




HEALTH AND SAFETY
AUTHORITY

CODE OF PRACTICE FOR SAFETY IN ROOFWORK





Our Vision:
healthy, safe and
productive lives

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FOREWORD

The Health and Safety Authority, with the consent of Mr Gerald Nash TD, Minister of State for Business and Employment, publishes this amended Code of Practice, titled “*Code of Practice for Safety in Roofwork*”, in accordance with Section 60 of the Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005).

The aim of this code of practice is to improve standards of safety during roofwork. In particular, it aims to reduce the incidence of falls from or through roofs during and after their construction.

This code of practice provides practical guidance as to the observance of the Safety, Health and Welfare at Work Act 2005, and the provisions of the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016 and of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. 291 of 2013).

This amended code of practice comes into operation on Monday 16th May, 2016, and replaces the “*Code of Practice for Safety in Roofwork*”, issued by the Authority on 1 September, 2011. Notice of the issue of this amended code of practice, and the revocation of the 2011 code of practice, was published in the *Iris Oifigiúil* of Friday 6th May, 2016.

As regards the use of codes of practice in criminal proceedings, section 61 of the Safety, Health and Welfare at Work Act 2005 provides as follows:

- 61.—(1) Where in proceedings for an offence under this Act relating to an alleged contravention of any requirement or prohibition imposed by or under a relevant statutory provision being a provision for which a code of practice had been published or approved by the Authority under section 60 at the time of the alleged contravention, [2005.] [No. 10.] Safety, Health and Welfare at Work Act 2005, subsection (2) shall have effect with respect to that code of practice in relation to those proceedings.
- (2)(a) Where a code of practice referred to in subsection (1) appears to the court to give practical guidance as to the observance of the requirement or prohibition alleged to have been contravened, the code of practice shall be admissible in evidence.
- (2)(b) Where it is proved that any act or omission of the defendant alleged to constitute the contravention—
- (i) is a failure to observe a code of practice referred to in subsection (1), or
 - (ii) is a compliance with that code of practice, then such failure or compliance is admissible in evidence.
- (3) A document bearing the seal of the Authority and purporting to be a code of practice or part of a code of practice published or approved of by the Authority under this section shall be admissible as evidence in any proceedings under this Act.

Dr. Marie Dalton
Secretary to the Board
Health and Safety Authority

PART 1

GENERAL INTRODUCTION

01: INTRODUCTION

1.1 Status of Code of Practice

This code of practice is issued by the Health and Safety Authority (HSA) under Section 60 of the Safety, Health and Welfare at Work Act 2005 and with the consent of the Minister of State at the Department of Jobs, Enterprise, and Innovation.

It gives practical guidance to roofing companies, clients, designers, project supervisors (design and construction stages), safety representatives, safety consultants, advisors and anyone carrying out roofwork on the requirements and prohibitions set out in the Safety, Health and Welfare at Work Act 2005, the Safety, Health and Welfare at Work (Construction) Regulations 2013 and the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016.

A failure to observe any part of this code will not by itself render a person liable to civil or criminal proceedings. However, where the code of practice gives practical guidance on the observance of any of the relevant statutory provisions compliance or noncompliance with its guidance may be admissible in evidence in any criminal proceedings.

1.2 Scope of Code of Practice

This code of practice gives recommendations and practical guidance on how to work safely on roofs, including the safe maintenance of roof mounted plant and services, and how to design and plan for safe working. It offers guidance on the design and construction of roofs on new buildings and the maintenance, cleaning and demolition of existing roofs; however, the wide range of roof types and roofwork makes it impractical to offer guidance specific to all roof types or roofwork activities. All work at height poses a risk and a risk assessment should be carried out to assess those risks and put appropriate controls in place.

This code also gives guidance to those not directly involved in roofwork (e.g. clients and designers). Clients should provide amounts of time and money adequate to ensure that the work can be carried out safely. They will benefit from reduced running costs if maintenance and repair are considered at an early stage in the design process.

When designing roof structures, designers need to take account of the health and safety implications of their decisions. They can often remove risks by designing them out at source. Designers need to have a reasonable understanding of the problems faced by contractors and others, to allow them apply the principles of prevention in their design.

The principal problem when working on roofs is falls, either through fragile roof coverings or from unprotected roof edges. In many cases, straightforward physical protection measures can prevent accidents occurring. In many cases, accidents can be prevented, but too often a lack of foresight and of management control result in the necessary protection being neglected during high-risk work.

