the risk assessment process, the primary consideration should always be safety. However employers should take into account the logistical effort, productivity and financial impact of using the methods selected.

Due considerations need to be made to safeguard against falls from height whilst surveying a location for scaffolding e.g. accessing roofs, refurbishment work, emergency protection, retention or shoring scaffolds for dangerous buildings etc.

## 2.5 Rescue planning

Arrangements for emergencies and rescue from height also need to be considered as part of the planning and risk assessment for each task by employers. It is a legal requirement for scaffolding contractors and their clients to address the need for timely evacuation and rescue in an emergency when working at height. Further information for rescue planning in section 7 and in NASC Safety Guidance 19 (SG19) - A Guide to Formulating a Rescue Plan.

## 2.6 Collective fall protection (Third party)

This guidance focuses on the various methods of creating and using collective fall protection for scaffolding operations (erecting, altering and dismantling). In certain situations both the scaffolders and the users of the scaffolding could be faced with a risk of a fall, where protection measures may be the responsibility of a third party to establish and maintain (e.g. the principal contractor will ensure safety netting is rigged for roof work or internal safety decking is provided for brickwork, which will offer protection for falls from the external scaffolding).

Collective fall arrest systems are common place throughout the construction industry (e.g. safety nets, soft landing bags, safety decking etc.), however their application in routine scaffolding operations is limited. Employers must co-operate and co-ordinate activities to ensure such third party fall protection measures are in place and suitable before work at height can continue, unless suitable alternative protection can be provided e.g. temporary guardrails installed.

### Case Study 3

A 17 year old trainee scaffolder was tragically killed when he fell approximately 18 metres while erecting an access birdcage scaffold.

In the subsequent prosecution by the Health and Safety Executive (HSE), the court heard that the scaffold was constructed with incomplete working platforms, a lack of guardrails and inadequate ladder access. The competence and supervision of the scaffolding gang was also insufficient. Other issues included were inadequacies regarding the use of personal fall protection equipment (harnesses).

Three companies were prosecuted (including the scaffolding contractor) with fines totalling £217,500 plus £125,000 costs.

The supervisor was found guilty of failing to take reasonable care for the health and safety of others affected by his acts or omissions at work (HSW Act 1974, Section 7(1)). He was fined £7,500 and ordered to pay £15,000 in costs.

*Source: HSE*

## 2.7 Weather conditions

Weather conditions must be considered as part of the risk assessment and planning for work at height. Adverse weather conditions can significantly increase the risk of a fall when scaffolding at height e.g. lightning, high winds, rain, snow, ice and extreme temperatures. High winds and icy or wet surfaces can be especially hazardous. The employer's risk assessment should consider all aspects of working in adverse weather conditions, and not just simply specify protective clothing, footwear or sun cream.

## 2.8 Temporary works design

When designing scaffolding structures, engineers have a duty as designers under the Construction (Design and Management) Regulations (regulations 9 and 11) to consider the risks to health and safety of those who erect, alter and dismantle temporary works and those who use the equipment. Section 2 of BS 5975 is a mode of practice for temporary works procedures that can be used to assist the management of all construction temporary works, of which access scaffolding is one example. Many larger clients and contractors already follow BS 5975 procedures as they assist the parties to ensure that all aspects of the procurement, design and use of temporary structures is suitable.

Designs and calculations should consider fall protection measures that will form part of the finished scaffolding structure e.g. scaffolders' guardrails, board-bearer transoms for non-working lifts and guardrails for internal fall hazards, where appropriate. Also ensuring compliance with the relevant generally recognised standards to ensure scaffolds are suitably secured and stable (i.e. British and European Standards, NASC Technical Guidance notes (including TG20 compliance sheets for tube and fitting scaffolds) and manufacturers' instruction manuals for proprietary equipment).

Designers must include adequate health and safety information about significant hazards that remain in the design and the resulting risks. It is good design practice for scaffolding designers to highlight on the drawings any known significant hazards or hazardous work sequences critical to the design that require particular consideration. Caution signs and notes are commonly used to draw attention to important detail (*Figure 7*). TG20 compliance sheets and manufacturers' instructions should also include health and safety information from the designers. Residual risk from the design and the control measures established should be included in the operational risk assessment and method statement (RAMS) by the scaffolding contractor and communicated to the scaffolders before commencing the work.

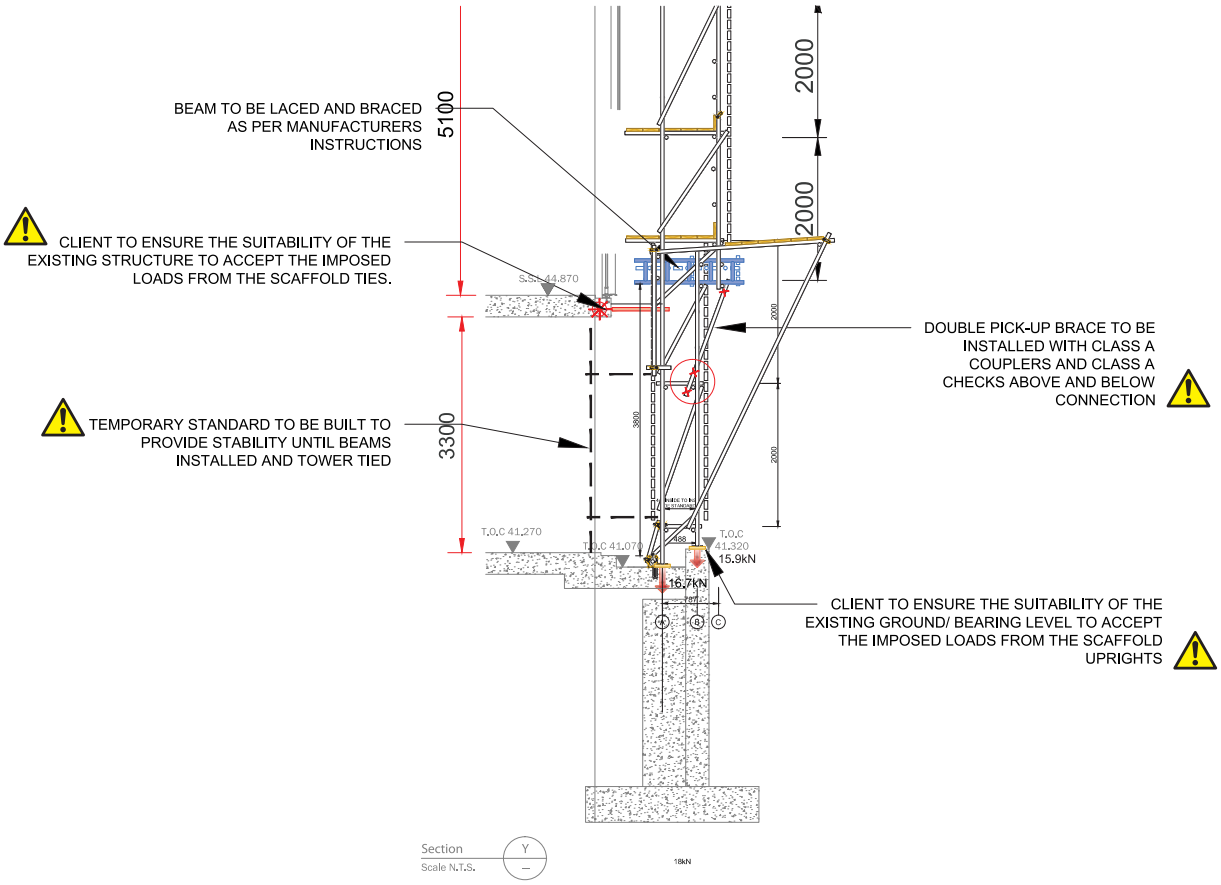



*Figure 7: Extract from a drawing showing hazard warning.*

## 2.9 Scaffolding operatives' responsibilities

All employees have general duties under health and safety law to take reasonable care of themselves and others who may be affected by what they do, or fail to do, at work and to co-operate with their employer to enable them to carry out their duties. Serious breaches of health and safety law by employees can result in them being personally prosecuted with fines and possible imprisonment.

With particular consideration for working at height and the potential hazards involved, scaffolders should always:

- take positive steps to understand the hazards involved and requirements of the risk assessment and method statement (RAMS);
- utilise techniques and equipment provided to prevent or protect against falls, in accordance with instruction and training received and not to act in a reckless or careless manner;
- establish a **scaffolders' safe zone**, wherever possible, as the priority when working at height;
- not tamper with or modify equipment provided, or use equipment that is not authorised by the employer;
- check fall arrest equipment daily and report to their employer any damaged or defective equipment identified, for example badly worn or cut webbing on a harness or lanyard;
- report to their employer any additional or emergent hazards not previously considered so that appropriate corrective actions can be taken to avoid any potential incidents;
- not work at height if affected by drugs or alcohol (including prescription medication that may affect ability to work safely);
- inform employers of any medical condition that may affect ability to work safely at height.

### Case Study 4

A scaffolder and his labourer were observed working unsafely by a HSE Inspector, risking their lives and endangering the public. In court the Magistrates heard how there was a complete lack of edge protection to prevent a fall, no safety harnesses, no ladder access to some of the work areas and large gaps in between the boards that posed a significant fall risk.

He co-operated fully with the HSE, but still received a fine of £800, plus £577 of costs for breaches of the Work at Height Regulations 2005.

*Source: HSE*

# The scaffolders' safe zone

This section identifies what a **scaffolders' safe zone** is, and how to safely create it.

Scaffolders must focus upon creating a **scaffolders' safe zone** utilising one, or a combination,of the methods detailed in this section, as a priority when working at height, with a minimum of:

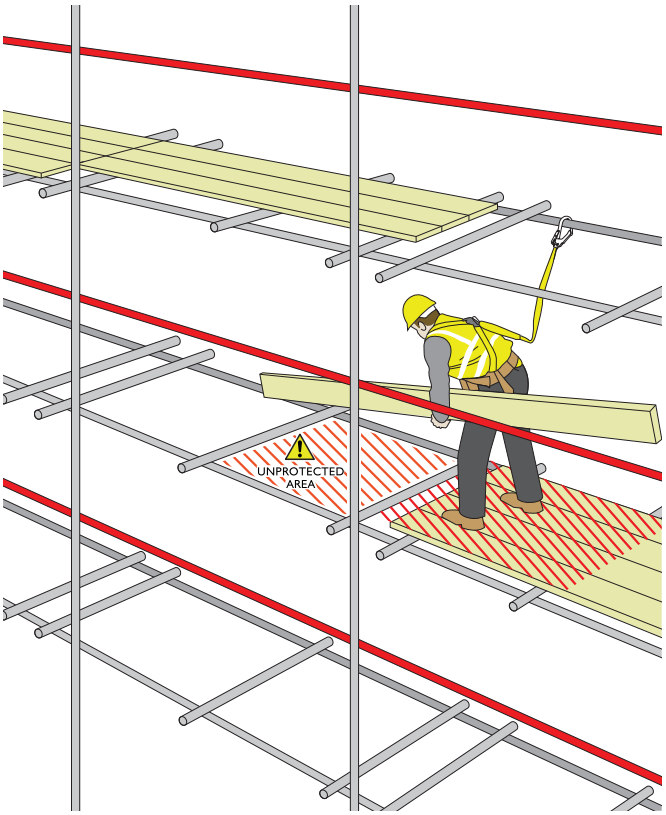
- a correctly boarded and supported platform without gaps through which someone could fall (see section 3); and,
- a single main guardrail (950mm above the platform) where there is a risk of a fall.

The principles of creating a **scaffolders' safe zone** should be adopted for all general scaffolding operations where suitable. Scaffolders should focus on establishing a **scaffolders' safe zone** as their priority when working at height, where appropriate, to reduce reliance on personal fall protection equipment (PFPE). Employers should choose the most suitable method of installing the **scaffolders' safe zone** that best suits the scaffolding application contemplated.

Since the previous edition of this guidance (November 2010) it has not been permitted for scaffolders to traverse unprotected along a platform without any form of fall protection. It is paramount that scaffolding operatives are never placed in a position where they are exposed to a risk of a fall without suitable fall prevention or protection in place.

It must be recognised that the **scaffolders' safe zone** does not completely eliminate the risk of a fall for all scaffolding operations, for example when raising or lowering working platform boards as the erection or dismantling of the scaffold progresses. Personal fall protection equipment (safety harnesses) will still be required at some point in the system of work unless every lift remains fully boarded and all edges are protected with guardrails or similar. In addition some methods of creating a **scaffolders' safe zone** and elements of work within a **scaffolders' safe zone** may also expose scaffolders to a risk of a fall and necessitate the need for personal fall protection equipment to be used.

When scaffolders are working without a fully boarded platform (e.g. raising or lowering platform boards) or without guardrail protection, then they must remain continually clipped on to a suitable anchor point when exposed to the risk of a fall.



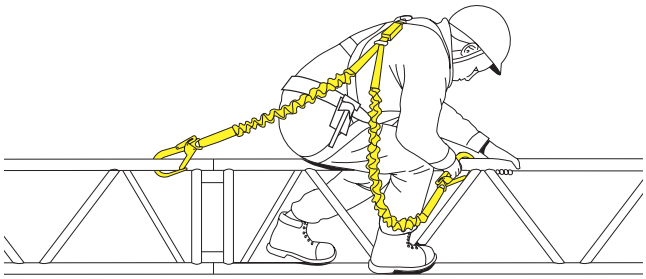



*Figure 8: These illustrations show examples of the inherent risk of a fall in scaffolding where personal fall protection equipment will be the primary method of fall protection (e.g. (i) raising and lowering boards and (ii) working without a **scaffolders' safe zone**).*

When scaffolders encroach from a **scaffolders' safe zone** to within 1 metre of an area not protected by guardrails they are considered 'at risk' and personal fall protection equipment must be used (*Figure 9*).

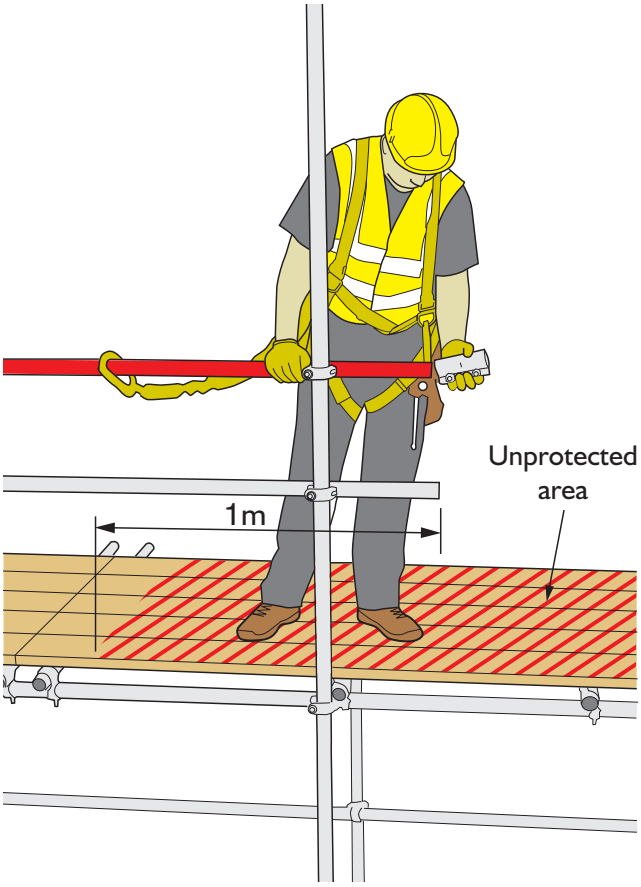



*Figure 9: Shows a scaffolder exposed to a risk of falling at a leading edge (within 1 metre from the edge of the **scaffolders' safe zone**).*

## 3.1 Working platforms

It is important to identify that there are different types of working platforms used in scaffolding. The term 'working platform' applies to a temporary platform provided for access at various stages of the erection, use, alteration and dismantling of scaffolding, these include:

- The finished working platform (Used by others)
- Other purposes (e.g. loading towers for materials that require personnel access)
- Erection, alteration or dismantling of scaffolding ONLY! (The **scaffolders' safe zone**)

Scaffolders must consider the following working platform requirements for creating the **scaffolders' safe zone**:

- Scaffolders should install a minimum of a single guardrail, at least 950mm above the platform, on each face of the scaffold where a fall could occur. On finished working platforms for others, progressively install the double guardrails (with no gap greater than 470mm).
- Inside gaps (greater than 225mm) between the inner standard of the working platform and façade/structure or openings in the façade (e.g. windows), where scaffolders face a risk of falling, need to be protected with guardrails in same manner as the outer faces of the platform (also see NASC Safety Guidance 29 (SG29) Internal edge protection on scaffold platforms).
- Guardrails should be erected and left in place for the duration of the works (e.g. for alterations or dismantling).

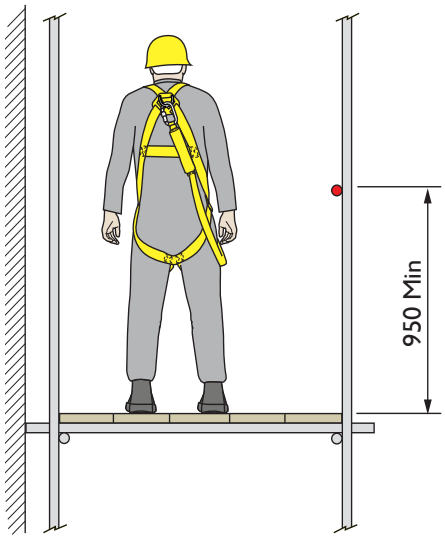



*Figure 10: A temporary scaffolders working platform to form the minimum **scaffolders'safe zone**.*

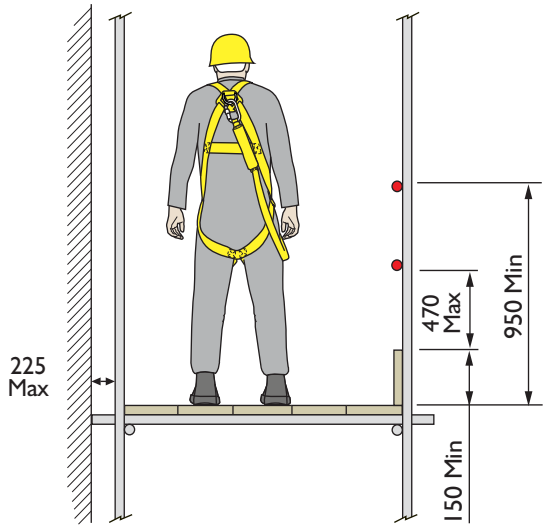



*Figure 11: A finished working platform for users*

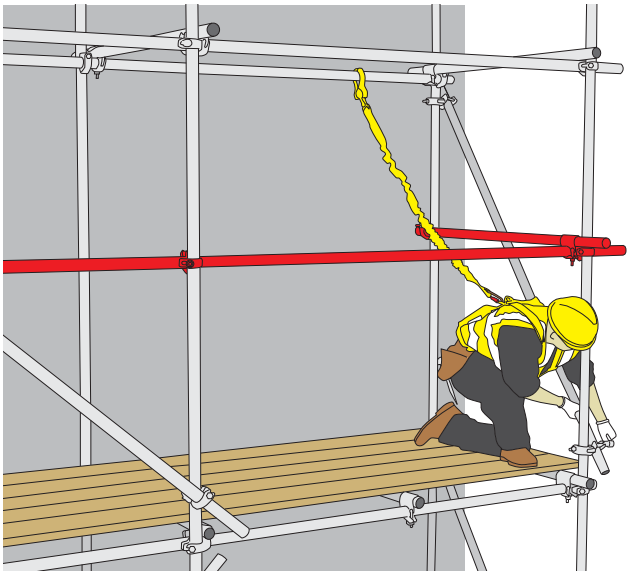
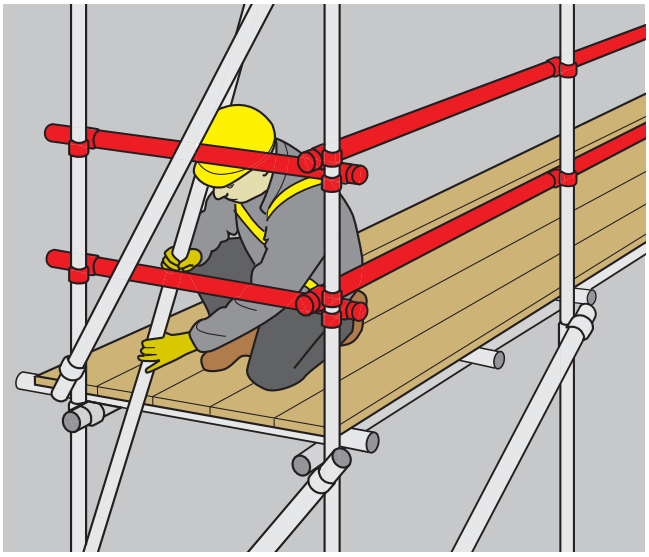


*Figure 12: A scaffolder reaching below the single guardrail must be clipped on.*



- Scaffolders' guardrails should be installed on all lifts where the lift height is greater than 950mm (e.g. progressive bricklayers' lifts 1.35-1.5 metres).
- When it is necessary to reach below a single guardrail scaffolders must be clipped on to the highest available anchor point (e.g. when fixing bracing or handling materials below the height of the single guardrail see *Figure 12*).
- When raising or lowering materials scaffolders should be clipped-on or create a safe handling platform with double guardrails, including stop-ends so that there is no gap greater than 470mm through which a scaffolder could fall (*Figure 13*).
- When moving, raising or lowering platform boards, working less than 1 metre from an exposed edge or outside of guardrail fall protection, where exposed to a risk of a fall, scaffolders must be clipped on (*Figure 9*).
- The working platform should be fully boarded out, without gaps through which a person could fall, except when access is required to a ledger below the lift for attaching fall arrest equipment, then one board may be omitted for ease of access to the ledger as an anchor point (*Figure 14*).

*Figure 13: Safe handling bay. This illustration shows a scaffolder using a safe handling bay with double guardrails (including stop-end returns) for raising or lowering materials, without the need to be clipped on.*

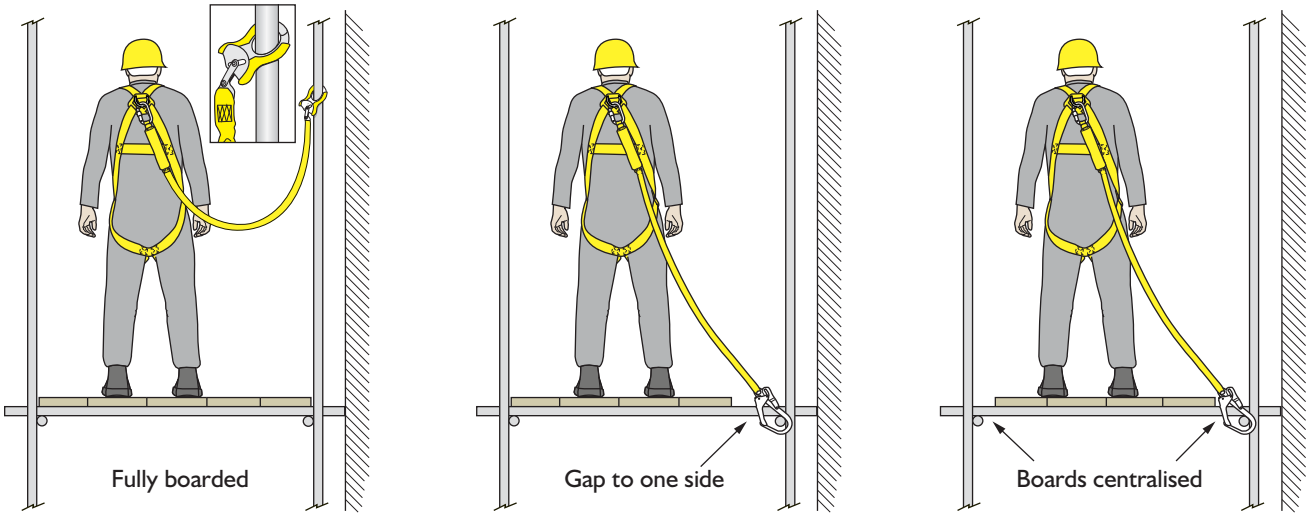



*Figure 14: Fully boarded platform with a maximum of one board gap (225mm) may be permitted only if required to access the ledger below the platform as an anchor point.*

- Scaffold boards must be correctly supported by transoms or bearers in accordance with NASC Technical Guide TG20 Operational Guide (Tables 6.3, 6.4 and 6.5) e.g. 38mm thickness timber scaffold boards for scaffold load classes 1 to 3 must be supported every 1.2 metres. Exceeding the specified maximum span of scaffold boards increases the risk of a fall due to the board failing.

- Ensure boards are suitably stable and trap-ends avoided by not exceeding minimum or maximum specified overhangs (TG20 Operational Guide, table 6.3) e.g. 38mm thick timber scaffold boards (BS 2482) have a minimum overhang of 50mm and a maximum overhang of 150mm.

- In the case of proprietary system scaffolding battens and decking, these must be used in accordance with supplier's instructions. Particular consideration must be given to the method of raising and lowering battens or decks for system scaffolding and the protective measures recommended by the manufacturer.

- Gaps formed in working platforms to create ladder access traps should be protected against accidental falls once the scaffold is completed. Scaffolders should install these measures progressively to provide protection for themselves as the job progresses (see Section 5 Methods of access and egress and NASC Safety Guidance Note 25 (SG25) Access and egress from scaffolds).

- The first lift should, where possible, be boarded out from below to avoid the risk of a fall when working at low level (*Figure 15*).

- All other lifts, where practical, should be boarded out and removed from below.

- All guardrails should be secured so that they cannot become accidentally displaced should someone fall against them.

- Lateral gaps in guardrails are only permitted at a point of access to a ladder or stairway where a gap is necessary (see Section 5 Methods of access and egress).

- When a 3rd party has agreed to provide collective protection for use by a scaffolding contractor, work should not proceed without such measures in place, unless alternative steps have been taken e.g. installing a **scaffolders' safe zone** or using personal fall protection equipment (safety harnesses). A common example is the traditional building process, such as home building, where the fall risk to the interior of the building from the external scaffolding is often protected with a collective fall arrest system, rather than guardrails or internal scaffold platforms (*see figure 16*). For further information and guidance see NASC Safety Guidance note 29 (SG29) Internal edge protection on scaffold platforms.

- Any incomplete scaffold working platform, where someone may fall or where an object could fall and injure someone, needs to be clearly identified with warning signs, and access restricted by suitable physical measures to prevent unauthorised access (e.g. guardrails, ladder access removed or boarded over) (*Figure 17*).

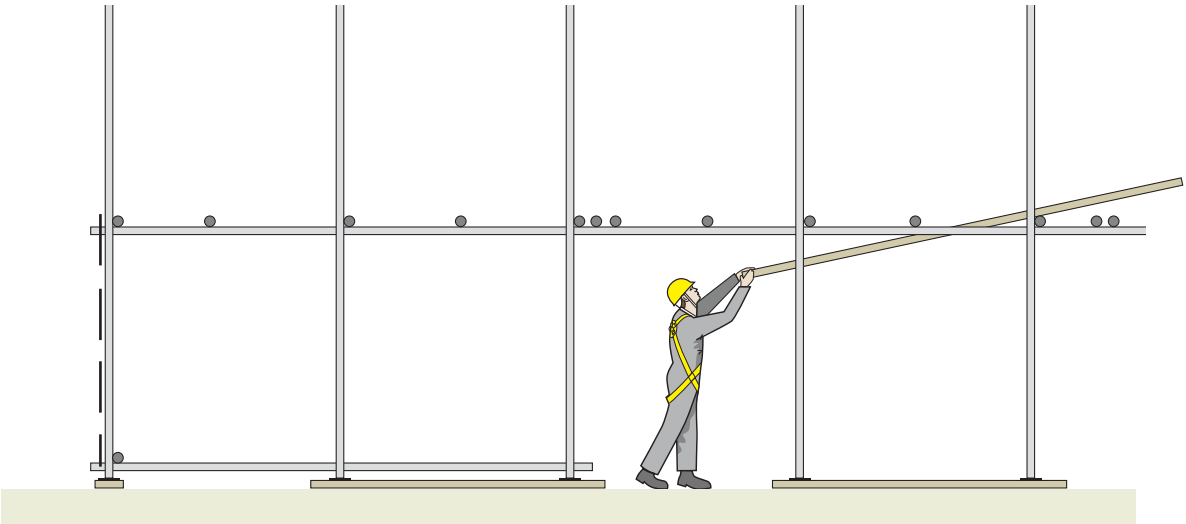
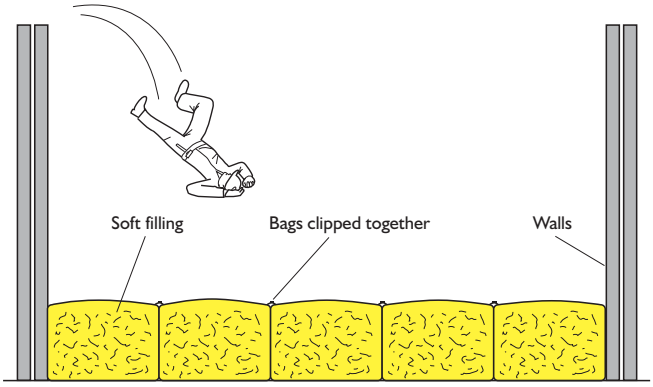
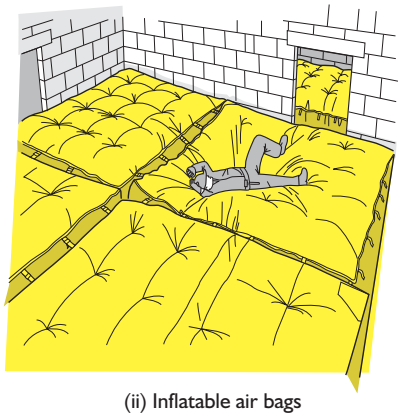


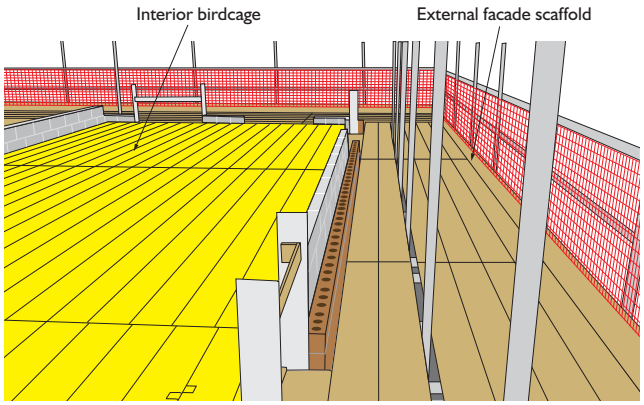
*Figure 15: Boarding out first lift from below.*



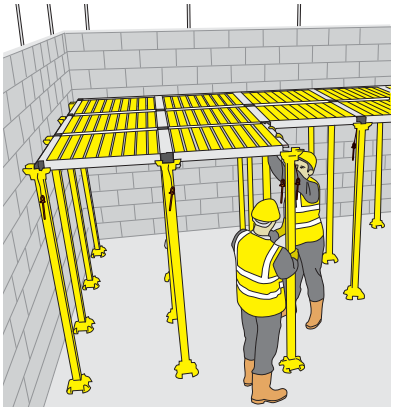

(i) Soft landing



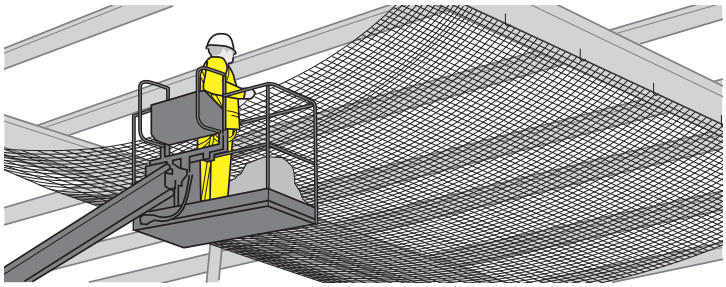
(ii) Inflatable air bags




(iii) Internal scaffolding



(iv) Proprietary decking systems



*(v) Safety netting*

*Figure 16: Examples of other collective fall arrest systems to provide internal fall protection*

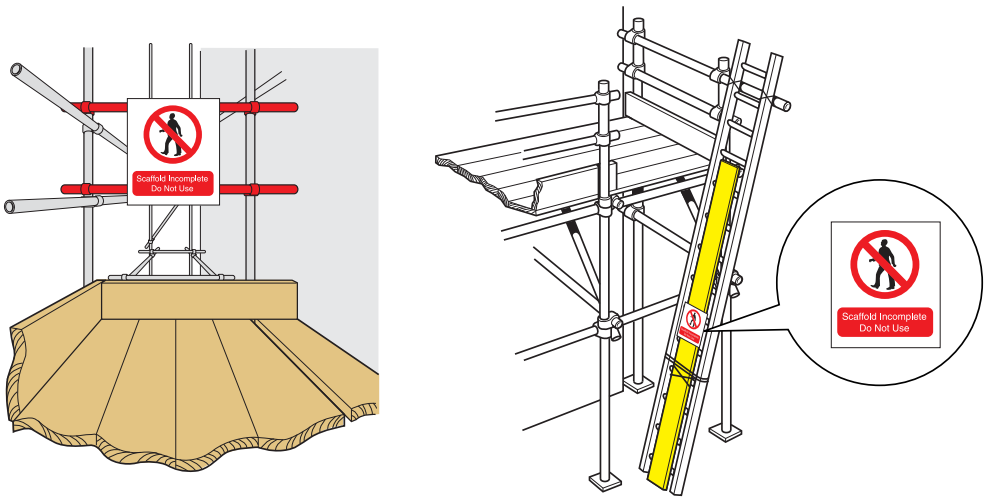



*Figure 17: Restricted access. Shows examples of incomplete scaffolds with access restricted by physical means and warning signs restricting access to authorised scaffolders ONLY!*

## 3.2 Methods of creating a scaffolders' safe zone

This guidance establishes the principle of creating a **scaffolders' safe zone** with a suitable platform and guardrails installed as a priority, where possible, when working at height. To assist employers, when completing their risk assessment and selecting the most appropriate method of creating the **scaffolders' safe zone** for the task, a range of established proven solutions are featured in this section.

These established systems of work protect scaffolders whilst creating the **scaffolders' safe zone** and include:

- Tools for installing guardrails in advance
- Proprietary advanced guardrail equipment
- Use of special personal protective equipment
- Methods of work without specialist equipment

Some of these innovative methods of work provide the same levels of collective fall protection as similar proprietary products, but utilise standard scaffolding materials without the need to invest in specialist equipment (e.g. short-lift method).

When selecting the most appropriate system or method of working, (or a combination of systems), employers must always consider:

- The suitability of the method(s) chosen for the scaffolding application.
- The requirements of the manufacturer's instructions for the use of proprietary equipment.
- Different techniques required e.g. hemping a standard over a guardrail (*see Figure 18*).
- The tasks to be performed from a smaller platform (e.g. handling long materials or the risk of over-reaching from a scaffolders' step).
- Are all fall risks protected e.g. stop-end guardrails, inside face, access traps or leading edge?
- Is additional personal fall protection equipment (safety harnesses) required for safe use?
- Can the equipment be used as an anchor point for personal fall protection equipment?
- Any training or instruction the scaffolders may need to ensure safe use.
- Arrangements for the handling, delivery and storage of special equipment.
- Any inspection and maintenance arrangements required for special equipment used.

### Case Study 5

Scaffolding business owner received a 15 month prison sentence following a fall from height accident, where a scaffolder fell 14 metres to his death. He was found guilty of a breach of the Work at Height Regulations 2005 (amongst other breaches) for failing to properly plan, supervise and carry out work at height in a safe manner. The HSE investigation established that edge protection was missing and the scaffolder was not provided with any other means to prevent or protect against a fall, such as a safety harness. Fines to the business totalled £12,000 plus costs of £5,601 under the Health and Safety at Work etc. Act 1974 and Employers' Liability (Compulsory Insurance) Act 1969.

*Source: HSE*

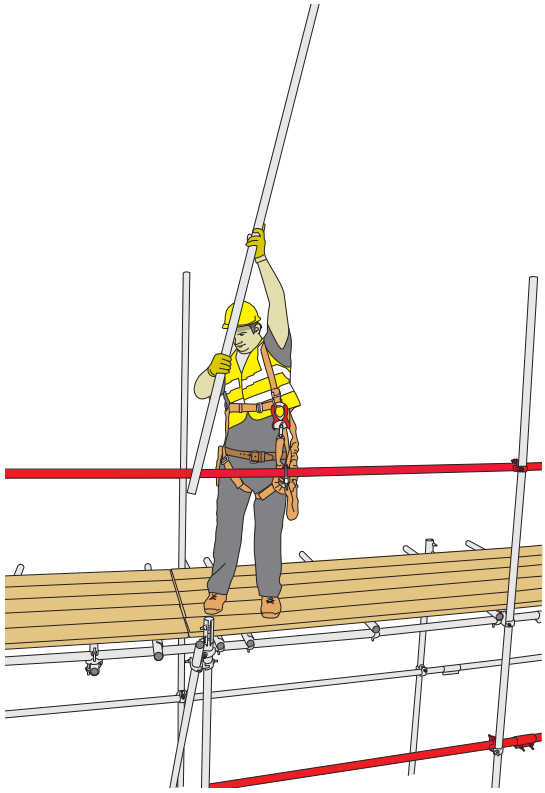


*Figure 18: Illustration shows a scaffolder hemping a standard over a guardrail.*

## 3.2.1. Scaffolders' step

This popular system utilises a proprietary step that is fixed to the main guardrail approximately 1m above the working platform. This enables the scaffolder to erect the guardrail protection on the lift above in advance or remove them from below during dismantling (*Figure 19*).

The sequence of work needs to be considered when using some older designs of scaffolders' step, as ledger bracing or stop-end guardrails may impede their use. Therefore, these items may need to be fixed after the guardrails have been erected in the lift above with scaffolders using personal fall protection equipment (safety harnesses), where necessary.

For some modular system scaffolding, standard side brackets (hop-ups) can be used to create an internal temporary platform to install guardrails in the lift above, in a similar fashion to the proprietary scaffolders' step system.

Note that a guardrail will need to be fixed to the base lift to accommodate the step for the first lift (*Figure 21*). A foot tie may also be required to secure the base lift with certain step designs that are supported by a scaffold standard – see manufacturers' instructions. For uneven ground the base lift may need to be boarded out to ensure some types of step are correctly supported at the base (*Figure 21ii*).

**IMPORTANT**
**Scaffolders must be clipped on to a suitable anchor point, ideally to the back ledger, due to the risk of falling from the scaffold when using a scaffolders' step system. Scaffolders must be clipped on before climbing on the temporary platform and must not jump down onto the boarded platform due to the risk of board failure from impact loads.**

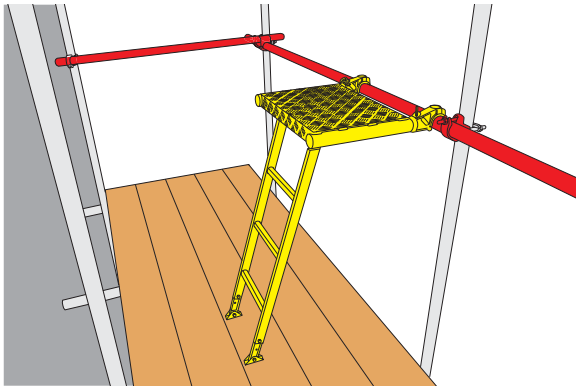


*Figure 19: Examples of a scaffolders' step used to install guardrails in advance.*

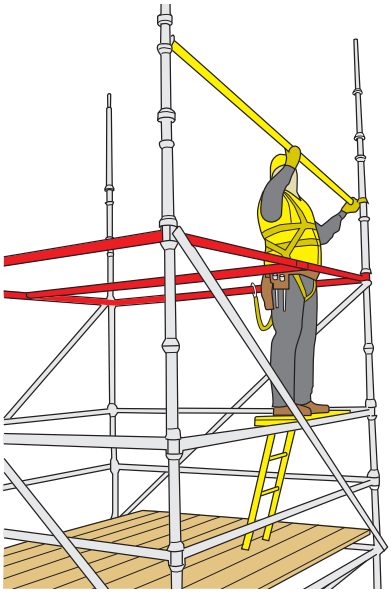
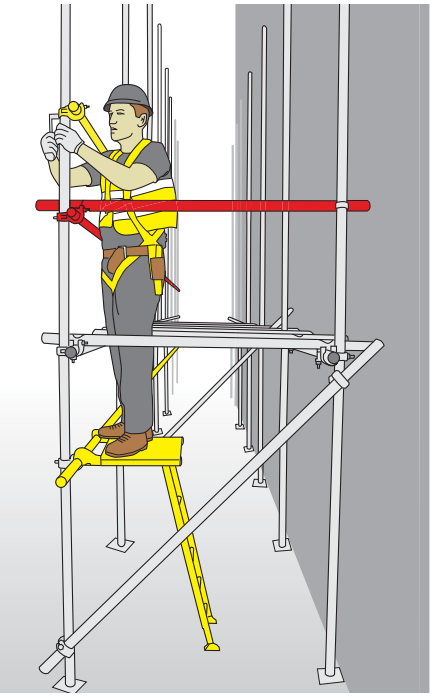


*Figure 20: Scaffolder installing a guardrail in advance to the next lift from a scaffolders' step protected by the ledgers and transoms.*



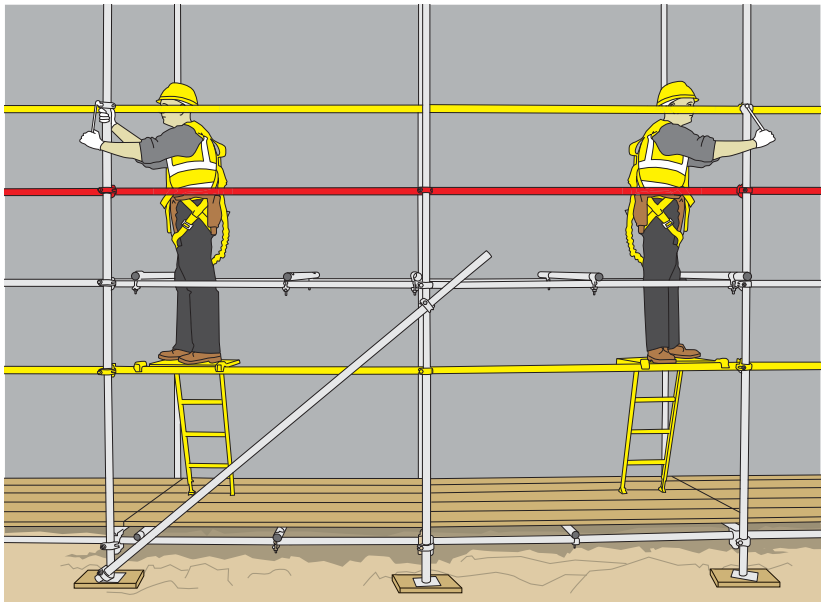


*Figure 21: Shows the scaffolders' step being used with (i. Left) an additional guardrail to the base lift to support step and (ii. Above) boarded base lift to support the step on uneven ground.*

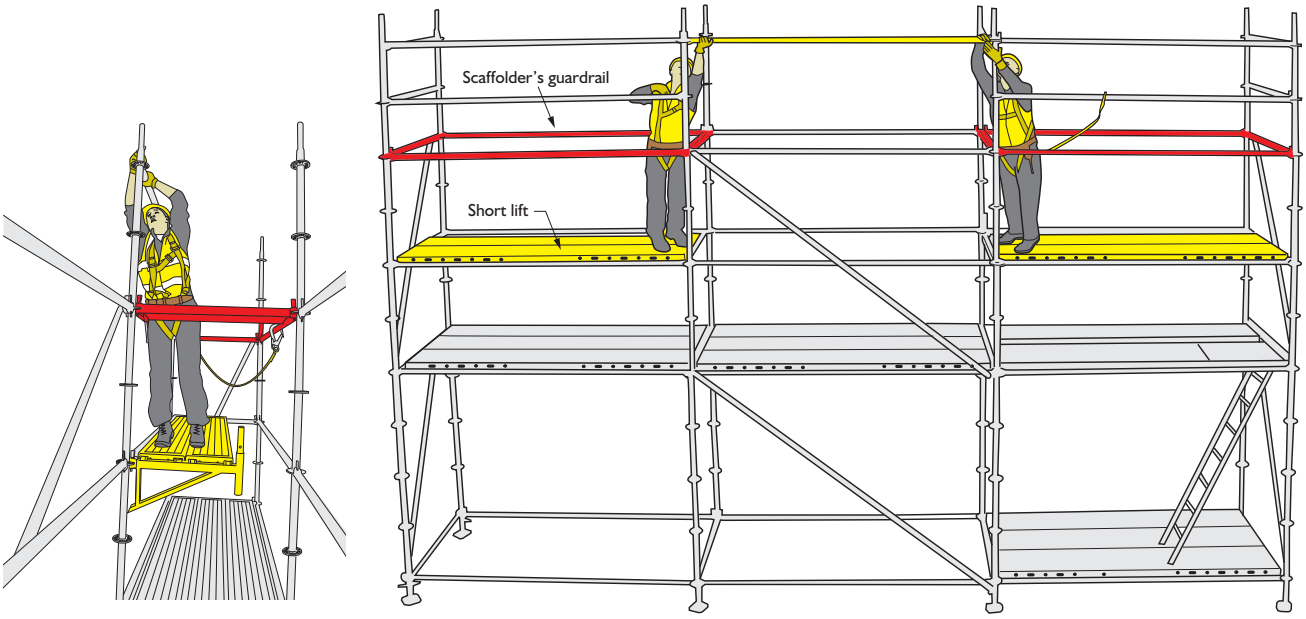



*Figure 22: System scaffold side brackets used to create a scaffolders' step platform in alternate bays. The middle bays can be reached from adjacent bays to fix the guardrails.*

## 3.2.2 Push up advanced guardrail tool

This *push up type advanced guardrail tool (AGT)* utilises special couplers that allows scaffold tube guardrails to be erected from below and pushed up into position with a locating tool (*Figure 23*). The guardrail is automatically locked and remains in place to provide fall protection when scaffolders access the next lift. The sequence of work is critical as the advance guardrails need to be raised before the next lift is formed. The temporary guardrail remains in place whilst the permanent guardrails are fitted. Alternatively, the AGT couplers can be replaced with normal right-angle scaffold couplers to form the scaffold guardrails. This system can be used on all faces of the scaffold including inside fall risks and stop-ends.

The positioning tool is also used to unlock the guardrail from below during dismantling. This system is primarily suited for traditional tube and fitting scaffolds.

Some proprietary system scaffold manufacturers provide advanced guardrail tools that are bespoke to their particular product (*Figure 24*). Special arms are used to locate/remove the guardrail frame in the lift above.

*Figure 23: Push type Advanced Guardrail Tool (AGT) using special couplers and a positioning tool.*

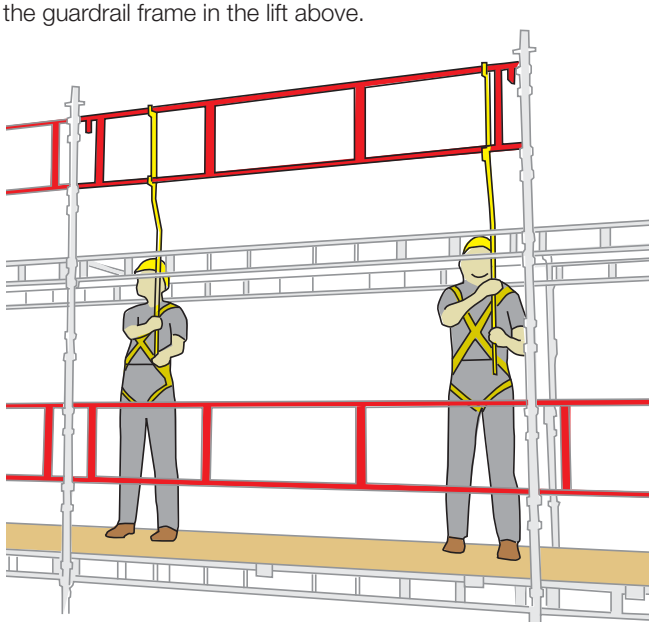


*Figure 24: Example of a system scaffold specific advanced guardrail tool.*

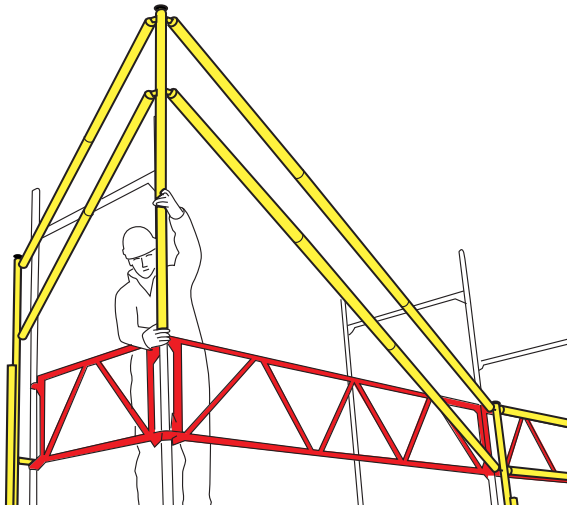
### 3.2.3 Proprietary Advanced Guardrail Systems (AGS)

Several proprietary collective fall protection systems are available and have become known as 'Advanced Guardrail Systems' (AGS) (see figure 25).