This code of practice highlights some of the main safe systems of work that are available. However it does not seek to identify all of the systems as new technologies are being developed all the time. You will not need to implement all of the safe systems of work identified in this code of practice. Your safe system of work will depend on the nature and degree of the risks for the roofwork that you are involved in.

This code is structured to identify precautions that are applicable to roofwork. It also identifies those which are particular to specific types of roof and types of work. However, risks are significant in ALL roofwork and high standards are necessary to provide adequate protection.

Further detailed guidance for all types of construction work is available in *Guidelines on the Procurement, Design and Management Requirements of the Safety Health and Welfare at Work (Construction) Regulations 2013*.

1.3 Who Should Read this Code of Practice?

Roofwork is not just an issue for construction companies. Non-construction workers such as factory maintenance staff may be at risk from falls from or through roofs. This guidance will be useful to:

- Anyone carrying out roofwork, including employees and the self-employed.
- Directors and partners of companies who carry out roofwork.
- Project clients.
- Owners/occupiers of buildings.
- Designers, quantity surveyors and specifiers of buildings and components.
- Designers of proprietary products used in roofing.
- Designers of temporary works for contractors (including scaffolding, edge protection etc.).
- Project supervisors for the design process.
- Project supervisors for the construction stage.
- Employees' safety representatives and safety officers.
- Safety consultants and advisers.
- Suppliers of materials and systems for roof assembly.
- Glazing companies, companies fitting rainwater goods and mechanical/electrical companies engaged in work where access to a roof is required.

1.4 Reasons for You to Use this Code of Practice

Roofwork is a high-risk activity. Unfortunately there has been a large number of accidents, many of which have proved fatal. Below is given a table of fatal accidents that have occurred over the last eight years. In this period 30 people have lost their lives while working on roofs. Each death was the consequence of a preventable accident.

2006

Industry	What Went Wrong
Support Services Activities	The deceased was cleaning windows while standing on the roof of an entrance porch when he fell to the ground.
Agriculture	The deceased was repairing the roof of a farm building when he fell through a corrugated Perspex sheet falling to the floor of the building.
Construction	The deceased was installing roof panels on a farm building when he fell approximately 5 metres onto a concrete floor.

2007

Industry	What Went Wrong
Communications	The deceased was working alone on the roof of a warehouse installing broadband. He fell through a fragile roof a distance of approximately 6 metres and sustained fatal injuries.
Construction	The deceased fell through a Perspex roof while putting a bitumen seal on a roof belonging to a friend and sustained head injuries from which he later died.
Construction	The deceased fell from an unprotected edge where the fall protection had been removed to facilitate building maintenance.

2008

Industry	What Went Wrong
Agriculture	The deceased fell from the roof of a building while it was under repair.
Construction	The deceased was engaged in roofing a slatted shed under construction on a farm. He fell a distance of approximately 9 metres onto a concrete floor.
Construction	The deceased was involved in the erection of new extended roof sheeting to a smoking area at the rear of a public house. He was found lying on the ground having apparently fallen 3 metres through clear fragile roof sheeting onto a concrete surface.

2009

Industry	What Went Wrong
Construction	The deceased was re-roofing a single bay shed using ladders. The victim climbed a ladder while holding one end of a corrugated roofing panel. A co-worker climbed a second ladder holding the other end of the roof panel. The victim's ladder, which was not secured or footed, moved causing the victim to fall approximately 6 metres.
Agriculture	The deceased was working on the roof of shed when it appears that a beam he was standing on broke and the victim fell to the ground sustaining fatal injuries.
Construction	The deceased was working on a flat roof extension of a single storey house when he fell from the roof to the ground, 3 metres below.
Construction	The deceased was going up a ladder and fell from a height of approximately 2 metres on to a concrete driveway to the garage. He was taken to the Tallaght Hospital where he died the next evening. It is not clear yet why he lost his balance but one indication is that his ladder fell at the same time.
Construction	The deceased fell from a roof while retrieving ridge tiles.
Construction	The deceased was installing corrugated iron sheets on the roof of a remote single storey dwelling when he fell to the ground.

2010

Industry	What Went Wrong
Manufacturing	The deceased fell through an asbestos roof to the ground below while attempting to repair a roof vent.
Construction	The deceased fell from a height while carrying out asbestos removal for the replacement of an existing roof.
Agriculture	The deceased fell through an asbestos roof a distance of approximately 2.6 metres to the ground below.
Manufacturing	The deceased was in the process of cleaning material from the roof of a warehouse when he stepped on and fell through a Perspex rooflight to the ground 7 metres below.
Construction	The deceased and his father were clearing a gutter and chimneys. It appears that the victim was clearing grass from a chimney when he fell from the roof of a two-storey house, hitting railings and then the ground.
Agriculture	The deceased, it appears, had climbed on to the roof of a barn on his farm when he fell through a skylight to the ground below.