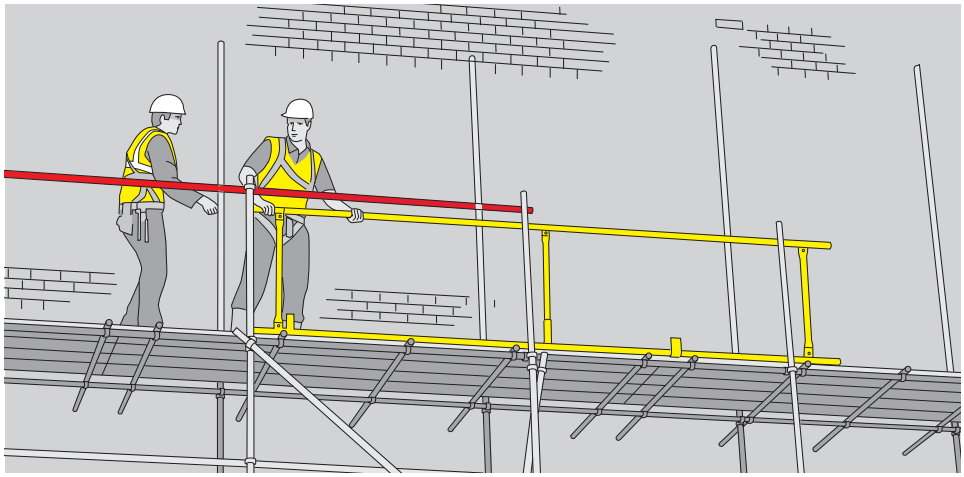
Advanced guardrail systems provide collective fall prevention for scaffolders when traversing along a boarded lift, erecting, altering or dismantling scaffolding. These temporary guardrails remain in place whilst the platform guardrails are installed or removed, allowing scaffolders to maintain guardrail edge protection on working platforms at all times.

The suitability of advanced guardrail systems needs to be considered as part of the risk assessment process when planning work at height and included in the method statement. These systems are best suited to straight uniform scaffold structures without complex elements e.g. long straight facades with minimum returns, recesses or protrusions.

Some advanced guardrail systems do not provide full collective protection e.g. stop-ends, inside face or at a leading edge.



*i Telescopic type advanced guardrail system*



*ii. Horizontal type advanced guardrail system*

*Figure 25: Examples of Advanced Guardrail Systems (AGS).*

Where an AGS is pushed up the outside of the structure, their operation can be impeded by protrusions from the scaffold or façade. Scaffolders may have to ensure that the transoms, ledgers, bracing etc. are correctly sized so that they do not have excessive overhang.

Where there exists a risk of a fall to the inside face of the scaffold, scaffolders may need to change the normal sequence of work to accommodate the AGS e.g. locate the AGS above, before fixing transoms, hop-up brackets or tie assemblies (Figure 26).

*Figure 26: Shows the modified sequence of erection to allow 'push-up' AGS's to be used on the inside face before fixing transoms, ties or hop-ups inside board brackets above.*

The horizontal type AGS (Figure 25ii) is best suited to independent tied scaffolding (façade scaffolds), because it pushes along the lift, fixes to the standards and can provide protection to both inside and outside faces of the scaffold. To provide full collective protection it must be used in conjunction with an additional AGS that can be fixed/removed from below for the first bay during erection and the last bay when dismantling. Again, additional precautions need to be taken at stop-ends or corner returns.

Some manufacturers of proprietary system scaffolding have developed an integrated AGS that form the permanent guardrails for the completed scaffold structure (*Figure 27*)

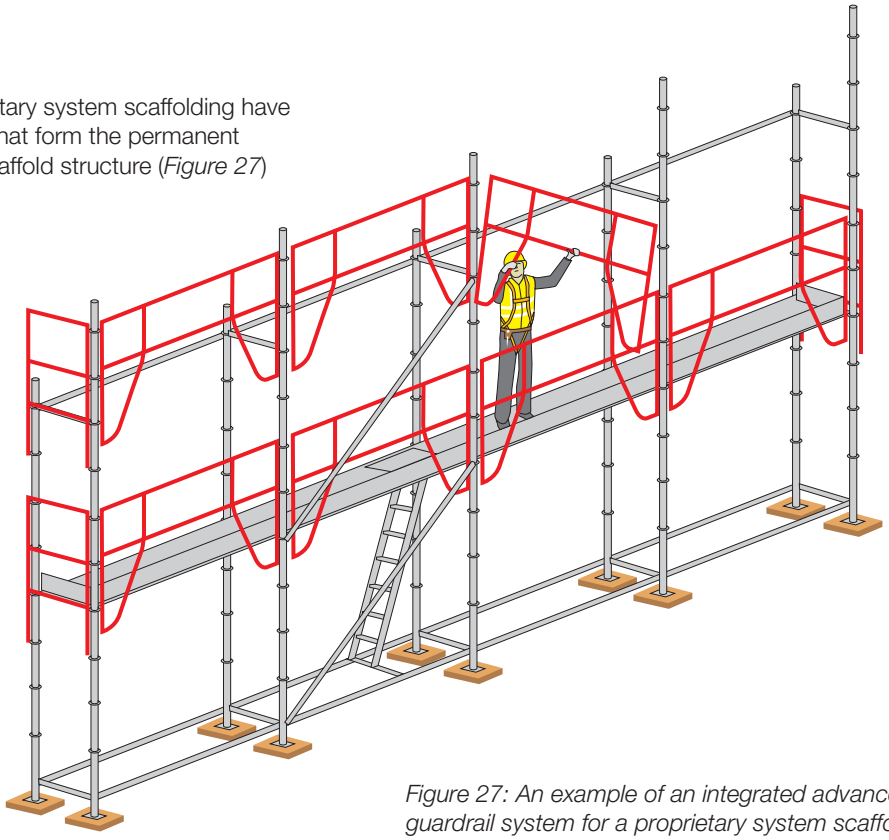


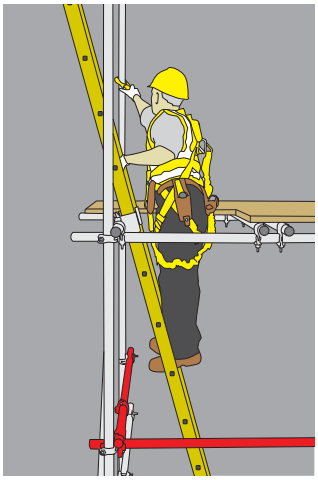
*Figure 27: An example of an integrated advanced guardrail system for a proprietary system scaffold.*

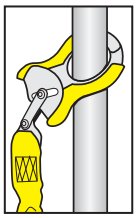
## 3.2.4 Protected traversing

When utilising this system of work, to create a **scaffolders' safe zone**, then suitable compensatory measures must be taken that minimise the distance and consequences of a fall. In practical terms scaffolders **MUST** be continually clipped on to a suitable anchor point when exposed to the risk of a fall whilst working outside (or within 1 metre of the end) of guardrail protection (*see Figure 9*).

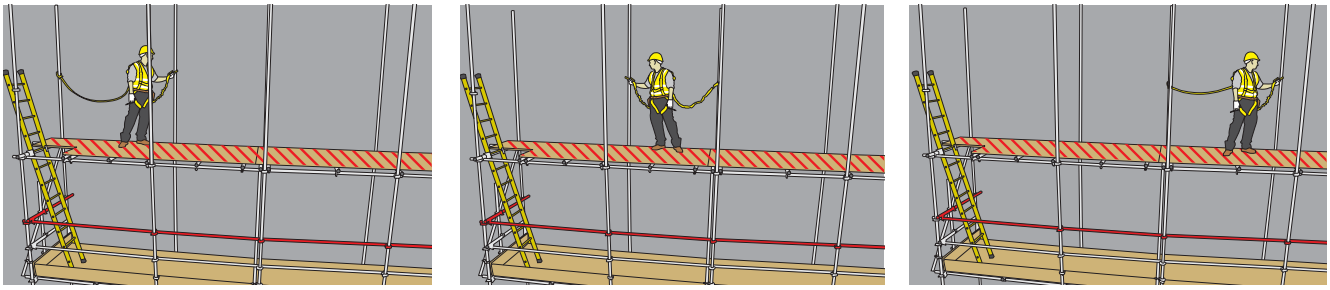
In order to traverse along an unprotected platform, a minimum system of work would be required utilising double or twin-tailed lanyards. An example of this system is shown in *Figure 28* below.

To minimise the potential fall distance it is preferable for scaffolders to utilise anchor devices that fix to the standard above (ideally the inside standard furthest from the edge) rather than the ledger below foot level (*see Section 6 Personal fall protection equipment and Figure 74 anchor devices*).

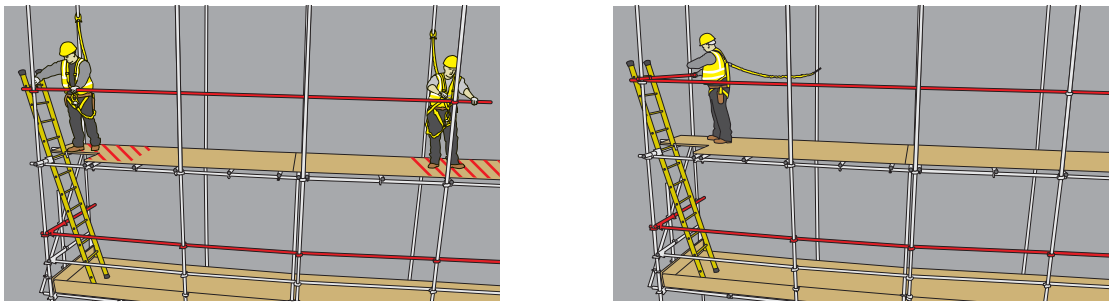




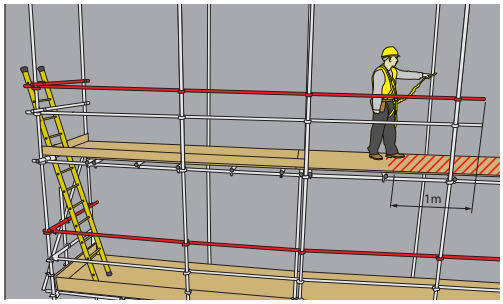
*(i) Clipping-on through the ladder trap. Inset showing special anchor device for attaching to standards.*



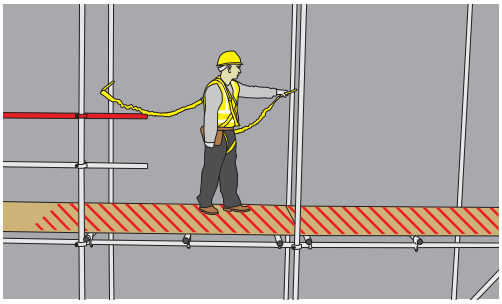
*(ii) To traverse, double lanyards are used to remain continually attached, ideally to the inner standards or ledgers.*



*(iii) Progressively install guardrails (including stop-ends etc.) remaining continually attached to create the **scaffolders' safe zone**.*




*(iv) Attaching if encroaching within 1 metre of the end of the protected **scaffolders' safe zone**.*



*(v) The process is repeated, progressively installing guardrails to create the **scaffolders' safe zone** whilst remaining continually attached.*

*Figure 28: Protected Traverse sequence of work using double lanyards attached to standards.*

## 3.2.5 Short lift system

To use the short-lift system of work, the ledgers and transoms of the next lift are erected as normal to form a main lift (e.g. 2m above the current lift). Then a temporary intermediate 1m high short-lift is formed (also referred to as a dummy lift). Therefore, as the scaffolders access the next 1m level, the ledgers and transoms are already in place and act as guardrails to provide collective fall protection (*Figure 29*). Decking on the temporary short-lift can be raised to the next lift and any temporary transoms required can be removed later to provide clear access on all working lifts for other trades.

This system of working can be used on all scaffolds with conventional lift heights of up to 2.1m, however it is best suited to scaffolds designed without ledger bracing (e.g. modular system scaffolds or prefabricated transom units used in accordance with the manufacturer's instructions and TG20). System decking also eliminates the need to install temporary intermediate transoms as board bearers.

Suitable methods of access and egress between the main lifts of the scaffold must be used (*see Section 5 - Methods of access and egress*).

**IMPORTANT**
**Scaffolders must be clipped on to a suitable anchor point before climbing on and off the temporary platform and must not jump down onto the boarded platform due to the risk of board failure from impact loads.**

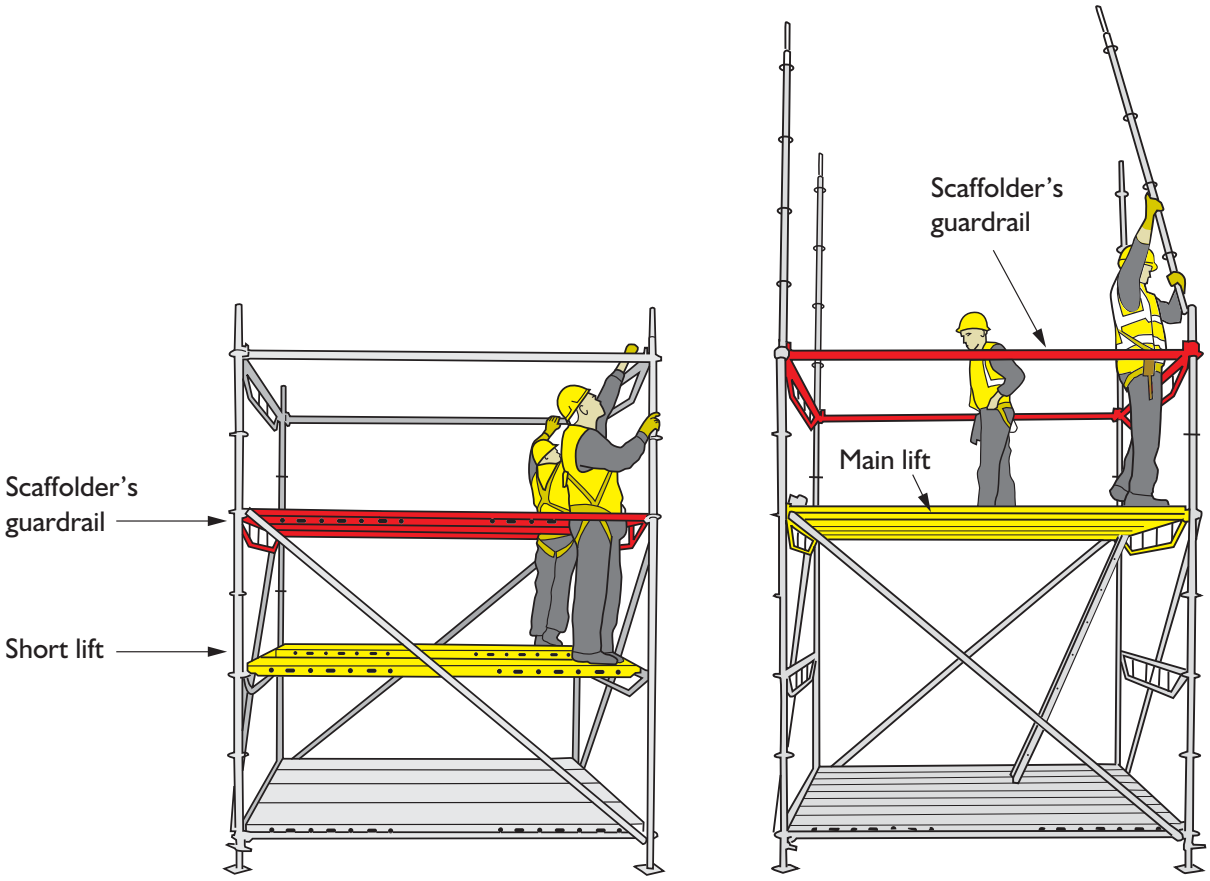



*Figure 29: This sequence shows the short-lift system used to erect a system scaffold tower.*

## 3.2.6 Tube and fitting frame type AGS

This tube and fitting frame type advanced guardrail system (AGS) functions similarly to proprietary advanced guardrail systems.

Step 1
Select materials to suit the length of the scaffold elevation and bay sizes to be protected. The uprights are formed with 2.7 metre or 3 metre (9ft or 10ft) scaffold tubes, and a single tube is used to form the temporary guardrail. Aluminium tube can be used to reduce the handling weight.

Step 2
Lay out the tubes on the ground to form a 'goal post' frame. Then fix the guardrail to the end of the upright tubes using right-angle couplers (EN74)

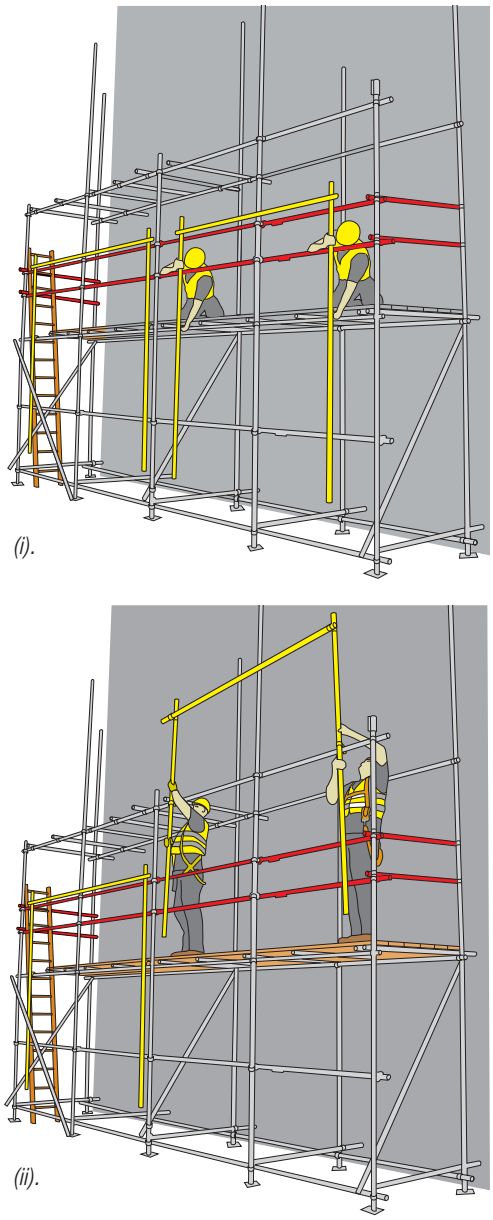



*Figure 30: AGS frame constructed on the ground and fixed to the base lift. (i). Releasing the guardrail from the ledger. (ii). Raising the guardrail to the next level.*

Step 3
Now fix a second right-angle coupler to each upright tube. Measure 1100mm down from the centre of the top coupler. Note that these couplers must be to the opposite side of the tube and fixed 'up-side-down' (*see Figure 31 inset*).

Step 4
Using two scaffolders, lift the frame and fix to the ledger. Note by fixing the coupler 'up-side-down' it will support itself until secured (*see Figure 31 inset*). Also note that an additional guardrail is required for the base lift only for the vertical tube to act against.

Step 5
The couplers can now be secured to fix the advanced guardrail in place. Scaffolders can now access the platform and erect the next lift once the collective protection is in place.

Step 6
When the permanent guardrails have been installed, the advanced guardrail can be raised to the next level (Figure 30(ii)). This is more easily achieved by pulling back the outside board to access the coupler, from above (Figure 30(i)).

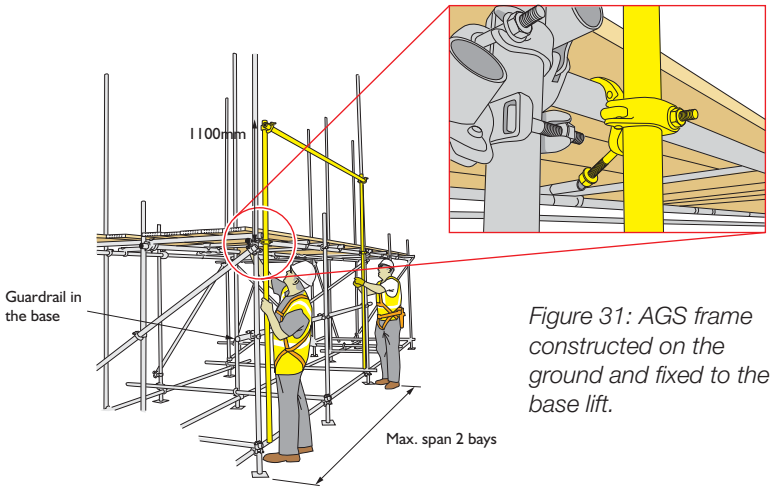



*Figure 31: AGS frame constructed on the ground and fixed to the base lift.*

Where tie assemblies, transoms for inside boards, buttresses or other protrusions may obstruct the raising of the advanced guardrail, the build sequence will be critical, ensuring the advanced guardrail is raised prior to the transoms etc. being installed.

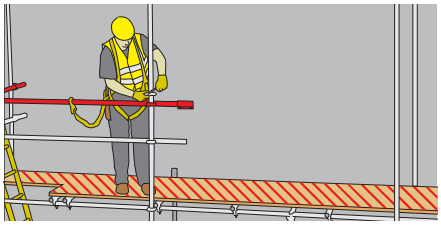
If the advanced guardrail is obstructed by the façade bracing, then fix the brace once the advanced guardrail has been raised.

This advanced guardrail system can also be used for dismantling and alterations that necessitate the removal of guardrail protection.

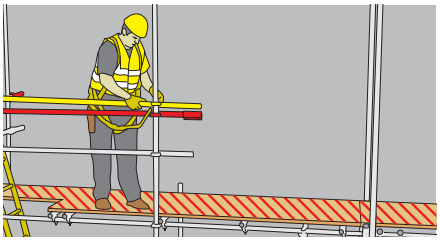
## 3.2.7 Tube and fitting horizontal type AGS

This tube and fitting advanced guardrail functions similarly to proprietary horizontal type systems. Other forms of protection must be used to create the **scaffolders' safe zone** for the first bay.

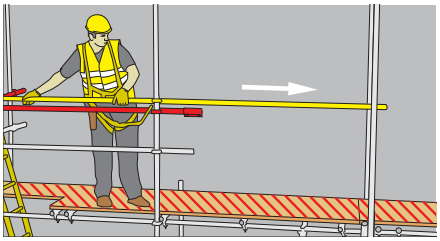
**Step 1**
Working from behind the guardrail protection, fix two right-angle couplers to the standards above the existing guardrail *(Figure 32 (i))*.



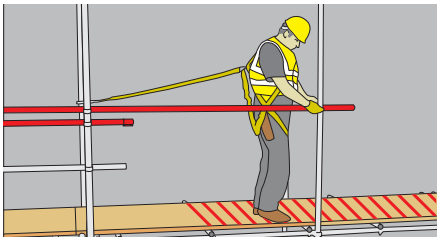
**Step 2**
Using another tube to form a temporary guardrail, place it loosely into the two fittings so the tube can still slide horizontally *(Figure 32 (ii))*.



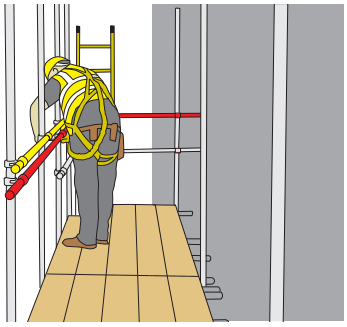
**Step 3**
Push the tube out horizontally past the next standard (one bay max) and tighten the end coupler *(Figure 32 (iii))*.



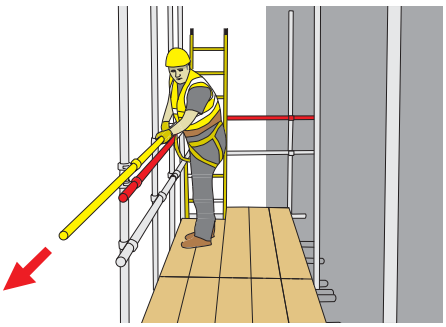
**Step 4**
Now walk out to fix the temporary guardrail to the standard, clipping on until the guardrail is secured and if encroaching within 1m of the end *(Figure 32 (iv))*.



**Step 5**
The working platform guardrail(s) can now be completed and next lift constructed with the **scaffolders' safe zone** in place *(Figure 32 (v))*.



**Step 6**
The temporary guardrail can then be released and slid along horizontally to the next bay *(Figure 32 (vi))*. This sequence is repeated one bay at a time to provide the **scaffolders' safe zone**.



# Other scaffolding applications

The purpose of this section is to feature examples of good practice and specific guidance for various common scaffolding applications. In keeping with the general theme of this guidance it does not extend to all scaffolding applications; however, the methods and principles highlighted may be adopted as good practice for other applications.

## 4.1 Scaffolding from a Mobile Elevating Work Platform (MEWP)

Mobile Elevating Work Platforms (MEWPs) are also commonly referred to as 'cherry pickers', 'booms' or 'scissor-lifts'. MEWPs are available in all shapes and sizes and are often considered to be a competitor to the scaffolding industry. In recent years, the availability and cost of hiring MEWPs as a safeguard against falls for some of the more hazardous scaffolding operations is now a viable option *(Figure 33)*.