2011

Industry	What Went Wrong
Agriculture	Went on roof to clear chutes. Fell through fragile roof material.
Construction	Fell from roof while removing asbestos sheeting
Construction	Fell from scaffold whilst trying to access flat roof to carry out work.
Construction	Victim fell from roof rafters on domestic dwelling.

2012

Industry	What Went Wrong
Construction	Fall from roof during construction
Agriculture	Fall from roof while replacing roof sheets
Cleaning / Maintenance	Victim fell while cleaning roof gutters.

2013

Industry	What Went Wrong
Construction	Fall from height while carrying out roofwork
Construction	Fall from flat roof

Stark reading! These are the types of work activity that can result in accidents. Roofwork is a high-risk task, and particularly when working on tall buildings. But working at any height can result in serious injury or death.

Please read the portions of this code that concerns you and your work. Put control measures in place to protect yourself, your employees, and the people around you.

1.5 How to Use this Code of Practice

This code of practice is laid out in five parts:

- Part 1 is a general introduction to the code of practice:**
This part outlines the status and scope of the code of practice, as well as its potential readership, and the need for it in this high-risk construction activity.
- Part 2 deals with the duties of the different parties involved in roofwork:**
This part introduces the main duty holders for roofwork: In particular, the client or occupier of the premises. The client often initiates the roofwork and may control access to existing roofs. There is a summary of the duties of the PSDP and designers which specifies their overall duty to eliminate or reduce risks during the design process. The duties of the PSCS and contractors are also detailed. Wall and roofing systems fall under the definition of 'articles' in Section 16 of the Safety, Health and Welfare at Work Act 2005. As a consequence Section 16 requires suppliers to provide information to allow for their systems to be incorporated into design and construction safety on site.
- Part 3 deals with roofwork undertaken for standard domestic dwellings:**
This part provides guidance which is specific to roofs on standard domestic dwellings or other similar small element roofs. So, for example, it would apply to normal slate or tile pitched roofs.
- Part 4 deals with roofwork for commercial, industrial and agricultural buildings:**
This part provides guidance for work on roofs on commercial, industrial and agricultural buildings or other similar large-element roofs. Guidance is provided for traditional roofs, sloped roofs and flat roofs. In addition guidance is given on the incorporation of solar panels into roofs.
- Part 5 covers common issues such as safe systems of work and competencies:**
This is a significant part of the code of practice, providing detailed guidance on a wide range of roofwork safety issues. This includes creating a safe place of work at roof level, controlling health hazards and identifying particular risks, for example demolition. This part also provides guidance on different types of roofwork and Construction Skills Certification Scheme (CSCS) training requirements.

The appendices support the various aspects of the code of practice by providing examples of safety options and good practice as well as in particular specific details for fall arrest protection.

The code of practice is structured to help duty holders access information that applies to their role and for the type of roof that they are dealing with.

PART 2

ROLES AND RESPONSIBILITIES

02: ROLE OF THE CLIENT/OCCUPIER

2.1 Clients and Roofwork

Those who own, occupy or have responsibility for a building have an important role to play when arranging for roofwork to be done.

In most cases roofwork will be deemed to be construction work. This will mean that if you intend to do roofwork you will have to discharge the duties of a client. For example, you will have to engage competent designers and contractors, consider the design brief for the roofwork and then control the areas of overlap between your work activities and that of the contractor when they are undertaking the roofwork at your place of work.

The client/occupier should have a system in place to control access to existing roofs. Depending on the outcome of your risk assessment, this could be in the form of a permit to work system or a system that controls access through direct supervision.

The client should allow a reasonable timescale to carry out the project and should not place undue pressure on those responsible for designing and carrying out the work to do so quickly. Unrealistic building or refurbishment programmes can lead to pressure on those carrying out the work. This can make it harder for contractors to plan for safe working and to prepare acceptable safety method statements. Also to review and amend their systems of work. Clients have an important role here. They should not place unreasonable planning or other demands on the project team.