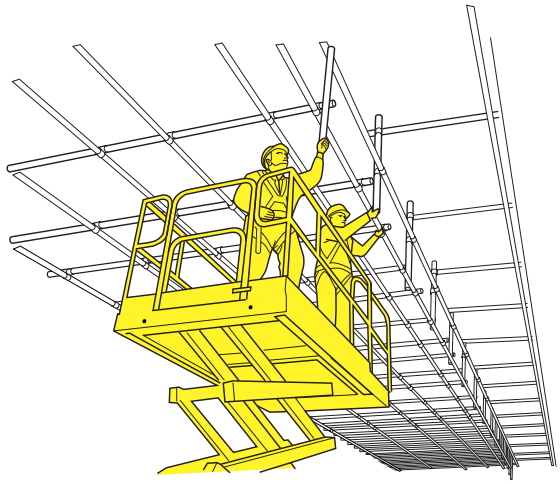


*Figure 33: Scaffolders using a MEWP to erect a suspended scaffold.*

It is important to recognise that MEWPs are only suitable for certain scaffolding applications and cannot be considered as a practical option for the majority of routine scaffolding operations. MEWPs can offer collective fall protection for some applications where scaffolders would typically rely upon personal fall protection equipment working from the scaffold structure without a **scaffolders' safe zone**.

Where MEWPs are selected for erecting, altering and dismantling scaffolding, employers must have a safe system of work for their intended use. Care should be taken to select the most suitable type and specification of MEWP for the operation.

The use of a MEWP would not be suitable where there is restricted access, work over water or at very high levels. Only Scaffolders who are authorised and trained (e.g. International Powered Access Federation (IPAF) powered access licence (PAL) or equivalent) should operate MEWPs.

***IMPORTANT***
***The powered access industry recommends that work restraint lanyards are used to prevent the operator being exposed to a risk of falling from the platform. However it is recommended by the NASC that scaffolders who regularly use MEWP's should consider using an adjustable fall arrest lanyard that may also be used for work restraint (Figure 34). Always check with the MEWP supplier to ensure only specified attachment points are used.***

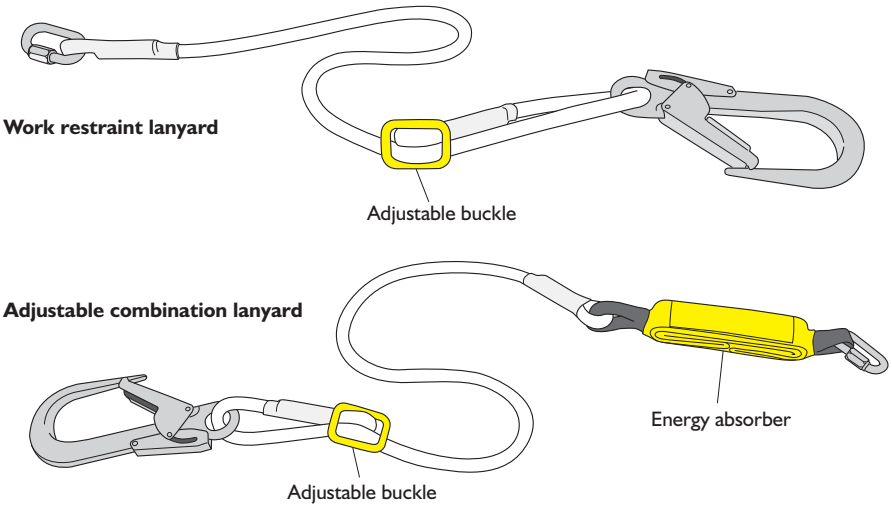



*Figure 34: Illustration showing i. a work restraint only that must not be used in fall arrest, and ii. a combination lanyard that can be used in fall restraint and arrest when required.*

## 4.2 Proprietary system scaffolding

Manufacturers and suppliers of scaffolding systems have legal duties to carry out appropriate research and testing of their products and to provide information and instructions. They must ensure the equipment can be used safely, meets the provisions of the Work at Height Regulations and any other statutory requirements or industry guidance, regarding falls from height.

In addition to the minimum requirements of any British or European manufacturing standards, manufacturers should undertake a product risk assessment. The purpose of a product risk assessment in this case is to ensure that safe erection, altering, use and dismantling processes are specified.

Scaffolding contractors who use system scaffolding must ensure that it is erected, altered and dismantled in accordance with the manufacturers' instructions for safe use. Particular attention should be given to the use of suitable anchor positions for personal fall arrest equipment when applying the principles of this NASC guidance.

All scaffolders must receive all necessary information, instruction, training and supervision in the safe erection, altering and dismantling of the proprietary system scaffolding used, in accordance with the manufacturers' instructions and ideally the CISRS System Scaffold Product Training Scheme (SSPTS).

## 4.3 Shorter lifts (Bricklayers' lifts)

Progressive scaffolds for brickwork are normally erected using 1.35 – 1.5 metre lift heights. Many of the established collective fall protection systems do not easily accommodate these smaller lift heights. In such cases the scaffolders' step or small proprietary standings may be used to enable scaffolders to install guardrails in advance to the next lift. The intermediate guardrail can often be fixed simply from the lift below as they are typically only 1.75-2 metres above the lift (*see Figure 36*).

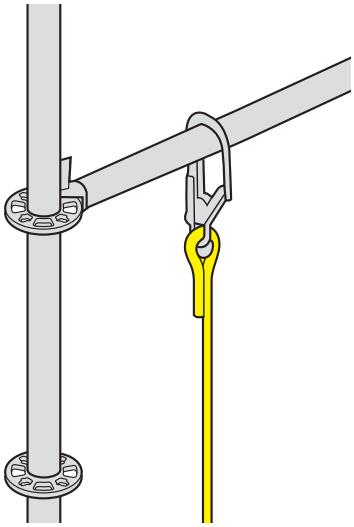
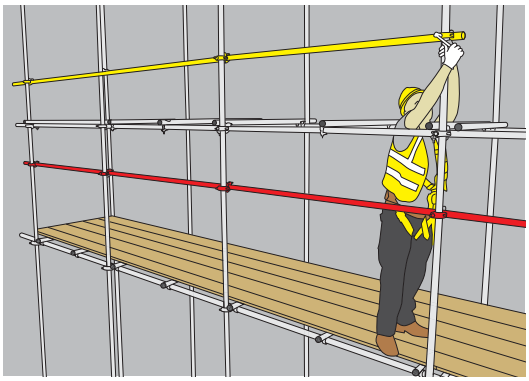
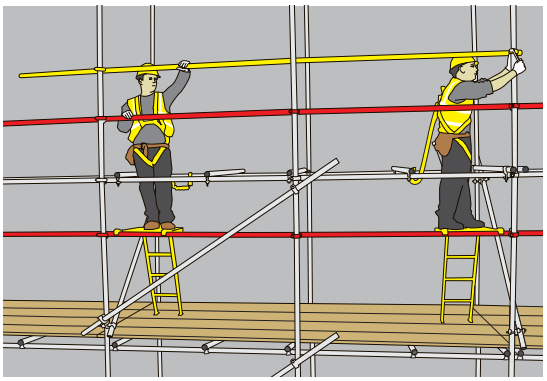


*Figure 35: An example of an anchor point for a proprietary scaffolding system as per the manufacturers' instructions.*

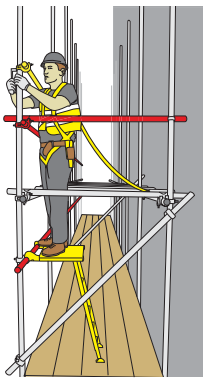
*(iii)*



*(i)*



*(ii)*



*(ii) inset*

*Figure 36: Example of a sequence of work used to erect guardrails in advance for shorter lift heights. (i.) Shows the intermediate guardrail installed from the lift below, (ii.) a scaffolders' step used to install the main guardrail and (inset) showing stop-end guardrail. (iii.) a 600mm proprietary staging platform being used as an alternative step-up.*

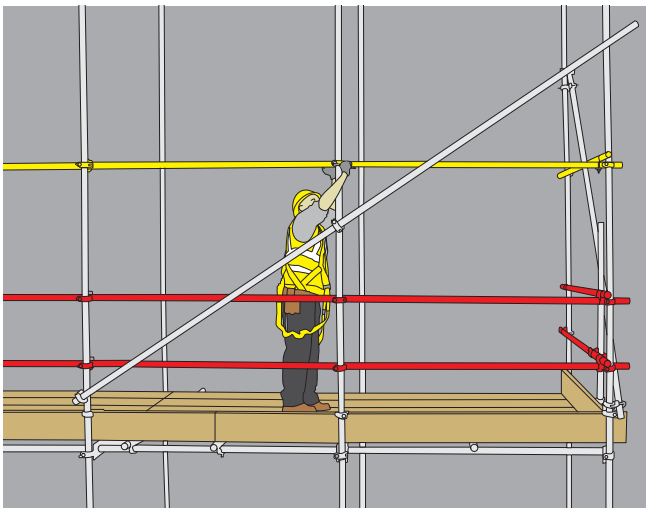
## 4.4 Tall lifts (Floor height lifts, pavement lifts and gantries)

Scaffolding with taller lift heights such as the erection of pedestrian base lifts (up to 2.7 metres) or floor height lifts (up to 3 metres) are often difficult to provide collective fall protection for, as most of the common systems of work are designed for a standard 2 metre lift height only.

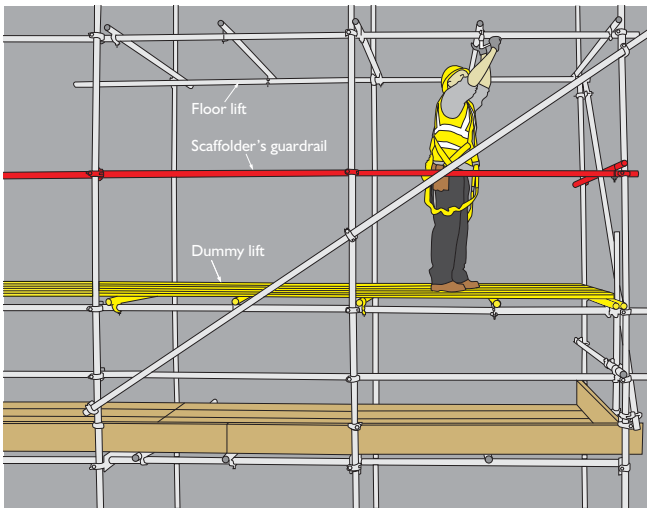
Scaffolders may have to use a combination of systems to achieve full collective protection for taller lifts. For example, using the 'short lift method' (page 26) (or dummy lift) at approximately 1 metre and then resorting to other safe methods to install guardrails on the working platform *(see Figure 37)*. The dummy lift can then be dismantled to allow unimpeded access on the working lift during use of the scaffolding, but should be reinstated for any alterations and dismantling. Note that temporary guardrails should be left in place where possible for dismantling. Alternatively floor height lifts can be constructed by splitting the lift height into a conventional 2 metre lift and a shorter lift which can remain in place throughout the works.

The use of a podium step or mobile access tower *(as shown in Figure 39)* is one example for erecting/dismantling tall base lifts providing the ground condition is suitable.

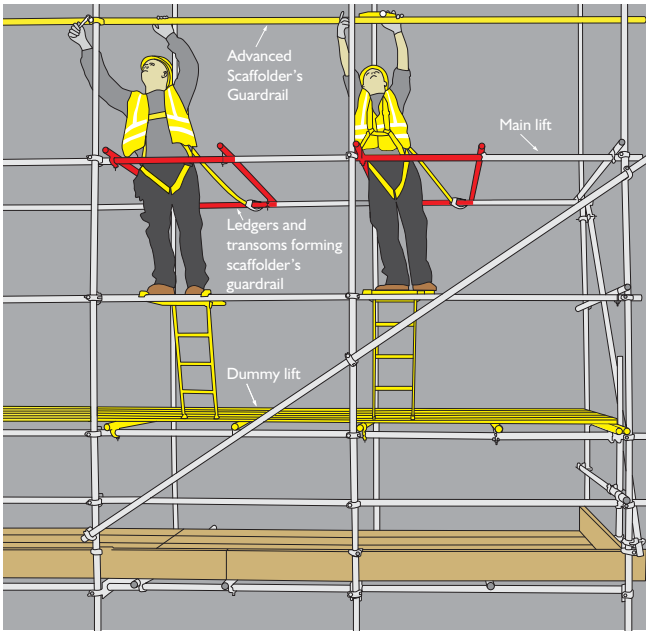
Where scaffolders' steps are used to install taller lifts (as opposed to fixing guardrails in advance) guardrails should be installed to prevent falls from the step from the scaffolding and scaffolders must remain clipped-on *(see Figure 38 (i))*.



*(i) Guardrail installed in advance to provide a safe zone for the dummy lift.*

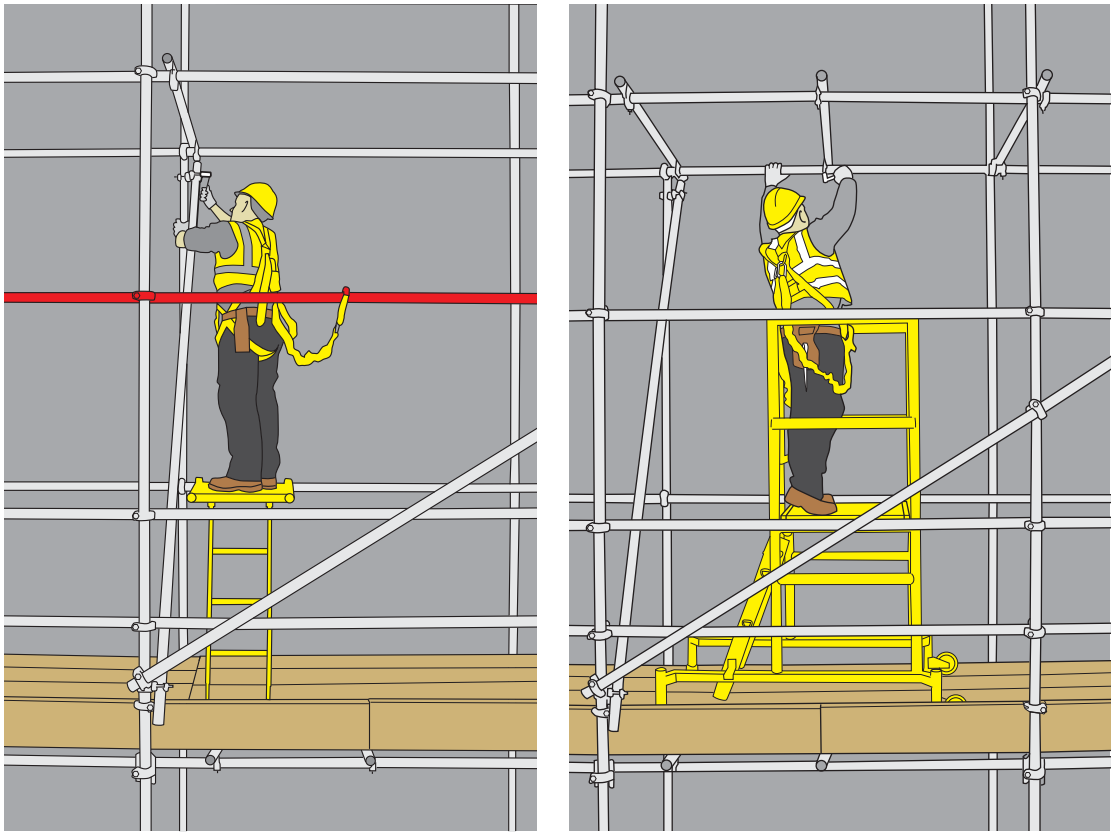



*(ii) Dummy lift installed to enable fixing of the floor height lift.*




*(iii) Scaffolders' steps used to install the guardrails in advance on the main lift to form the **scaffolders' safe zone**.*

*Figure 37: A sequence of work for floor height lifts using a combination of methods to create the **scaffolders' safe zone**.*



(i) (ii)

*Figure 38: Tall Lifts (i). Scaffolder using a scaffolders' step to form a floor height lift and (ii). Podium used as an alternative for taller lift heights.*

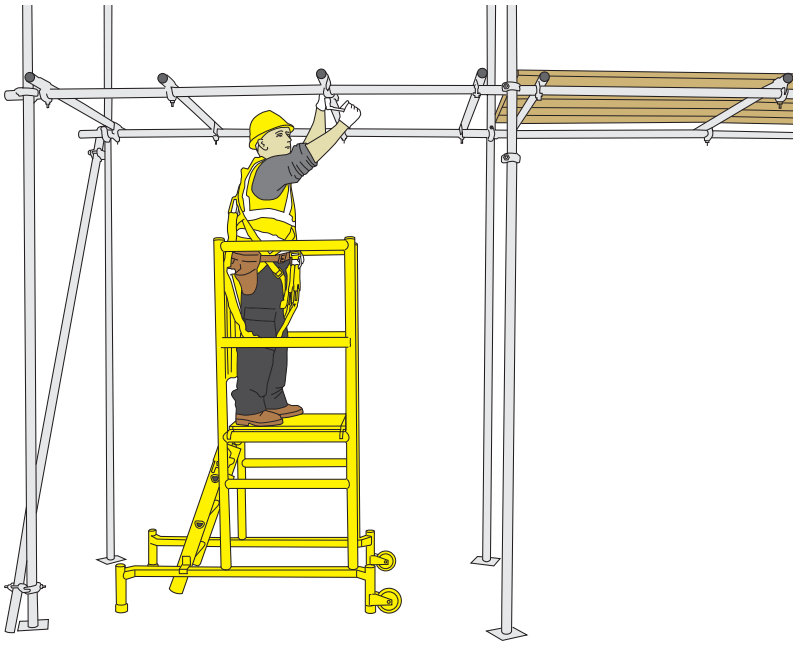


*Figure 39: A podium scaffold used to erect a pavement lift.*

## 4.5 Birdcage access scaffolding

The basic principles of this guidance can be applied to birdcage access scaffolding. The main risk of a fall is associated with raising and lowering boards over a large surface area. Scaffolders should plan the erection and dismantling by systematically working away from and back towards the access position. Birdcage scaffolding normally consists of one working platform and scaffolders have two options when erecting the intermediate lifts:

**i. Fully board the whole area**
– this means that all bays will require transoms and all of the boards will have to be raised systematically. Scaffolders must remain clipped on when encroaching less than 1 metre from the leading edge. Only the perimeter or outer elevations of birdcage (if exposed) will require guardrails.

**ii. Partially boarded**
– this means constructing **scaffolders' safe zones** in runs for the erection of the birdcage scaffold. Internal falls must be protected with guardrails.

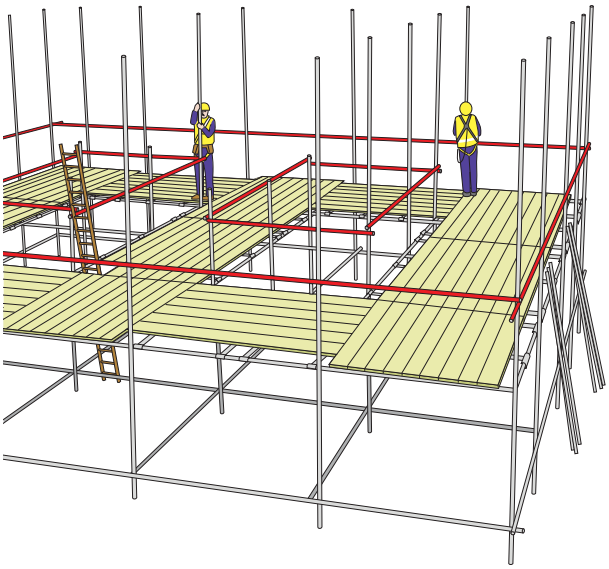


*Figure 40: Example of a birdcage scaffolding system of work. Shows the **scaffolders' safe zone** used in runs for the erection of birdcage scaffolding. All bays can be reached to fix ledgers, transoms and braces without the requirement to fully board the entire structure.*

## 4.6 Bridging with beams

This section features examples of good practice for constructing openings within independent scaffolding using prefabricated beams. NASC Technical Guidance TG20 Operational Guide provides standard configurations and guidance (Chapter 9) for two- and three-bay bridge spans, which must be constructed in accordance with the TG20 compliance sheet and associated guidance.

It is generally necessary for scaffolders to climb on the beams (commonly referred to as crabbing) to fix the transoms and braces etc. to form the structural box girder and therefore they are reliant on their personal fall protection equipment (safety harnesses). Typically, a double lanyard system of work is required to maintain continual fall protection.

For constructing a TG20 compliant bridge, it is possible to progressively place short scaffold boards onto the bottom chord of the beams between the vertical rungs/lattice bracing, to provide a better footing for scaffolders to stand on and remove the need to climb on the beams themselves, whilst traversing *(Figure 41)*.

Depending upon the bridge span, guardrails can also be installed above the bridge beams at the same time as the beams are fixed, thus providing a degree of collective protection during the erection process. Deep section beams will also provide a degree of side protection for the scaffolders when working from a boarded bottom chord.

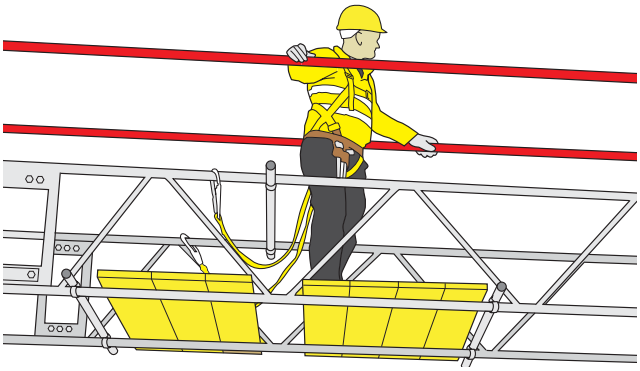


*Figure 41: An example of bridging with beams using a double lanyard, temporary boarding and scaffolders' guardrails.*

***IMPORTANT***
***Caution should be taken when traversing in this fashion as the short boards are not typically secured, do not provide a complete platform and individual boards may need to be removed to fix members to the beams. Therefore it is recommended that scaffolders remain continually attached to an anchor point, until the bridge is complete and a scaffolders' safe zone is created.***

***Care must be taken to observe the boards' target span, and the minimum and maximum board overhangs.***

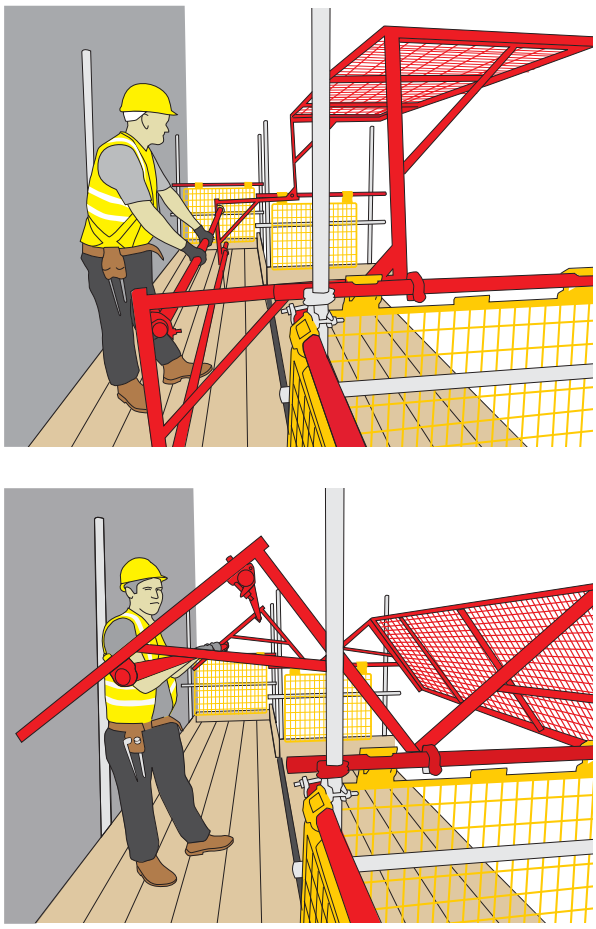


*Figure 42: Example of a loading bay gate to maintain collective fall protection for the scaffold users when the loading bay gate is open.*

## 4.7 Loading bays

Loading bays (also known as towers) can be constructed as standalone structures or attached to access scaffolds for the loading and storage of materials and equipment. The basic principles and methods of protection featured in this guidance can be utilised for the erection, alteration and dismantling of loading bays. A key feature for loading bay platforms, and good practice, is to use a loading bay gate system that allows the passage of bulk goods using mechanical handling equipment (e.g. forklift truck) whilst maintaining collective fall protection. It is recommended, before installing and removing loading bay gates, that scaffolders should fix a temporary guardrail to maintain the **scaffolders' safe zone** *(see Figure 43)*. Also see *Section 5 – Methods of access and egress (page 37)* for advice on providing safe access for constructing standalone loading bays.

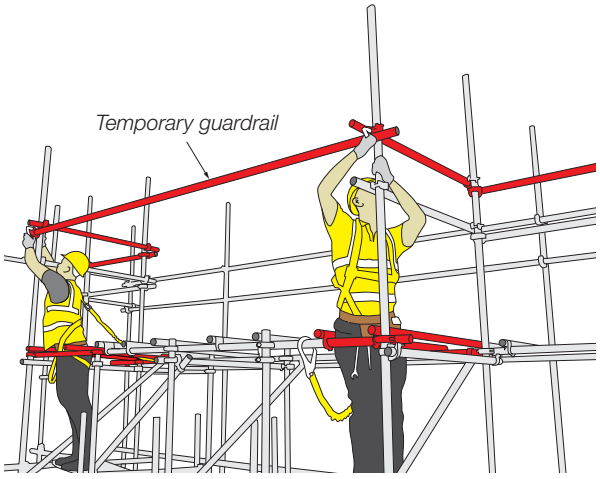
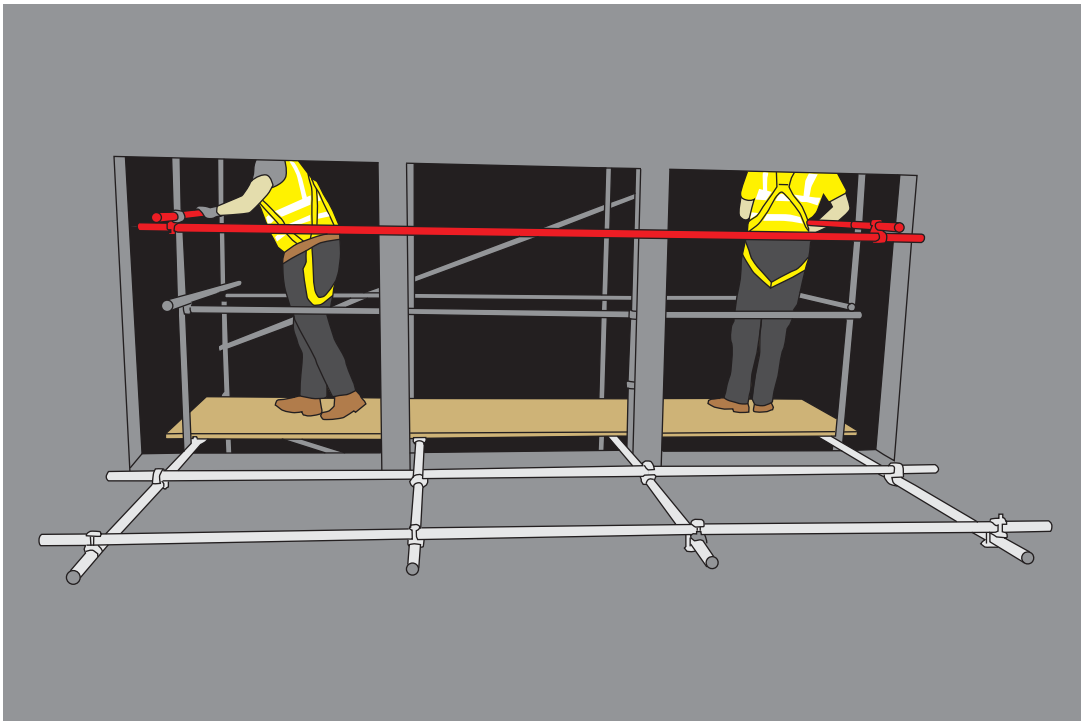



*Figure 43: Temporary guardrail to maintain a **scaffolders' safe zone** for loading bay gate installation and removal. The temporary guardrail is removed once the gate is installed.*

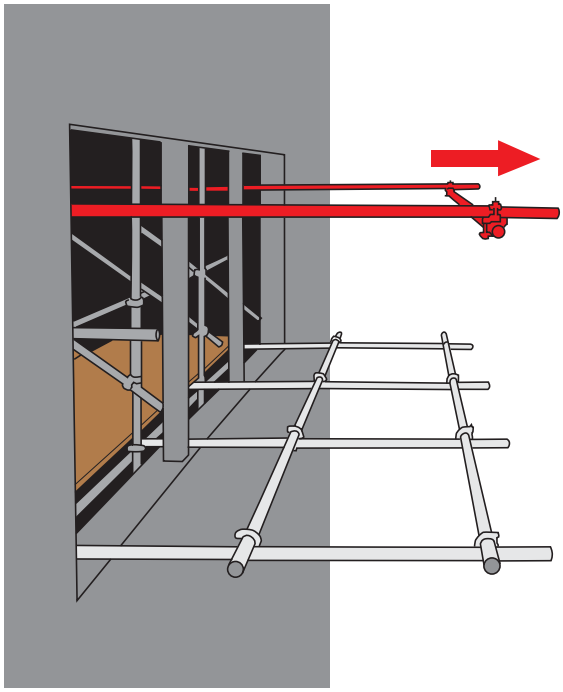
## 4.8 Protection fans and Cantilevered Structures

The construction of protection fans and other cantilevered structures requires scaffolders to fix the needles or beams from the main scaffold (back or horse scaffold) and typically relies on the use of personal fall protection equipment (safety harnesses) solely for completing the structure. Inertia reels are often used for this purpose *(see Figure 44 and Section 6 – Personal fall protection equipment)*. In some cantilevered scaffolding applications (e.g. truss-out scaffolding) it may be possible to push out the cantilever from the protection of the main scaffold a guardrail assembly, in advance, to provide a temporary guardrail and form a **scaffolders' safe zone** *(Figure 45)*.

*Figure 44: Falling object protection fan erected using an inertia reel.*



*(i). Temporary guardrail formed from the back scaffold (horse or support scaffold) within a **scaffolders' safe zone**.*



*(ii) Guardrail pushed out horizontally from the back scaffold to protect the truss-out.*

*(iii) Needles are boarded out to create a **scaffolders' safe zone** to complete the truss-out scaffold.*

*Figure 45: An example of a temporary guardrail assembly used to provide a **scaffolders' safe zone** during the erection of a truss-out cantilevered scaffold.*

## 4.9 Chimney-stack scaffolding (roof saddles)

Scaffolding operations for accessing chimneys and constructing scaffolding on pitched roofs presents challenges for scaffolding contractors to establish suitable protection against falls from height, due to the variety of roof types, chimney positions and intended use of the scaffolding.

This section provides some basic principles to be considered by employers when completing a risk assessment and preparing a method statement for the erection, alteration and dismantling of chimney-stack scaffolding. Standard configurations and guidance for typical chimney-stack scaffolding can be found in the NASC Technical Guidance TG20 Operational Guide (Chapter 16).

To access a chimney-stack positioned at the ridge, mid-pitch or eaves, an access scaffold (independent or tower scaffolding) should be erected at the eaves to provide safe access and fall protection for scaffolders when erecting and dismantling the roof saddle etc. The access scaffold should be securely tied and be long enough to cover the working area of the scaffolders accessing the roof. A working platform complete with guardrails should be erected within a 500mm vertical distance from the eaves level to provide collective edge protection for the scaffolders working on the roof *(Figure 46)*.

Ideally the perimeter of the roof should be protected with access scaffolding and/or guardrails to provide suitable edge protection when chimney access is combined with other construction or maintenance activities, but it is recognised that this is not a practical solution just for chimney work.

When erecting or dismantling the roof saddle and walkway access, scaffolders will typically rely upon personal fall protection equipment (safety harnesses) attached to the scaffolding structure, as their primary means of fall protection. Therefore the roof saddle and walkway structures should be constructed/removed progressively from the access scaffold to ensure a suitable anchor point is provided. To maintain continual attachment scaffolders would typically use a double lanyard system *(see Section 6 – Personal fall protection equipment and Figure 68)*. Continual attachment is particularly important when working over the ridge or near the verge of the roof, as the opposing eaves or gable verges are not typically protected by an access scaffold and is without edge protection.

For accessing a chimney-stack at a gable end, an access scaffold is provided at the verge to the same height as the working platform of the roof saddle. However, no collective edge protection is provided at the eaves so scaffolders should remain attached to the scaffold structure using their personal fall protection equipment. In addition to the edge protection and personal fall protection systems featured above, the frame of the roof saddle (e.g. ledgers and transoms attached to raking tubes and the access scaffold) may provide a foot-hold for scaffolders working from the roof surface, otherwise a suitable roof ladder may be required. Where a high standard of edge protection and/or personal fall protection equipment is used, it may be possible for scaffolders to work directly from the roof if the pitch is shallow, not fragile and the surface provides a particularly good foot-hold.

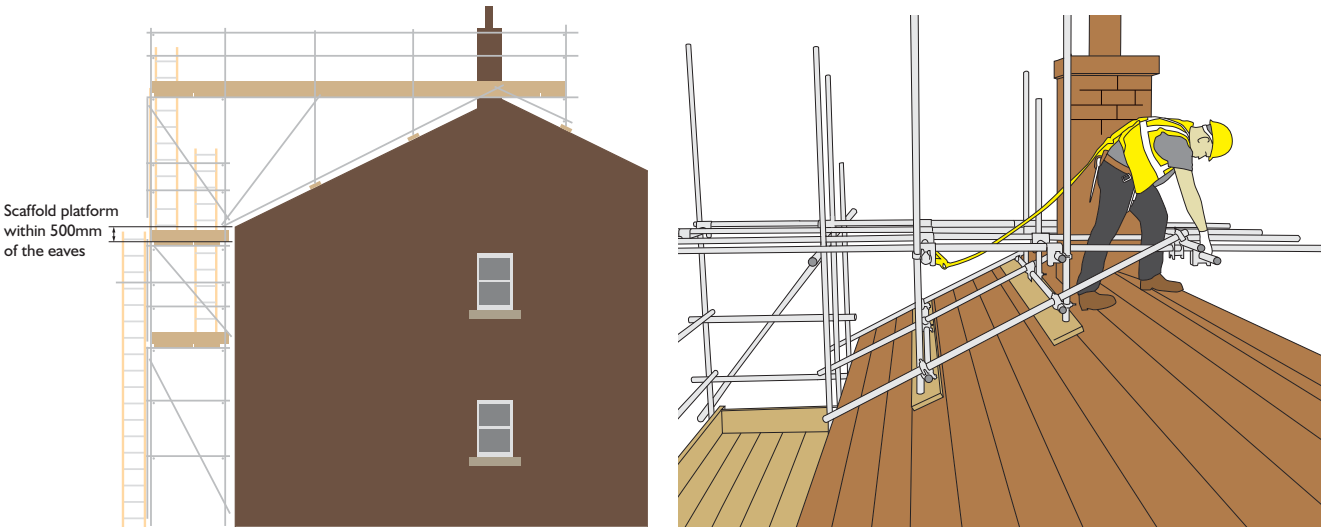
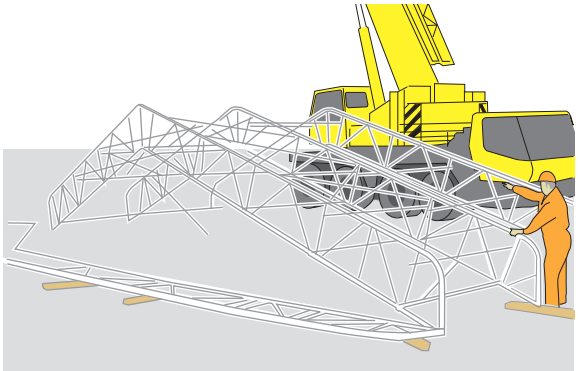
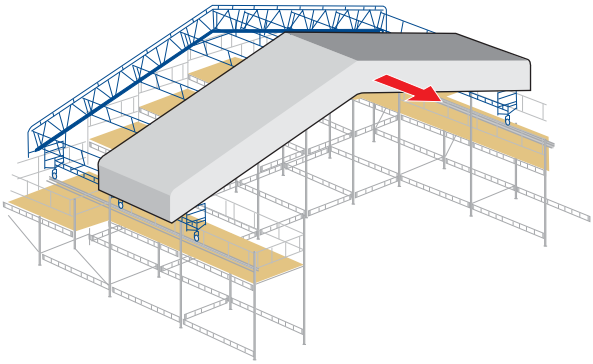
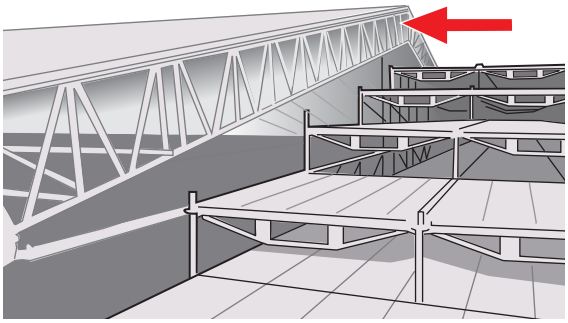



*Figure 46: Example of a roof saddle sequence of work with eaves edge protection and continual attachment and eaves edge protection.*

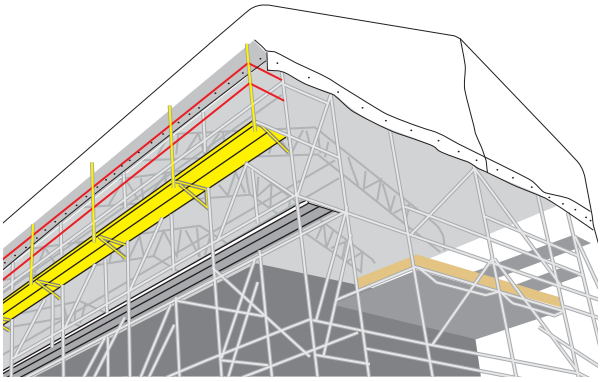


*(i.) Modular roof section assembled on the ground and craned into position avoiding the need for scaffolders to crab the beams.*





*(ii.) Wide gable-end bay scaffolding bay is provided for erecting roof sections from a **scaffolders' safe zone**. Modular sections are rolled out on special rail and caster systems, to avoid the need for scaffolders to crab the beams.*



*(iii.) Temporary eaves walkways constructed with guardrail protection to allow sheeting operations to be completed from a **scaffolders' safe zone**.*

*Figure 47: Examples of proprietary temporary roof systems using innovative methods of erection.*

## 4.10 Temporary roofs

The erection, modification and dismantling of temporary roofs has similar hazards associated with the construction of permanent roof structures and coverings. However, the temporary nature and purpose of temporary roofs often does not facilitate the same methods of work and safety precautions. For example, MEWP access is not normally a practical option for building the temporary structure which is normally erected over another existing building to provide weather protection. In addition, the roof structure may not support the anchor loads required for fall arrest netting. Also there is often insufficient clearance in the void between the permanent roof and temporary structure.

A number of proprietary temporary roof systems have introduced innovative and safer methods for assembling and erecting temporary roofs *(see Figure 47).* Traditionally, coverings for temporary roofs were corrugated iron or steel sheets, whilst new innovative systems tend to be fabric based.

Safe systems of work for traditional type temporary roofs erected in-situ rely upon scaffolders crabbing beams with double lanyards to construct the roof structure. Perimeter edge protection should be fixed prior to installing sheeting materials and remain in place. Scaffolders can utilise horizontal line systems for attaching their personal fall protection equipment for fall arrest or restraint whilst handling and fixing roof sheets (see Section 5 Personal Fall Protection Equipment). For further information reference should be made to NASC Technical Guidance 9 (TG9) - Guide to the design and construction of temporary roofs and buildings.

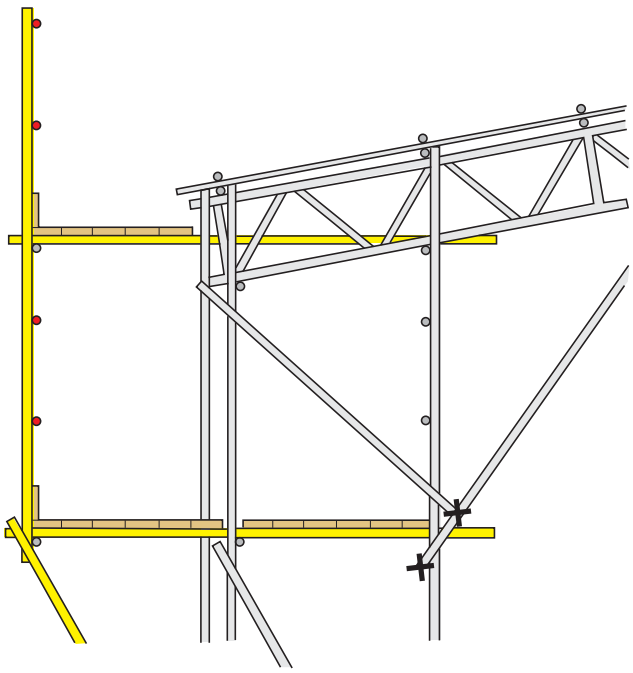


*Figure 48: An example of traditional temporary roof erected in-situ with perimeter edge protection and safe access to the roof surface via a cantilevered eaves walkway.*

## 4.11 Hoist towers and debris chutes

Hoist towers and debris chutes, commonly erected from traditional tube and fitting scaffolding materials, require particular consideration. Scaffold boards are often over-spanned because the bay must be kept clear of obstructions that would be created by transoms to support standard scaffold boards. Proprietary stagings or battens should be used that are capable of spanning the bay without the need for board bearers *(Figure 49).*

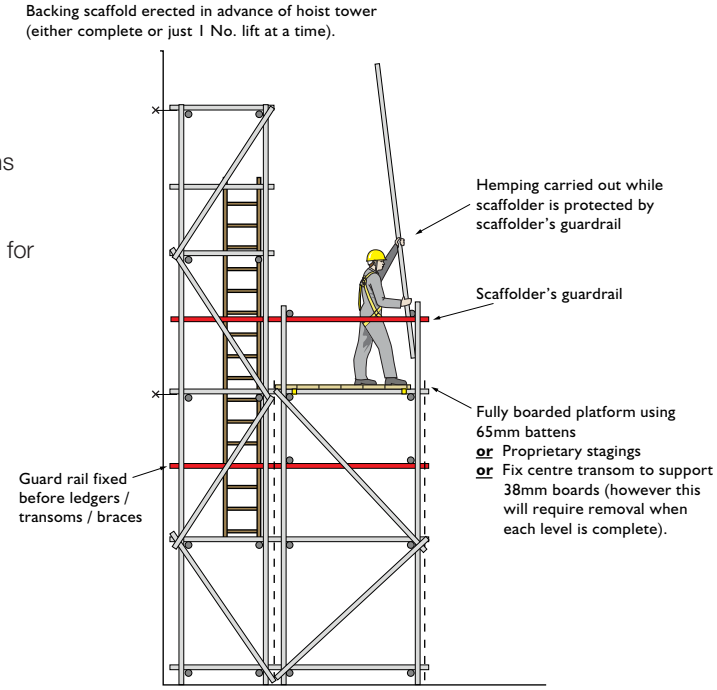



*Figure 49: Debris chute or hoist tower construction.*

## 4.12 Temporary edge protection

Examples of good planning to avoid work at height include the prefixing of guardrails to steelwork prior to installation at height *(see Figure 2, page 3)*. Where possible all temporary edge protection should be installed and removed from a MEWP to provide collective protection *(Figure 50)*. For further information on the use of MEWP's in scaffolding *see Section 4.1 – Scaffolding from a MEWP (page 25)*. For further guidance on temporary edge protection, reference should be made to NASC Safety Guidance Note 27 (SG27) Temporary edge protection on open steelwork. Collective fall arrest safety net fan systems provide useful solutions for congested or restricted sites where MEWP access is not possible *(Figure 51)*. Scaffolders can access the leading edge of the floor to erect temporary edge protection.

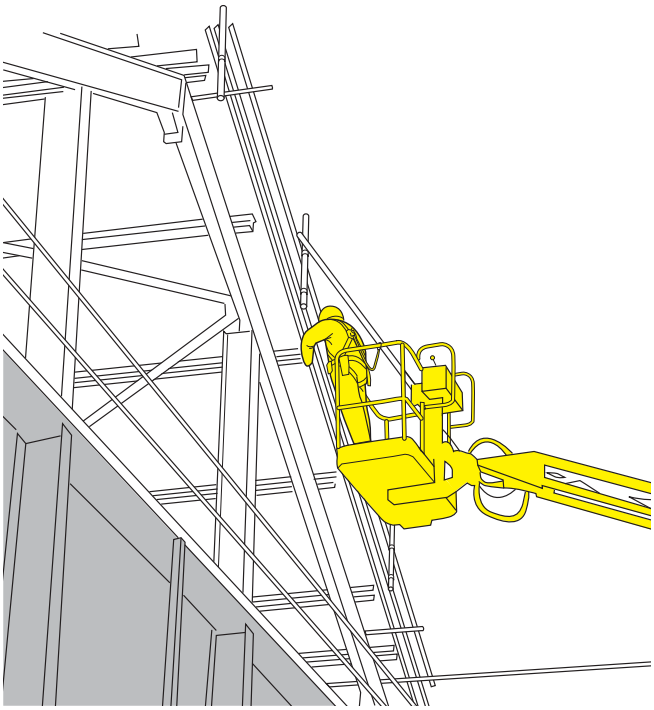


*Figure 50: Scaffolder erecting roof edge protection from a MEWP.*

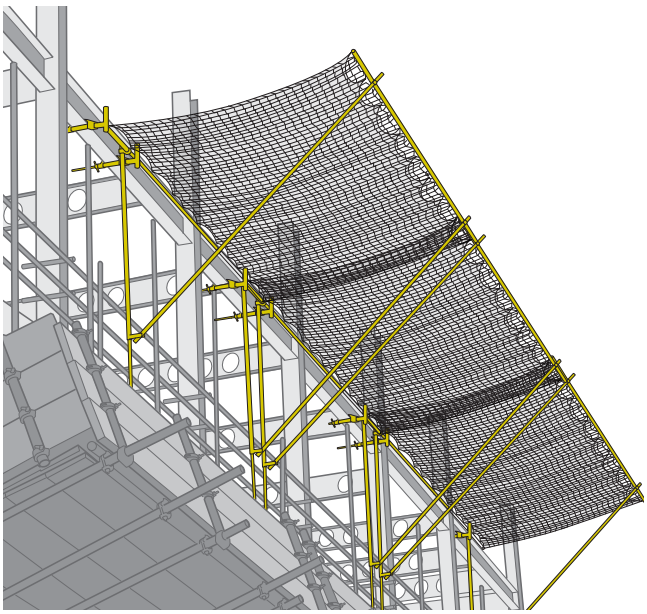


*Figure 51: Safety net fan system provides protection for erecting temporary edge protection.*

Another common challenge facing scaffolding contractors is the safe erection of temporary handrails for the installation of permanent stairways in construction. Again good planning between clients and their subcontractors has seen pre-cast concrete staircases manufactured to accommodate handrail posts that can be installed on the ground prior to them being craned into place, thereby eliminating or minimising the need for scaffolders to work at height.

Erecting edge protection to existing roofs can be particularly problematic for scaffolding contractors to provide safe systems of work, especially if MEWP access is not possible or there is an absence of suitable anchor points for using personal fall protection equipment. In such cases, scaffolders may need to rely upon mobile anchor devices, fall restraint systems or work positioning equipment (*for further guidance reference should be made to BS 8437 Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace*).

Occasionally scaffolders need to access or work on roofs, where there is a risk of a fall through a fragile surface, such as cement roof sheets or fragile roof lights. Clients should provide all available information regarding fragile roof surfaces to the scaffolding contractor. Scaffolders must not walk on or next to fragile materials unless fall prevention or fall mitigation measures are in place and used. These include one or a combination of; barriers, covers, crawling boards, horizontal line or rope grab harness anchor systems. Where it is not practical to cover the fragile materials, fall arrest safety nets or similar collective protection could be rigged to the underside of the structure to protect against any such fall *(Figure 52)*. Where collective fall arrest systems are chosen, they must be installed in accordance with manufacturers' instructions and any recognised training scheme (e.g. the Fall Arrest Safety Equipment Training (FASET) scheme).

Where existing permanently-installed fall protection systems are available for roof access then these should be utilised, where possible. Employers should seek advice from the occupiers or others responsible for the property, and must ensure they are used in accordance with the manufacturers' instructions, including checking maintenance and inspections records before use.

## Case Study 6

A scaffolding contractor utilised inertia reels fixed to the steel superstructure above a new stairwell from a MEWP. This enabled the erection of temporary handrails to a new staircase and provided continual fall protection for the scaffolders.

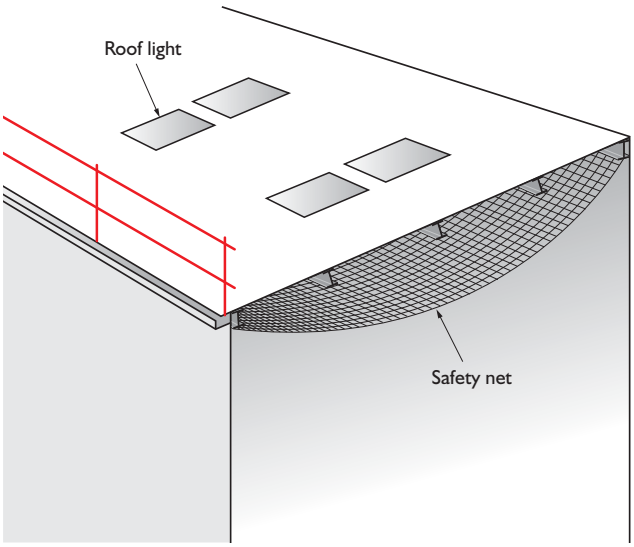



*Figure 52: Fall arrest netting rigged to protect against falls through a fragile roof light.*

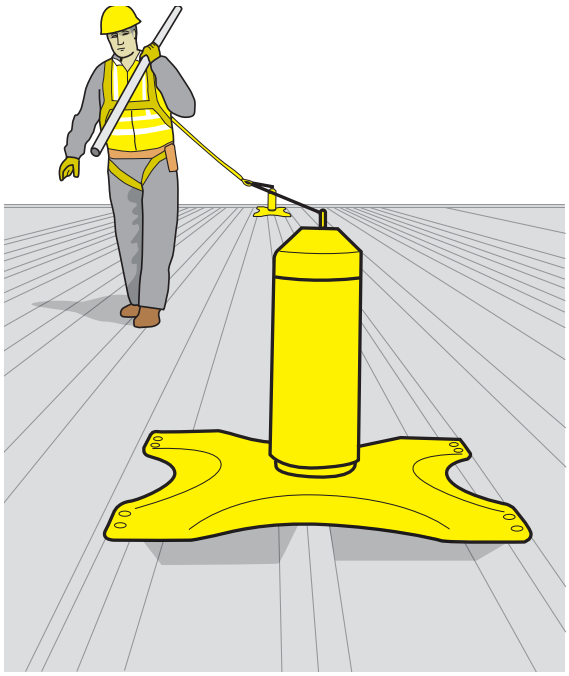


*Figure 53: Scaffolder utilising an installed fall protection system for roof access.*

## 4.13 Falsework, formwork and other temporary structures

The main focus of this guidance is aimed towards access scaffolding, however the basic principles of this guidance can be applied, where scaffolders construct other similar temporary structures in scaffolding or proprietary systems (e.g. falsework, formwork, stages, seating, bridging etc.). Collective fall protection methods (e.g. the **scaffolders' safe zone**), anchor points for attaching personal fall protection equipment and methods of access and egress must be considered by designers and employers at planning stage.

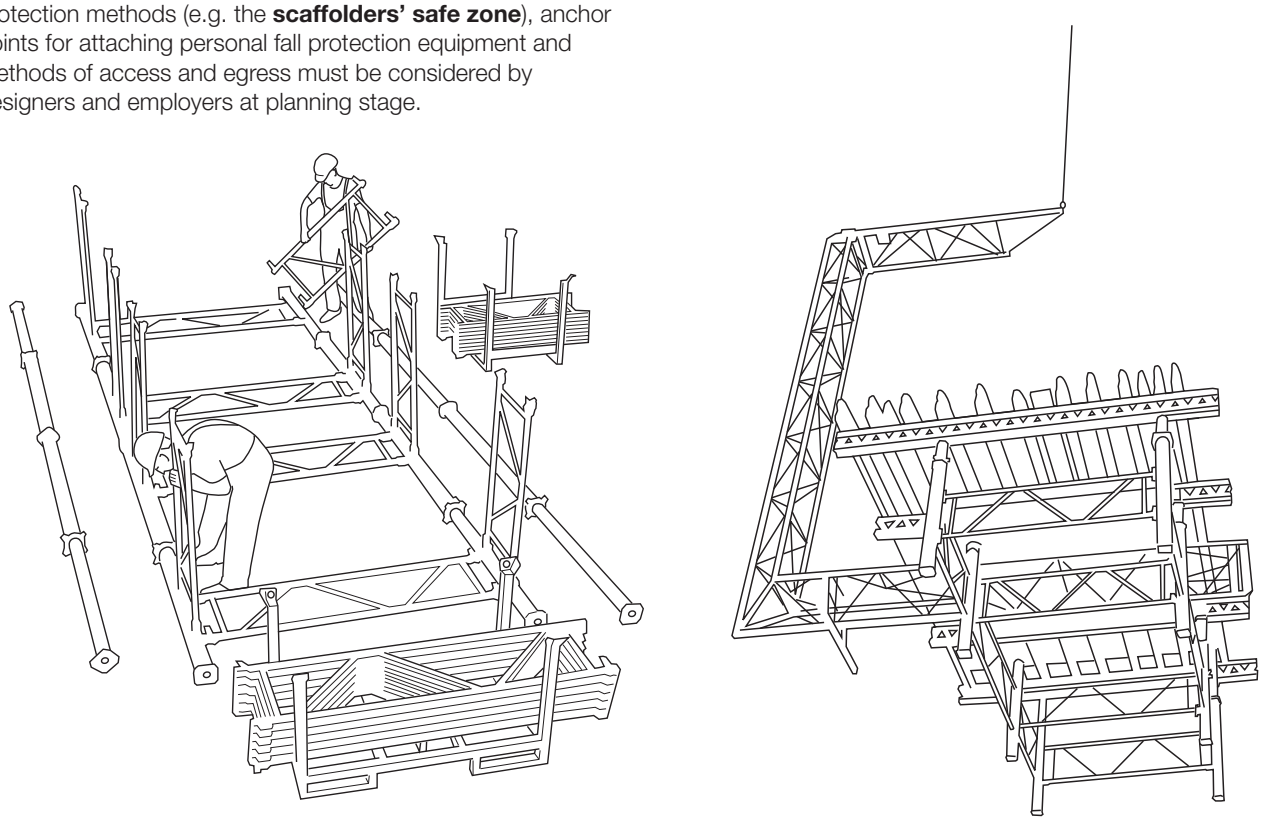


*Figure 54: Formwork system erected on the ground or slab and lifted into position to avoid the need to work at height.*

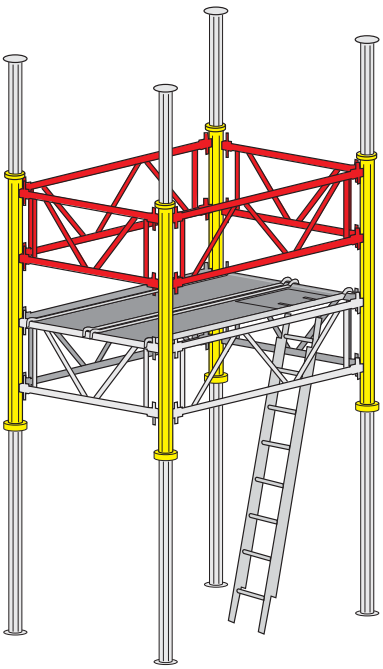


*Figure 55: Fully decked and guardrailed working platform to form a **scaffolders' safe zone** with safe access and egress, used for the erection, alteration and dismantling of a formwork system.*

# Methods of access and egress

Safe access for use by scaffolders should be included as early as possible in the erection process and removed as late as possible during dismantling, removing the need for scaffolders to climb the scaffold structure. It is recommended that wherever practicable, scaffolding should incorporate ladder access, ladder bays or stairways. A system of working should be adopted, where possible, that enables the scaffolders to work progressively away from and back towards their means of access and egress (i.e. ladder access or staircase) when erecting, altering or dismantling the next lift *(Figure 56)*.

During the planning phase, clients and contractors who specify access and egress to and from scaffolding, should consider the hierarchy of access in NASC Technical Guidance 20 (TG20) Operational Guide (Chapter 8) and Safety Guidance 25 (SG25) Access and egress from scaffolds via ladders and stair towers etc. *(Figures 57 - 60)* Special scaffold structures that do not normally include a method of access (e.g. falsework, shoring, loading bays etc.), consideration must be given in the planning process for the use of ladders etc. to avoid climbing the structure wherever possible *(Figure 61)*.

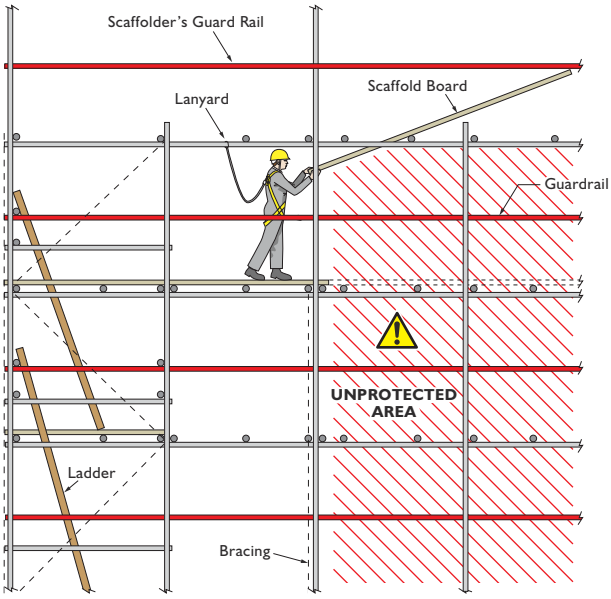



*Figure 56: A Scaffolder raising platform boards to the next lift above working progressively backwards towards the ladder access.*

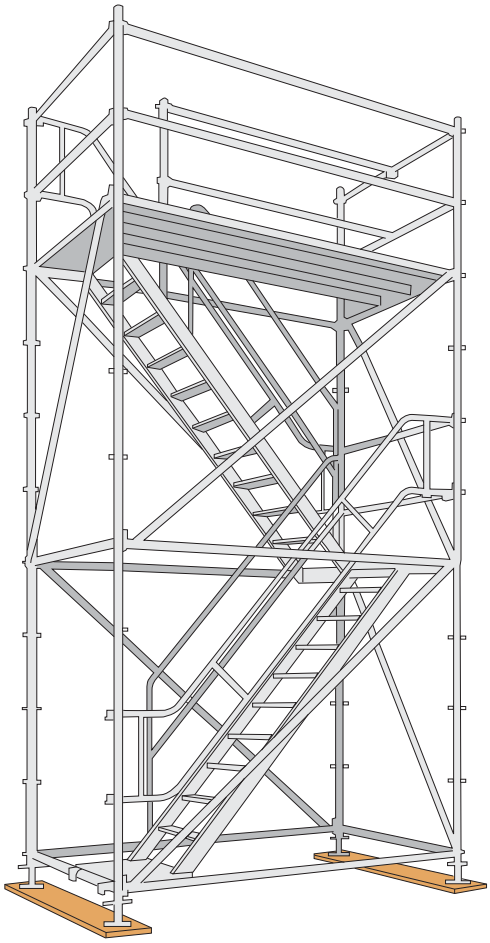


*Figure 57: Typical proprietary system scaffold stairway.*

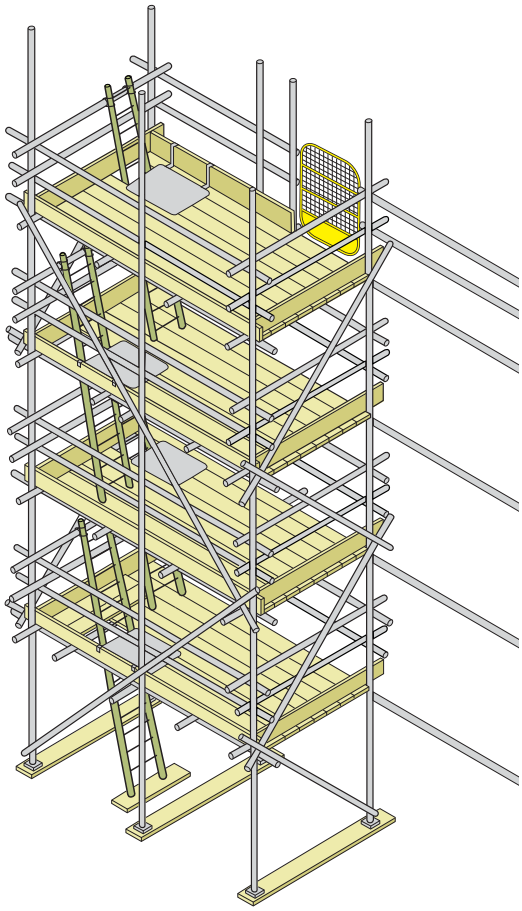


*Figure 58: Ladder access bays with single-lift ladders.*

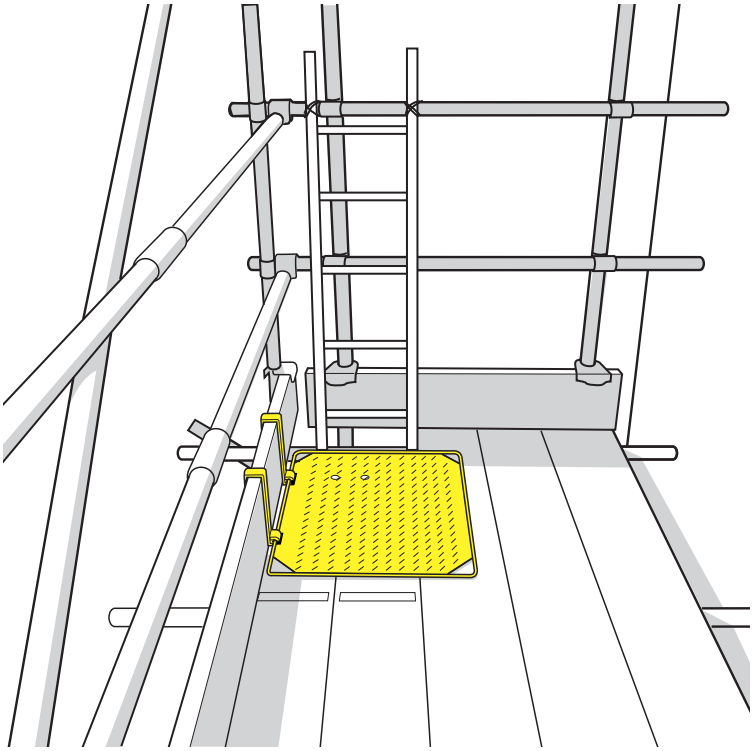


*Figure 59: Internal ladder access with a protected ladder trap an example of good practice.*

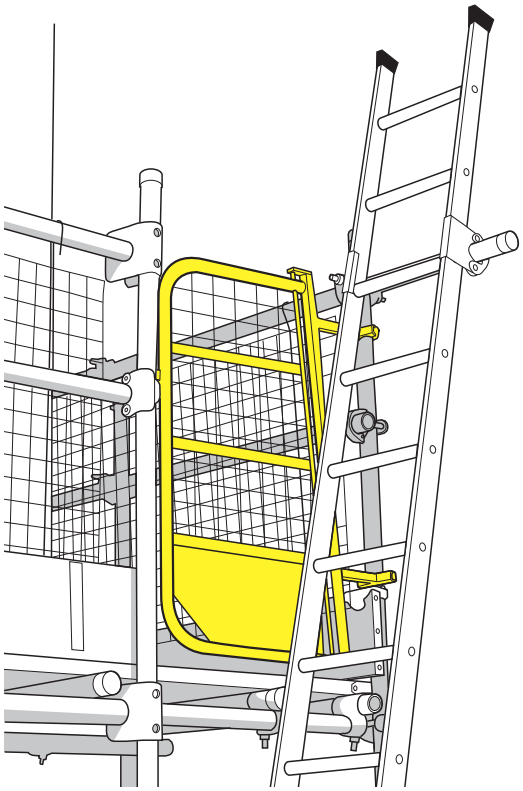


*Figure 60: External ladder access using a safety gate as an example of good practice.*

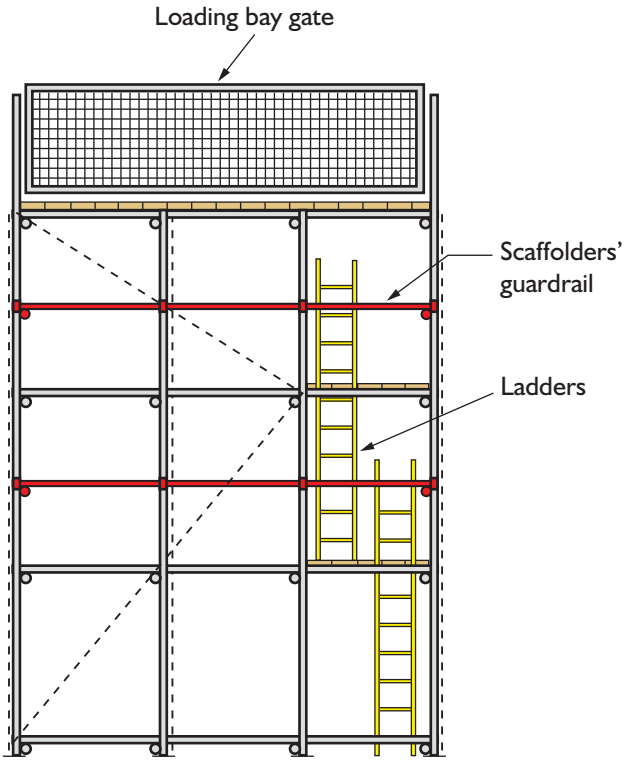



*Figure 61: A standalone loading tower with access built in and left for dismantling purposes only. Following erection it is recommended that the lower ladder is removed or secured to prevent access until required for alterations or dismantling.*

# Personal fall protection equipment



The temporary working platforms and guardrails that form the **scaffolders' safe zone** do not completely eliminate the need for personal fall arrest equipment for scaffolding operations. Therefore, it is recommended that all scaffolding operatives involved with working at height should wear and use personal fall arrest equipment (harnesses etc.) at all times, in accordance with the training and instruction received.

It is widely acknowledged that there is an inherent risk of a fall in all scaffolding operations, which cannot be completely eliminated. The use of fall arrest equipment does not prevent a fall occurring and does not eliminate the risk of injury completely. However, it is important to recognise that personal fall arrest may be the most suitable, or only, option in certain circumstances. Fall arrest equipment is used to arrest a fall should it occur, preventing the worker from hitting the ground (or other surface) or structure. The fall arrest equipment and anchorage points must be capable of withstanding the forces involved and minimising those forces to an acceptable level.

These systems typically include equipment such as:

- Harnesses
- Lanyards
- Energy absorbers
- Line systems
- Inertia reels
- Connectors
- Anchorage points

All personal fall protection systems are classed as active protection that is only effective if used correctly (e.g. a fall arrest harness and lanyard system requires a suitably secure anchor point and a minimum clearance distance to arrest a fall), unlike collective protection (sometimes referred to as passive protection) that offers protection continuously.

When a personal fall arrest system is used, consideration must be given to reducing the distance a person is liable to fall and the consequences of the fall, particularly the ease of rescuing of a person suspended in a harness (see Section 7 – Rescue).

When choosing personal fall protection equipment, as part of a risk assessment to establish a safe system of work, employers must ensure that the equipment is suitable, having been designed and tested for the purpose that it is intended to be used. Always read the manufacturers' instructions carefully and if in any doubt seek advice from the supplier. It is important to note that some fall arrest equipment is only designed, tested and manufactured to meet the minimum British and European Standard and will only be safe to use within certain limitations. For example, a standard retracting inertia reel (designed and tested to BS EN 360) may only be used if attached above the scaffolder and traversing horizontally is limited to the maximum angle from the vertical, as specified by the manufacturer.

## 6.1 Fall arrest harnesses and lanyards

Previous sections of this guidance have established that, in most scaffolding operations, the risk of a fall cannot be completely eliminated. Therefore the NASC strongly recommends that safety harnesses be:

i. Issued to ALL scaffolders*,

ii. Worn at all times when working at height; and,

iii. Used in accordance with this guidance note and the training and instruction received.

It is suggested that the following PPE should be issued to all scaffolders as part of a minimum personal fall arrest system (Figures 62 and 63):

- Fall arrest harness complete with rear dorsal ring (BS EN 361) to offer maximum protection to the user;
- Fall arrest lanyard (BS EN 354) incorporating an energy absorber (BS EN 355) designed to reduce the forces imposed on the body in the event of a fall;
- 55mm opening scaffold connector for one handed operation (BS EN 362) *(see section 6.4 Anchor points, connectors and anchor devices - Page 43)*.

**Excludes labourers and other non-scaffolding operatives, who are only permitted to access completed scaffolds.*

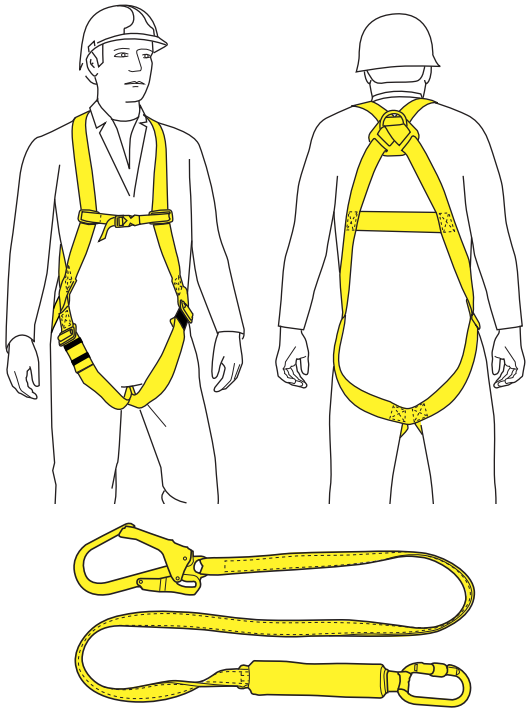


*Figure 62: A minimum suggested personal fall arrest system.*

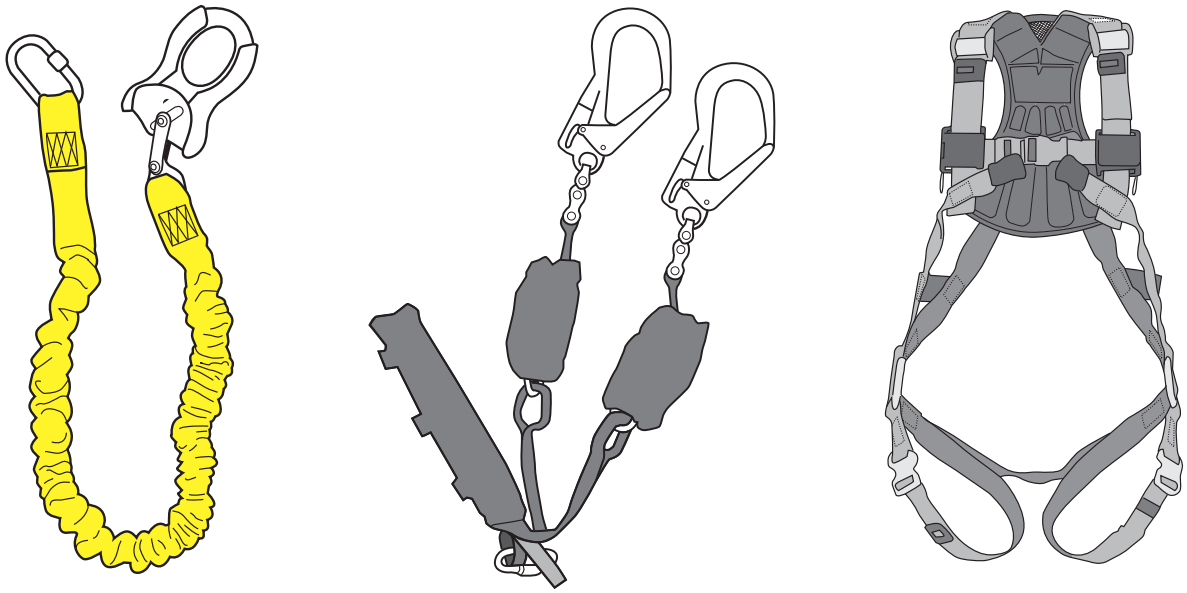


*Figure 63: High specification harness and lanyard systems.*

Employers must consider all available fall arrest technology when establishing a safe system of work, in order that the distance and consequences of any potential fall are minimised. A higher level of protection may be gained by selecting some of the alternative personal fall arrest equipment and techniques highlighted in this section. Employers must assess the suitability of the personal fall protection equipment for the users. Safety harnesses are available with a range of adjustment, sizes and load rating to suit different body sizes and weights.

When using fall arrest equipment, it is important to position your anchor point as high as possible and to use as short a lanyard as possible, to minimise the potential fall distance. The shorter the fall distance, the lesser the forces generated from the fall. The ideal fall arrest system would utilise an anchor point and lanyard with virtually no fall distance at all, effectively creating a fall factor zero *(Figure 65 below)*.

**Fall Factor = Fall Distance ÷ Length of Lanyard**

The diagram opposite *(Figure 64)* explains fall factors 1 and 2.

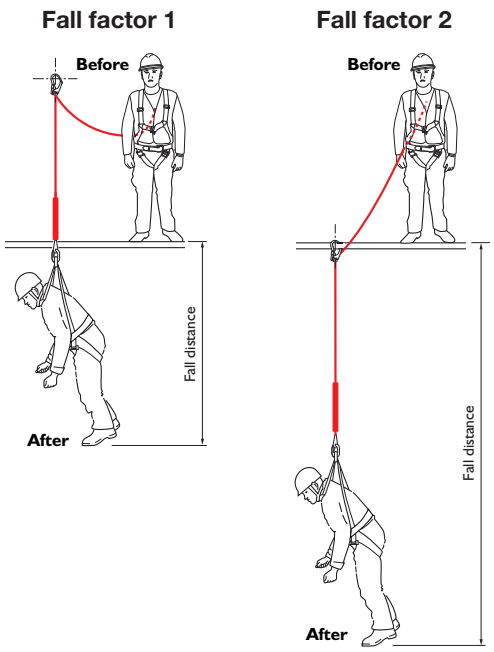



*Figure 64: Fall factors.*

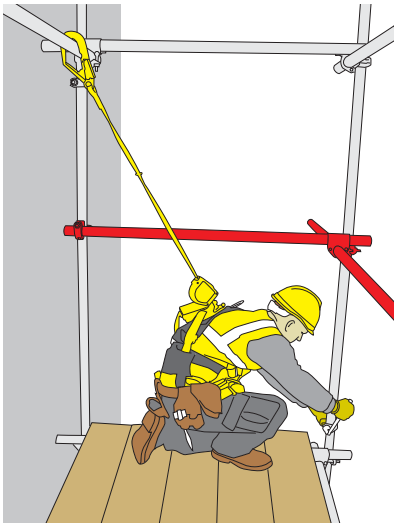


*Figure 65: Minimum fall distance - Shows a hybrid self-retracting fall arrest lanyard to minimise the potential fall distance and the consequences in a fall.*

There is an inherent risk of injury with the use of any personal fall arrest system, should a fall occur. In order to minimise the risk of injury there must be adequate clearance below. The clearance distance required will vary depending upon the type of fall arrest equipment selected and the manner in which it is used.

For example, a scaffolder using a fall arrest system with a full body harness, a 1.75 metre lanyard incorporating an energy absorber and 55mm opening scaffold hook will only start to become effective if attached to a suitable anchor point at the 4 metre level or above.

The optimum length of a fixed length lanyard for scaffolding is 1.75 metres; however the maximum overall length must not exceed 2 metres, including connectors *(Figure 66)*.

Shorter lanyards, adjustable lanyards or self-retracting lanyards of an optimum length for the task will reduce the potential fall distance, severity of injuries and clearance distance required below the anchor point.

***IMPORTANT***
***Employers should consider the risk of using a lanyard or inertia line passing over a sharp or abrasive edge (e.g. concrete slab or steel beam) during a fall, due to the risk of failure from friction and cutting on the unprotected edge. Note that several manufacturers have developed lanyards and lines specifically designed to resist the risk of damage at such an edge.***

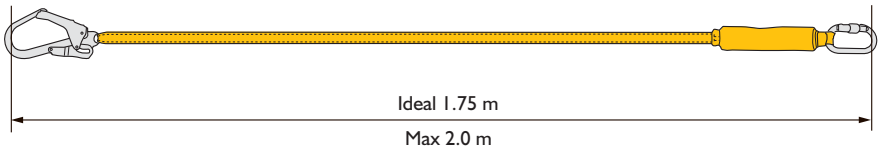



*Figure 66: The maximum length of fixed length lanyard.*

## 6.2 Single fall arrest lanyards

Personal fall arrest systems that utilise a single fall arrest lanyard are only effective if continually attached whilst exposed to a risk of fall. If the scaffolder has to change anchor positions to overcome an obstruction they would be without fall protection, e.g. passing transoms when sliding a scaffold hook along a ledger. Scaffolders utilising a personal fall arrest system, with a single lanyard and scaffold hook only, are NOT permitted to traverse outside of guardrail protection, as they will be exposed to the risk of a fall. Scaffolders working within 1 metre of an unprotected edge (e.g. the end of a guardrail where there is a fall risk) must remain clipped on *(see Figure 9 page 12)*, otherwise they must resort to an alternative system e.g. double fall arrest lanyards.

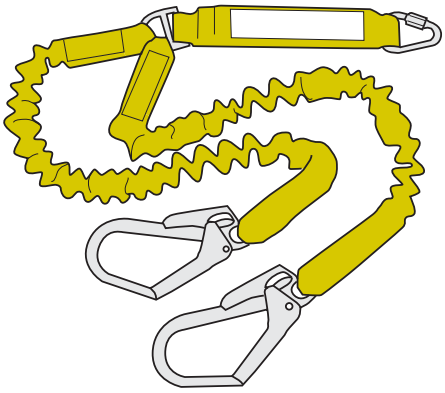


*Figure 67: Twin-tail lanyard that shares a common energy absorber.*

## 6.3 Double fall arrest lanyards

Certain scaffolding operations will require systems of work that use two energy absorbing lanyards or twin-tailed lanyards, commonly referred to as double lanyards *(Figures 67 and 68)*. Scaffolders are typically required to use double lanyards when they have to access structures without a boarded platform or guardrail protection e.g. bridging using beams or temporary roofs erected in-situ. The main benefit of using a double lanyard system of work is that it allows the scaffolder to remain clipped on continuously when exposed to the risk of a fall e.g. when crabbing along a beam, using the protected traversing technique *(see the protected traverse page 21)* or climbing a structure (last resort).

*Figure 68: Double lanyard system using two separate fall arrest lanyards.*

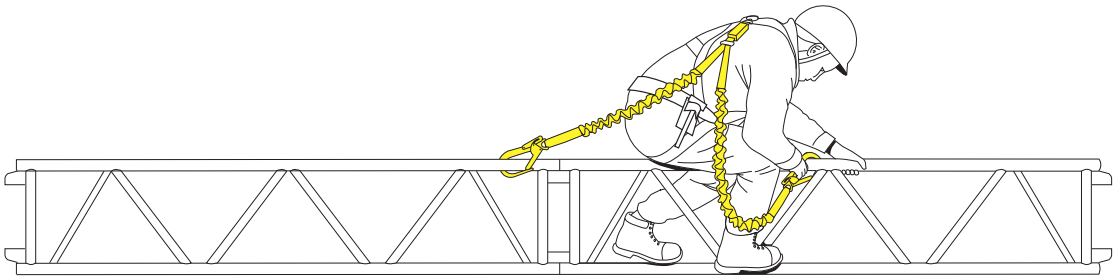


*Figure 69: Scaffolder using a twin-tailed energy absorbing lanyard.*

A twin-tailed energy absorbing lanyard should ideally be used with a common energy absorber, because two separate lanyards and energy absorbers may be less effective and increase the loads transferred into the body.

***IMPORTANT***
***When using only one of the twin-tail lanyards that shares a common energy absorber, scaffolders should NOT wrap the spare lanyard around their body or attach it back to the harness or tool belt, as this could reduce the effectiveness of the energy absorber and increase the load transferred into the body. The spare lanyard, when not in use, should either be clipped onto the same anchor point, hang free or be clipped to a purpose designed sacrificial lanyard parking point on the harness (Figure 70).***

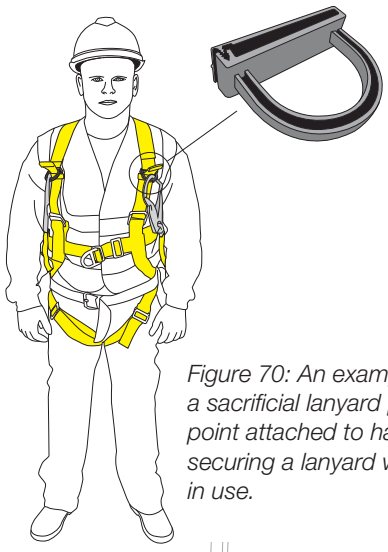
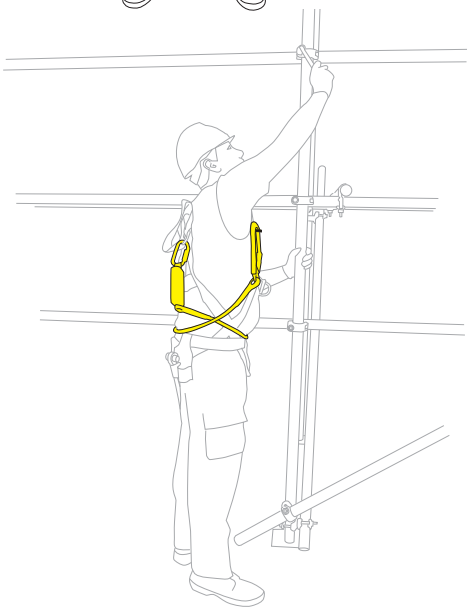
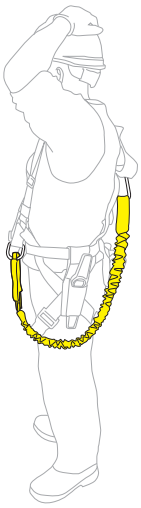


*Figure 70: An example of a sacrificial lanyard parking point attached to harness for securing a lanyard when not in use.*

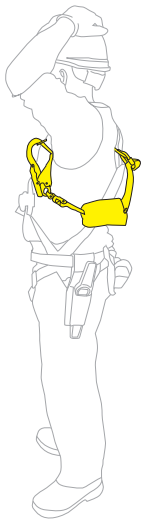
A trailing lanyard when not in use can present a snagging, entanglement and tripping hazard to the scaffolder. When not working at height or using the lanyard it should be securely stowed e.g. by wrapping it around the body and attaching it to the harness, ideally using a sacrificial lanyard parking point (as above). Elasticated type lanyards and self-retracting type lanyards (incorporating a mini-inertia reel) will reduce the risk associated with a trailing lanyard *(Figure 71)*.



*(i). A conventional fixed-length lanyard wrapped around the body and secured when not in use.*



*(ii). A contracted elasticated type lanyard reduced risk from a trailing lanyard when stowed.*



*(iii). A hybrid self-retracting lanyard with minimum trailing lanyard when stowed.*

*Figure 71: Typical options for stowing and securing a lanyard when not in use, to reduce the risk from a trailing lanyard.*

## 6.4 Anchor points, connectors and anchor devices

Personal fall protection systems are totally reliant on being attached to a suitable anchorage. To ensure the safe performance of the system, the likely loads that would be transferred into the anchorage and the ability of an anchor point and any supporting structure to resist those forces, must be established.

Very high loads can be transferred into an anchorage when a fall is arrested (6kN or more). Manufacturers and suppliers of personal fall arrest equipment should provide information on potential anchor loads.

## 6.5 Anchorage to tube & fitting scaffolds

Scaffolds must be erected in accordance with the relevant British and European Standards (e.g. BS EN 12811) and Technical Guidance (e.g. NASC TG20) so that they are adequately stable. Where ties and stability measures (e.g. buttressing, kentledge, guys and anchors etc.) are required they should be installed and removed as work progresses to ensure optimum stability against overturning or collapse of the structure. This includes the use of any temporary (dummy) stability measures required solely for erecting, altering and dismantling purposes. It has been established by the NASC, through independent testing, that steel tube and fitting TG20 compliant scaffolding can provide a safe anchor point for a scaffolder wearing a full body harness and attached by a lanyard with an energy absorber *(see Suitable scaffold anchor points below and Figure 72)*. Where alternative scaffolding materials are used, such as, aluminium or glass reinforced plastic (GRP), the users must contact the supplier to ensure anchorage to the structure is appropriate.

## 6.6 Suitable scaffold anchor points

- Ledgers and transoms supported with load bearing couplers
- Standards, but only when using a suitable anchor device designed for the purpose *(Figure 72)* and no joints between the lift and the attachment point
- Guardrails supported with load bearing couplers (guardrails within a scaffold structure)
- Plan braces (horizontal) supported on right-angle couplers

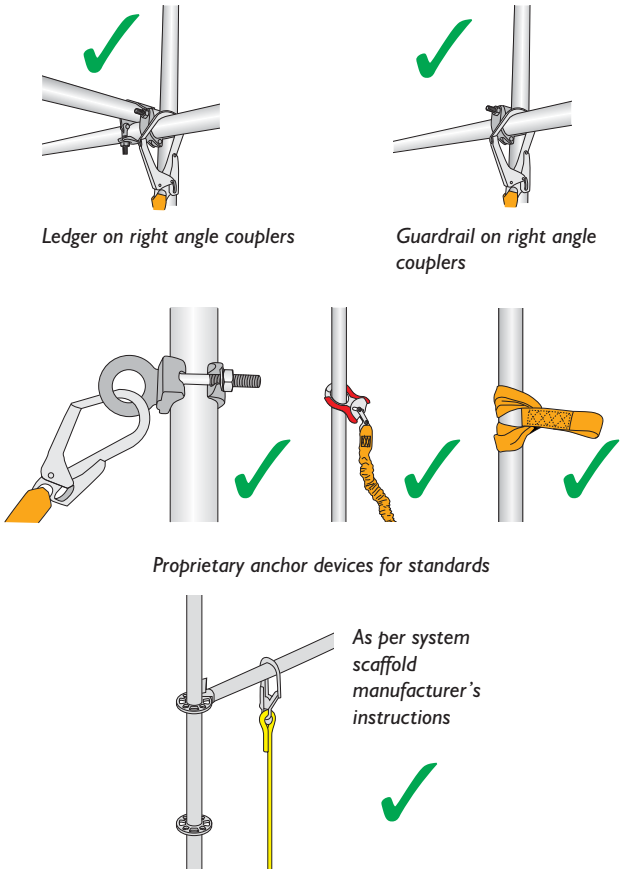



*Figure 72: Examples of suitable anchor points.*

## 6.7 Unsuitable Scaffold Anchor Points

- Ledgers or guardrails supported with putlog clips (single couplers)
- Ledgers or guardrails within a bay where it has a joint
- Standards unless a suitable anchor device is used designed for the purpose
- Standards with a joint between the lift and the attachment point
- Puncheons
- Transoms at foot level or below
- Putlog transoms or bridle tubes
- Underslung tubes below ledgers on non load-bearing couplers
- Reveal or prop tie assemblies
- Vertical braces (e.g. façade or ledger braces) or other diagonal tubes (e.g. spurs or rakers)
- Other tube open ended or not supported either side of the attachment position e.g. protruding end of a transom, needle or dropper

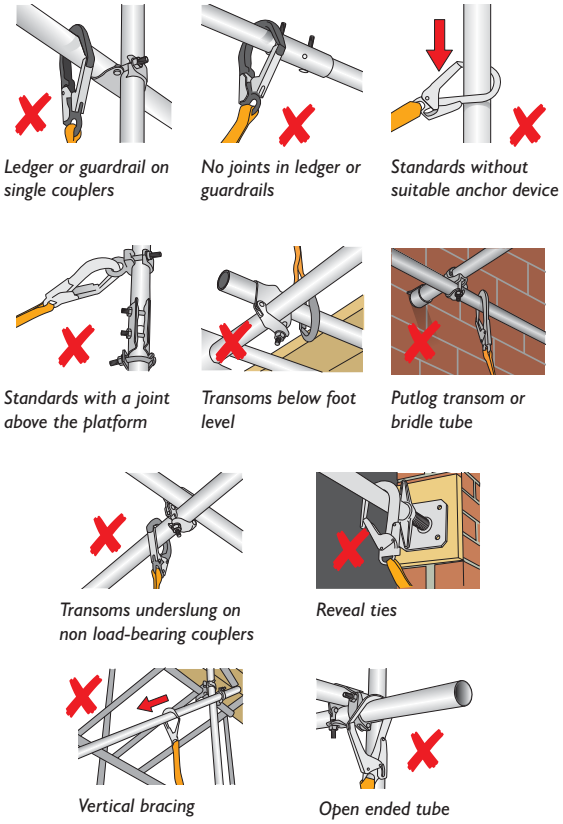



*Figure 73: Examples of unsuitable anchor points.*

## 6.8 Anchoring to scaffolding standards

Proprietary anchor devices for anchoring to scaffolding are now available that enable scaffolders to attach their lanyard to vertical standards *(Figure 74)*. This means that scaffolders can take advantage of a higher anchor position in preference to attaching to the ledger below their feet. Karabiners that are designed especially for attaching to scaffold standards make an effective and efficient anchor device. Another design includes special couplers that can be pre-assembled on standards before they are erected as part of a planned system of work. This provides scaffolders with alternative and convenient anchor positions as they access an unprotected area e.g. the protected traverse system of work *(see Methods of constructing a* ***scaffolders' safe zone*** *page 16)*. Always refer to the manufacturers' instructions to ensure safe use.

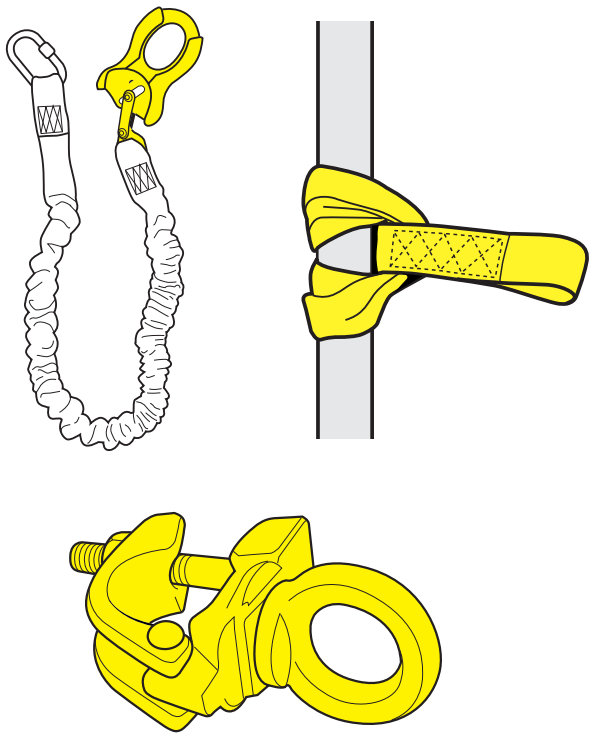


*Figure 74: Anchor devices These pictures illustrate the use of connectors specifically developed for use as anchor devices to scaffold standards.*

## 6.9 Anchorage to proprietary scaffolding systems

The NASC recommends that you follow the scaffolding system manufacturers' instructions as to the suitable anchor points for personal fall protection equipment. The requirements of manufacturers, to consider fall prevention and protection for their products, is outlined in an earlier section (see Proprietary scaffolding systems - Page 26).

## 6.10 Guidelines for anchorage on other structures

Alternative anchor points that may need to be used for scaffolding operations should always be checked to ensure they are suitable and sufficient and where necessary approval must be sought from the client or owner. If an alternative anchor point is required (e.g. steel beam) then an assessment may need to be made by a competent engineer. All permanently installed anchorage points or systems must have a current inspection and test certificate available for inspection, in accordance with the relevant British and European Standard.

Other possible anchorage points could include, for example:

- Beams;
- Girders;
- Any other structural steelwork;
- Wire systems; and,
- Permanently installed anchorage points

## 6.11 Anchorage to lightweight mobile access towers (MATs)

Generally, personal fall arrest equipment should not be used on lightweight mobile access towers (MAT), as they do not provide a suitably stable or secure anchorage. The Health and Safety Executive (HSE) supports a system of work for the erection, use and dismantling of MATs that minimises the risk of a fall. The NASC recommends that scaffolders required to erect, alter or dismantle MATs should be trained in accordance with the Construction Industry Scaffolders Record Scheme (CISRS) or similar.

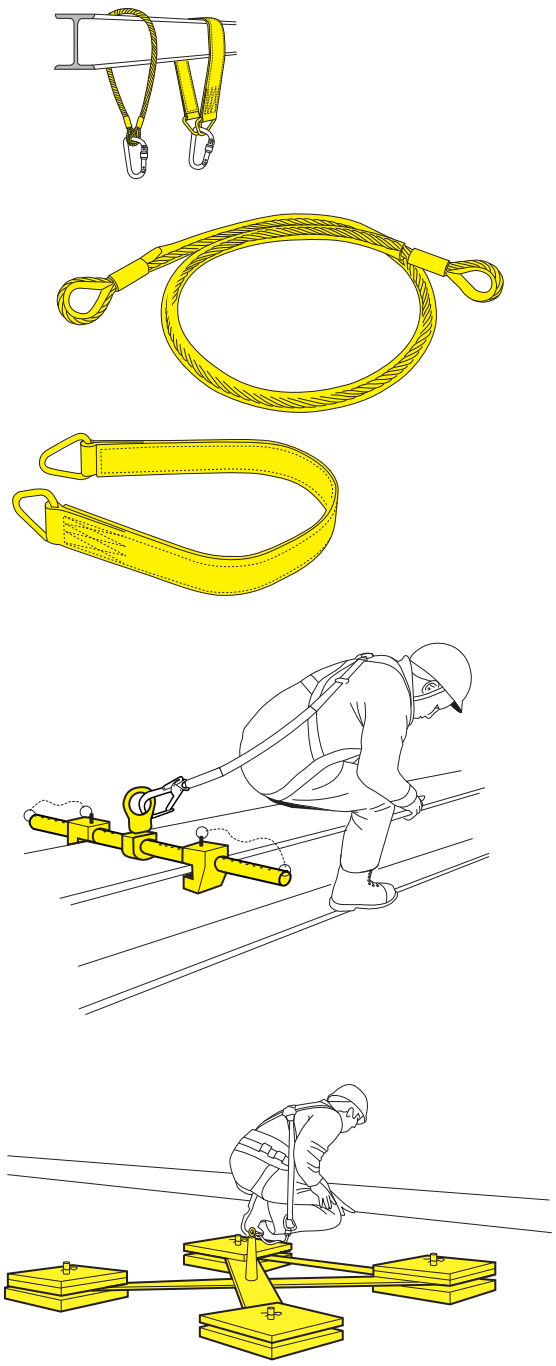


*Figure 75: A selection of special connectors and anchor devices.*

## 6.12 Inertia reels

Retractable line fall arrest devices are commonly known as inertia reels, lines or blocks. A steel cable or material webbing line extracts and retracts automatically and, should a fall occur, a braking mechanism stops the line paying out to arrest a fall, similar to the operation of a car seat belt.

Inertia reels are available in various lengths, sizes of block and critically weights, as they are required to be manually handled. Care must be taken when considering a system of work using inertia reels, as they must be suitable for the scaffolding operation and be used in accordance with the manufacturer's instructions. All retractable line fall arrest devices must be manufactured and tested in accordance with BS EN 360.

Most inertia reels are designed for an anchor point above the scaffolder to limit the distance a person can fall to a minimum. This is due to the fact that many inertia reels have no or little energy absorption capability should a fall occur. Generally, inertia reels should only be used in a broadly vertical plane with minimal horizontal movement, thus minimising the pendulum effect should a fall occur (e.g. Slung scaffold *(Figure 77)*). The working area and horizontal traversing is restricted because the angle of the line from vertical can be no greater than that specified by the manufacturer, to reduce the risk of injury from the pendulum effect or swing fall risk as it is also known *(Figure 76)*.

Inertia reels are ideally suited for drop-lift or slung scaffold structures, where a suitable anchor point can be erected above, and scaffolders are able to erect, alter and dismantle lift(s) below whilst remaining attached. When specifying inertia reels, consideration must be made for rescue and recovery should a fall occur. Where necessary, retrievable inertia reels should be specified that allow colleagues to winch the casualty up or down to safety by deploying an integral handle or similar device (see Section 07– Rescue). Where steel inertia lines are specified then webbing connection strops should be used. This will enable a rescuer to release the primary fall arrest equipment by cutting the webbing strop, if necessary *(Figure 77)*. Where the inertia reel is mounted out of reach of the work area (usually above), a tag line can be fitted to the end of the spooling line. This usually allows attachment connection to be spooled out of the reel, and allowed to retract under control, without need to climb up to the reel. The tag line should be coiled and stored ready for refitting when the worker disconnects from the line. Note that the tag line is a lightweight, non load-bearing line.

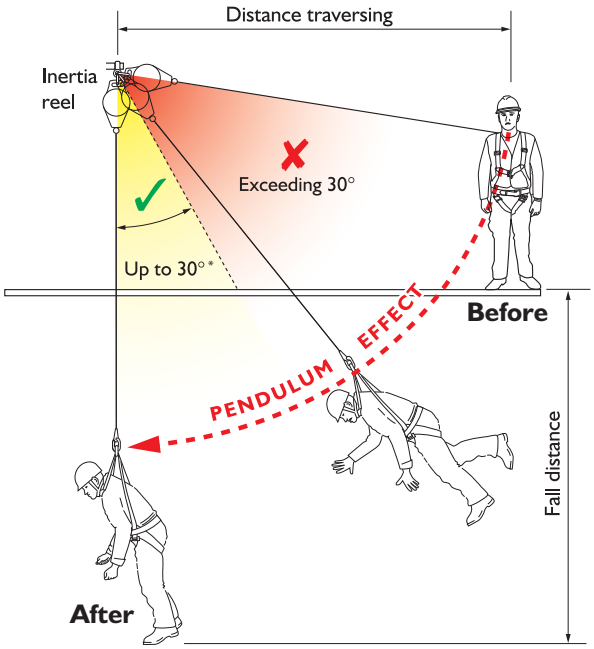



*Figure 76: The pendulum effect. This illustration shows the dangers of the pendulum effect also referred to as the swing fall risk. The faller will swing like a pendulum, at risk of striking the structure or the ground.*
** Do not exceed the manufacturer's recommended maximum angle from the vertical.*

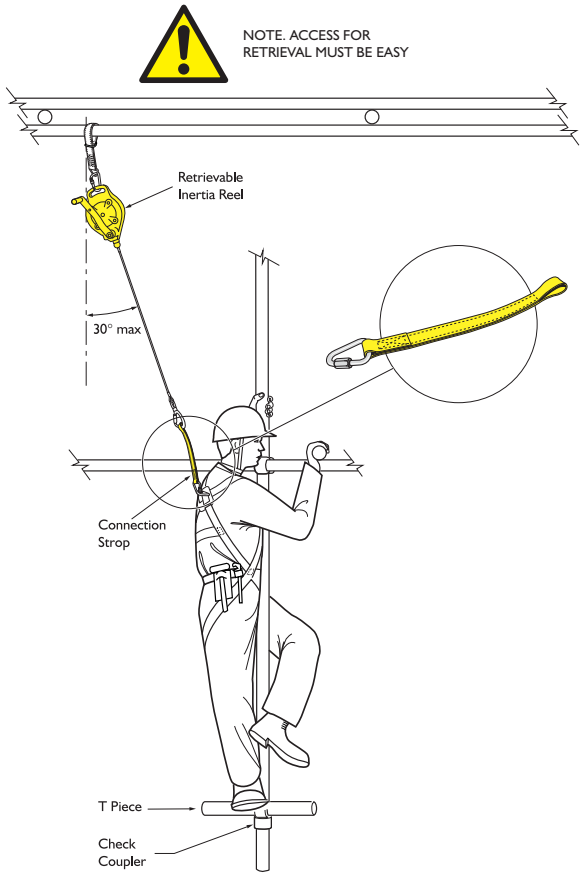


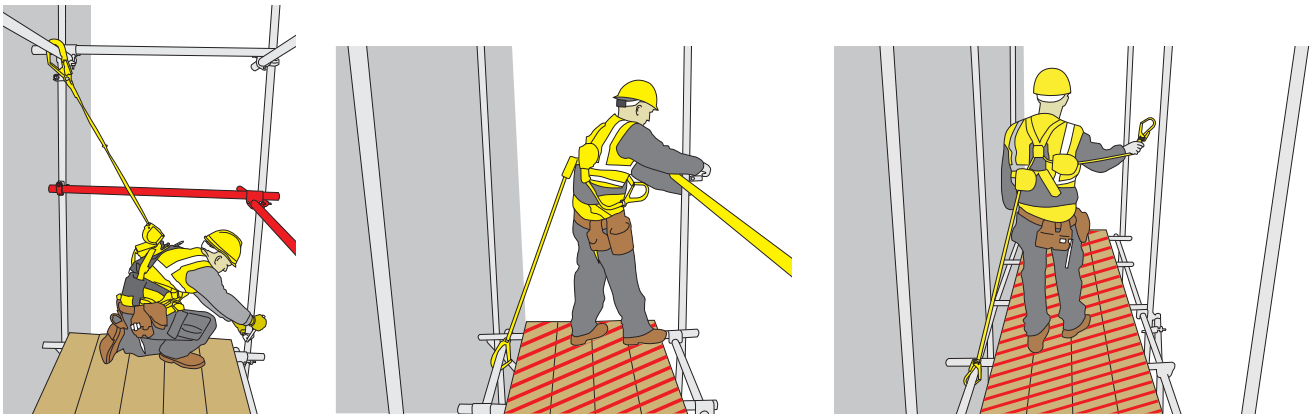

*Figure 77: A slung scaffold being erected by a scaffolder utilising an inertia reel as part of the personal fall protection system (inset) Webbing connection strop for use with lines. They provide ease of connection by the scaffolder and emergency release in rescue when using steel lines.*

## 6.13 Hybrid self-retracting lanyards

Several manufactures now offer self-retracting fall arrest lanyards that incorporate a mini inertia reel and energy absorber capability. These special devices have been designed and tested so that they can be attached to an anchor point below foot level (e.g. in a fall factor 2 scenario.), similar to a fixed length fall arrest lanyard.

These self-retracting lanyards can be used as single or double (twin) lanyard systems where conventional fall arrest lanyards would be used. Therefore they are suitable for many routine scaffolding applications and can also be used for some tasks where an inertia line would be deployed (e.g. small cantilever structures such as a protection fan).

By using these devices, fall distances can be reduced, trailing lanyard hazards minimised and greater flexibility is given to the scaffolder.



*(i). Anchored above* *(ii). Below foot level* *(iii). As a double lanyard*

*Figure 78: Examples of a hybrid self–retracting lanyard system in various scaffolding applications.*

## 6.14 Horizontal line systems

Horizontal line systems can enable scaffolders to traverse a lift or other structure whilst maintaining fall protection. Scaffolders should never erect or use improvised lines with equipment that is not designed or suitable for the purpose. Employers must consult the manufacturers' instructions or seek engineering advice to ensure the system chosen is suitable.

Scaffolders MUST be trained in the installation and use of the temporary horizontal line system used. The three major factors that need to be considered when selecting a suitable horizontal line system are:

**I. The amount of deflection in the line and the clearance required below the attachment position**
e.g. some systems at 20 metres in length can deflect more than 6 metres, where others have a deflection of less than 2 metres. Therefore, if a system is used that has a maximum deflection of 6 metres with a 1.75 metre lanyard to attach to the line, it would only be an effective personal fall arrest system at the 10 metre (5th lift) level or above. The line adopts a 'V' shape as it deflects between supports when arresting a fall. The user travels to the centre of the 'V' causing a swing fall risk. This risk is greater for multiple user systems. If using an inertia reel with a horizontal line system, users need to be aware of the risk from inertia reels continuing to pay out after a fall has occurred due to deflection and elasticity in the line causing the faller to rebound. This is known as the racketing effect and may affect clearance distances required.

**II. The supporting structure for anchoring the ends of the line system.**
With some systems, end loads into the anchor points need to be calculated allowing 24kN (approximately 2.4 tonnes of force). If attached to scaffold components (e.g. the standards) the forces generated in a fall could significantly deform the structure and may affect its stability or the security of the anchorage. Consideration needs to be given to the suitability and design of anchor positions for line systems, in accordance with the potential end loading, specified in the manufacturers' instructions.

**III. The maximum number of persons that can be attached to the system at any one time**.
Line systems are available that offer protection to only one or two scaffolders at a time (i.e. if a system is only suitable for one person and two scaffolders require protection, then two separate systems would be required). In addition, for a horizontal line positioned close to an open edge, deflection of the line during a fall is likely to drag the persons in the vicinity off the platform. For these reasons the design and use of horizontal line systems needs to be restricted to use where this is unlikely to occur. Where necessary rescue procedures need to cater for more than one person suspended.

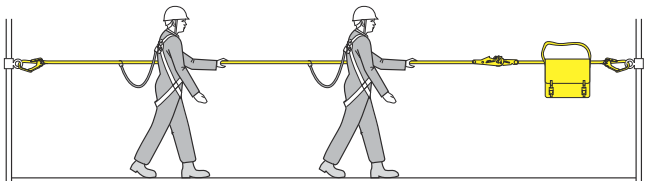


*Figure 79: A proprietary line system specifically developed for use by two operatives.*

## 6.15 Inspection and maintenance of personal fall arrest equipment

Fall arrest equipment made from rope or webbing materials is particularly vulnerable to damage and wear and tear during normal use by scaffolders. Therefore all scaffolding contractors must ensure adequate arrangements are made for the storage and inspection of all fall protection equipment, so that it is maintained fit for use.

The Health and Safety Executive (HSE) and the NASC recommend three levels of inspection for all personal fall protection equipment, as a minimum requirement as described in Health and Safety Executive (HSE) booklet INDG 367 and NASC Safety Guidance note 16 (SG16):

**I. Pre-use checks**
This level of inspection should be carried out by the user for both harnesses and lanyards at the beginning of each shift and are a means of checking that there are no visible or surface defects with the equipment. Pre-use checks should be tactile and visual. The whole lanyard and harness should be subject to the check, by passing it slowly through the hands (e.g. to detect softening or hardening of fibres or ingress of contaminants). A visual check should be undertaken in good light and will normally take just a few minutes.

Any defects or concerns identified during the pre-use check should be raised with the employer before the equipment is used. A suitably competent person, having received appropriate training, must carry out a detailed inspection to either satisfy themselves that the equipment is safe to use or remove from use and destroy the equipment depending upon the defect and concern raised.

There should be additional harnesses and lanyards available to use as replacements in the event that defective equipment has been taken out of use.

**II. Detailed inspections**
These are more formal in-depth inspections looking at the equipment for underlying defects or problems that may not be identified during the pre-use checks.

For frequently used equipment, particularly those used in arduous conditions such as scaffolding, the NASC recommend that a formally recorded detailed inspection is undertaken at least every three months.

**III. Interim inspections**
These are also in-depth inspections and may be carried out when necessary between detailed inspections. The need for interim inspections and their frequency should be identified through risk assessment. Examples of situations where interim inspections may be appropriate include:

- Arduous work environments involving paints, chemicals or grit blasting operations.
- Very hot environments or the risk of contact with hot materials or surfaces (e.g. foundries, steel works, welding, burning, cutting with abrasive wheels etc.).
- Acidic or alkaline environments (note that some fabrics offer low resistance to acids or alkalis).

Ancillary equipment (e.g. connection strops and anchor devices etc.) must also be subject to a suitable inspection regime. Specialist personal fall protection equipment (e.g. inertia reels) must be inspected before use and subject to servicing and maintenance in accordance with the manufacturers' recommendations.

You must record the results of all detailed inspections for each piece of equipment. If defects are identified they must be recorded. Records of inspections should be kept until the equipment is destroyed. If any defects or concerns are identified as a result of a pre-use check or detailed inspection then the equipment must be withdrawn from use and destroyed. Any lanyard and harness that has been used to arrest a fall should **never** be re-used and the equipment removed from use and destroyed.

Where equipment is removed from use and destroyed, this should be recorded in the inspection register.

## 6.16 Personal fall protection equipment manufacturers' instructions

Under the Personal Protective Equipment Regulations and British/European Standards on personal protective equipment (PPE), product information must be supplied by the manufacturer. This information should be read and understood by the scaffolders before using the equipment.

# Rescue

A rescue and recovery plan must be an integral part of any system of work involving fall arrest equipment. This section outlines the considerations that need to be made for rescue planning should an arrested fall occur and a scaffolder(s) becomes suspended by their personal fall protection equipment.

There are health risks associated with any person suspended in a fall arrest harness, therefore an adequate plan must be in place for every scaffolding operation, where fall arrest equipment is used, to ensure a speedy rescue.

The rescue techniques and equipment selected will depend upon the type and complexity of the scaffolding structure.

Any rescue plan must consider the potential danger in which rescuers may have to place themselves, to carry out a rescue. Therefore, when selecting rescue equipment, priority should be given to equipment and techniques that would minimise the risk of further accidents and injuries to the rescuers.

Rescue equipment that may be used remotely from a working platform or **scaffolders' safe zone** ought to be considered first. For example, if a personal fall protection system using inertia reels is selected for a slung scaffold, then a retrievable type inertia reel should be specified. Retrievable inertia reels incorporate a winch mechanism that enables colleagues to recover a suspended scaffolder should a fall occur *(Figure 80)*.

The NASC has produced a separate Safety Guidance note (SG19) to help scaffolding contractors in conjunction with their clients to prepare a rescue plan as part of the risk assessment process for each job. Details of the rescue plan should be incorporated into the risk assessment and method statement (RAMS). Safety Guidance 19 (SG19) includes a range of standard rescue plans that can be adopted for many routine scaffolding operations.

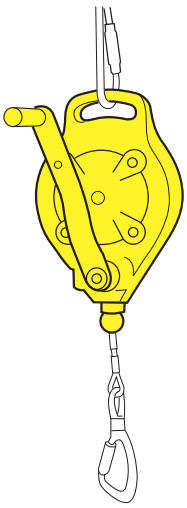


*Figure 80: Retrievable type inertia reel.*

## 7.1 Assisted rescue (without specialist rescue equipment)

In many cases where a scaffolder suffers an arrested fall, they may be able to recover themselves, or their colleagues could assist in a rescue, without the use of specialist rescue equipment. It is feasible for a scaffolder to pull themselves into the scaffolding structure at a lower lift, or back onto the structure for example, depending upon the fall distance, providing they are not seriously injured or unconscious. If complete self-recovery is not possible, merely supporting themselves on a ledger or other part of the structure until rescued will significantly reduce the risks from the effects of suspension in a safety harness. Employers may also consider supplying special supports, available from PFPE suppliers, which are attached or integrated during manufacture into the harness. These supports enable the scaffolder, in the event of an arrested fall, to release the straps and adjust them over their feet. Their body weight can then be supported by their feet until rescued, thereby reducing the risks from suspension fainting (otherwise known as Syncope).

### Case Study 7

A scaffolder suffered an arrested fall whilst erecting an independent tied scaffold. His colleagues were able to facilitate a rescue by moving platform boards to a lower lift to improvise a temporary platform at the same level as the casualty. He was pulled onto the safe platform until the emergency services arrived. In the meantime first aid was administered and safe access was provided to the temporary platform.

A rescue plan could include: the use of site access equipment, such as, a Mobile Elevating Work Platform (MEWP), mobile access tower (MAT) or a crane with a manriding basket that could facilitate a rescue (see SG19).

*Figure 81: Recovery from height by emergency services. Shows the emergency services using a MEWP to recover an accident casualty from height. However rescue plans must not rely upon the emergency services to recover a person suspended by personal fall protection equipment.*

## 7.2 Specialist rescue equipment

Rescue kits are available that can be deployed quickly by trained operators to facilitate a remote rescue using specialist equipment, without exposing the rescuers to unnecessary risk. These remote rescue kits enable rescuers to attach the equipment to the harness of the suspended scaffolder, release their primary fall protection equipment and either raise them to a safe platform or lower them to the base *(Figure 82)*.

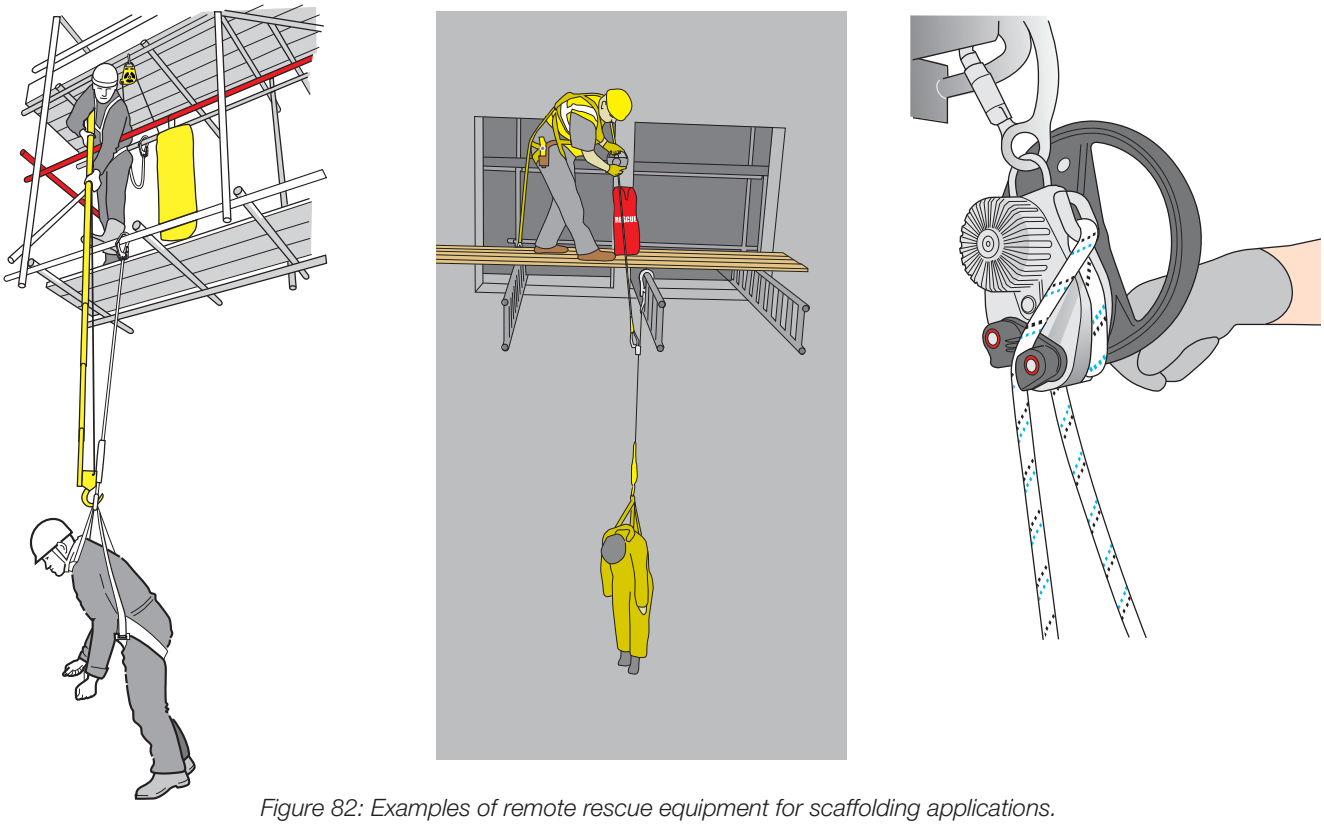


*Figure 82: Examples of remote rescue equipment for scaffolding applications.*

When choosing a rescue kit ensure that it is suitable for the scaffolding application. This includes for example:

- is there sufficient rope length to lower a person to the ground from the highest position if necessary?
- does the device allow casualties to be raised or lowered?
- is the device a descender only type, which may not be suitable for certain situations such as work over water or very high level work where a large quantity of rope would be required?
- is the rescue equipment readily available at all times when working at height?
- are there sufficient numbers of trained personnel available at all times during work at height that can use the equipment?

Equipment and techniques can be used that requires a rescuer to descend (or abseil) down to the suspended scaffolder, attach himself to the rescuer and then release the scaffolder's primary fall arrest device (e.g. lanyard). The rescuer may then either raise or lower the casualty to safety (depending upon the equipment used). This type of equipment and technique places a rescuer at greater risk and should only be considered as a last resort *(Figure 83)*.

Specialist rescue equipment must be subject to maintenance and an inspection regime to ensure that it is in good order whenever it is required to be used. Maintenance and inspection of rescue equipment should be in accordance with the manufacturers' instructions. Note that an inertia reel or other device that incorporates a winch to raise or lower a person is, by defenition, lifting equipment under the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER) and requires thorough examination at six-monthly intervals. The only exception to this is dedicated rescue equipment that remains sealed, dry, undamaged and unused (ie bagged or crated). An extended thorough examination interval may be agreed by a competent person.

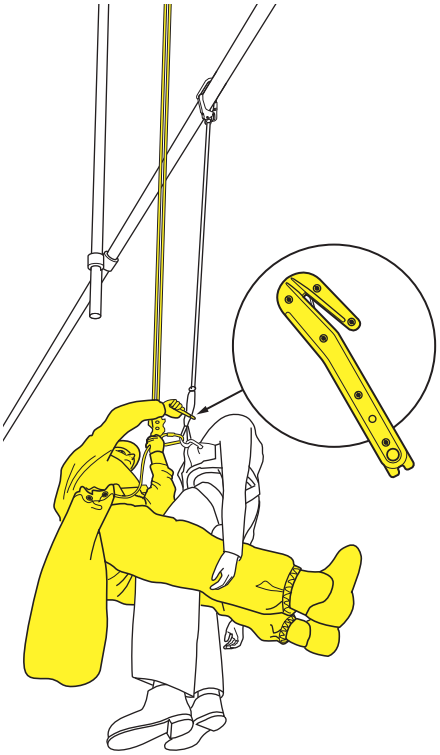


*Figure 83: Fully assisted rescue situation. The rescuer has attached the casualty to himself and is cutting the lanyard webbing using a special cutting device that reduces the risk of accidentally cutting the rescue equipment.*

## 7.3 Rescue training

Employers must ensure when specifying specialist rescue equipment as part of a rescue plan, that an adequate number of scaffolders have been suitably trained in its use, including any refresher training and exercises necessary.

Rescue must be an integral part of all scaffolder training and instruction in accordance with this NASC guide.

SECTION 08

# Relevant Health and Safety Law

- The Health and Safety at Work etc. Act 1974.
- The Management of Health and Safety at Work Regulations 1999.
- The Work at Height Regulations 2005 (as amended).
- The Construction (Design and Management) Regulations 2015.
- Lifting Operations and Lifting Equipment Regulations 1998.
- The Workplace (Health, Safety and Welfare) Regulations 1992.
- The Provision and Use of Work Equipment Regulations 1998.
- The Personal Protective Equipment (Health and Safety) Regulations 1992.
- The Health and Safety (Safety signs and signals) Regulations 1996.

# British and European Standards



- BS 2482: 2009 Specification for timber scaffold boards.
- BS 5975: 2008 + A1:2011 Code of practice for temporary works procedures and the permissible stress design of falsework.
- BS 8437: 2005 + A1:2012 Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace.
- BS 8454:2006 Code of practice for the delivery of training and education for work at height and rescue.
- BS EN 12810-1: 2003 Facade scaffolds made of prefabricated components. Product specifications.
- BS EN 12811-1: 2003 Scaffolds. Performance requirements and general design.
- BS EN 13374:2013 Temporary edge protection systems. Product specification. Test methods.
- BS EN 354:2010 Personal fall protection equipment. Lanyards.
- BS EN 355: 2002 Personal protective equipment against falls from a height. Energy absorbers.
- BS EN 360: 2002 Personal protective equipment against falls from height. Retractable type fall arresters.
- BS EN 361: 2002 Personal protective equipment against falls from a height. Full body harnesses.
- BS EN 362: 2004 Personal protective equipment against falls from a height. Connectors.
- BS EN 364: 1993 Personal protective equipment against falls from a height. Test methods.
- BS EN 365: 2004 Personal protective equipment against falls from a height. General requirements for instructions for use and for marking.
- BS EN 39: 2001 Loose steel tubes for tube and coupler scaffolds.
- BS EN 74-1: 2005 Couplers, spigot and baseplates for use in falsework and scaffolds.
- BS EN 795:2012 Personal fall protection equipment. Anchor devices.

# References and further reading

**National Access and Scaffolding Confederation (NASC)**
4th Floor, 12 Bridewell Place, London EC4V 6AP
enquiries@nasc.org.uk www.nasc.org.uk
Tel: 020 7822 7400 Fax: 020 7822 7401

- SG4:You User guide to SG4 Preventing falls in scaffolding.
- SG7 Risk assessments and method statements.
- SG16 Management of fall protection equipment.
- SG19 A guide to formulating a rescue plan.
- SG25 Access and egress from scaffolds.
- SG27 Temporary edge protection on open steelwork.
- SG29 Internal edge protection on scaffold platforms.
- TG9 Guide to the design and construction of temporary roofs and buildings.
- TG20 Operational guide – A comprehensive guide to good practice for tube and fittings scaffolding.

**HSE Books**
PO Box 1999, Sudbury, Suffolk, CO10 2WA
hsebooks@prolog.uk.com www.books.hse.gov.uk
Tel: 01787 881165 Fax: 01787 313995

All HSE free and priced publications can be downloaded free via the HSE website www.hse.gov.uk

- HSG150 Health and safety in construction.
- HSG33 Health and safety in roof work.
- L153 Managing health and safety in construction.
- INDG 367 Inspecting fall arrest equipment made from webbing or rope.
- GEIS6 The selection, management and use of mobile elevating work platforms.
- Research Report 116 Falls from height – Prevention and risk control effectiveness.
- Research Report 708 Evidence-based review of the current guidance on first aid measure for suspension trauma.

**Prefabricated Access Suppliers and Manufacturers Association (PASMA)**
PO Box 26969, Glasgow G3 9DR
info@pasma.co.uk www.pasma.co.uk
Tel: 0845 230 4041

- Operators' Code of Practice.

**International Powered Access Federation (IPAF)**
Bridge End Business Park, Park Road, Milnthorpe LA7 7RH
info@ipaf.org www.ipaf.org
Tel: 01539 562444

- Code of Practice.

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# Notes

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