For projects to which the Safety Health and Welfare at Work (Construction) Regulations 2013 apply, clients must where required:

- Appoint a competent and adequately resourced designer to carry out the work.
- Appoint a competent and adequately resourced contractor to carry out the work.
- Check the competence and resources of the contractor by asking for evidence of:
 - experience of carrying out similar projects.
 - safety and health training.
 - possession of Safe Pass safety awareness card(s).
 - The resources intended for use on the project, including equipment.
 - a good safety record, (e.g. absence of accidents, Notices issued by the Health and Safety Authority and any prosecutions).

For larger more complex projects:

- Appoint a competent and adequately resourced Project Supervisor Design Process (PSDP) before the start of any design work,*
 - checking the competence and resources of the PSDP by asking for evidence of:
 - Experience of carrying out similar projects.
 - Safety and health training or qualifications.
 - The resources intended for use on the project.
 - Evidence of a good safety record (e.g. absence of accidents, Notices issued by the Authority or prosecutions).

- Appoint a competent and adequately resourced Project Supervisor Construction Stage (PSCS)*,
 - checking the competence and resources of the PSCS by asking for evidence of:
 - Experience of carrying out similar projects.
 - Safety and health training or qualifications.
 - The resources intended for use on the project.
 - Evidence of good safety record (e.g. absence of accidents, Notices issued by the Authority or prosecutions).
- Cooperate with the project supervisors by:
 - Giving them any information you have about the state or condition of a structure or of a site.
 - If there is a safety file give it to the PSDP.
 - Set a realistic time frame for completion of the project, as rushing a project can lead to accidents.
- If the project is going to take longer than 30 days or 500 person days, then the client must notify the Authority of the appointment of the PSDP and if at this time you know who the PSCS is, include this information in the notification.
- Provide or arrange provision of a copy of the safety and health plan given to all those being considered for, or tendering for the role of Project Supervisor for the Construction Stage**
- The PSDP has to prepare on a preliminary basis a safety and health plan. The easiest way to ensure that it is included in the tender documentation for the post of PSCS is to instruct the PSDP to do so.
- Maintain the safety file that the PSDP will give you when the project is completed. You are required to maintain the safety file as and when other works are undertaken and make the safety file available to anyone undertaking maintenance or construction on your building.

*Appointments of supervisors are required where you have more than one contractor, a particular risk or the project is longer than 30 days.

**In the case of a homeowner the Safety and Health Plan only needs to be provided to the Project Supervisor Construction Stage after appointment.

Clients of small projects or persons who have never been a client before e.g. a homeowner can seek advice from the designer or contractor in relation to their duties.

The Health and Safety Authority has also published a number of publications to assist Clients in discharging their duties:

- Clients in Construction – Best Practice Guidance; this will assist clients in discharging their duties. The guidelines include a flowchart that helps clients identify whether they are required or not to appoint project supervisors (e.g. PSDP and PSCS).
- Guidance for Homeowners – Getting Construction Work Done Safely.

The guide for homeowners tells you what you need to know and do when having construction work done in your home.



The client should pass on information in his or her possession which may be needed to allow the work to be done safely. The client must make a copy of the safety file for the building available to the PSDP, the PSCS or others who require it to carry out the work safely.

The client should also provide information regarding hazards in the vicinity of the works. If the client is unsure or does not have knowledge of existing hazards, then the client should provide all reasonable assistance to others seeking to ascertain these hazards. For example:

- What an existing roof is made of, especially if it has fragile areas or materials containing asbestos (ACM).
- The age of an existing roof.
- Previous modifications made to an existing roof.
- Existing arrangements for access to the roof.
- Restrictions on availability of space for craneage.
- Any relevant permit-to-work arrangements operated by the client.
- Fire precautions on an occupied site.
- Areas where contractor access will be prohibited.
- Any restrictions on hours of work.

03: ROLE OF THE PROJECT SUPERVISOR DESIGN PROCESS (PSDP)

3.1 Introduction

The role of the PSDP is to coordinate the work of designers in the light of their duty in so far as is reasonably practicable to eliminate or minimise risks which are apparent during the design process. The PSDP, through the PSCS, also acts as the link between the designers and the site on questions of health and safety. During the project the PSDP may also offer an opinion to the client on the competence of designers and contractors in respect of safety, health and welfare.

3.2 Duties of the Project Supervisor Design Process

The PSDP should identify hazards arising from the design or from the technical, organisational, planning, or timing aspects of the project and:

- Where possible, eliminate the hazards or reduce the risk.
- Communicate necessary control measures, design assumptions, or remaining risks to the PSCS so they can be dealt with in the safety and health plan.
- Ensure that the work of designers is coordinated to ensure safety.
- Organise cooperation between designers.
- Prepare a written safety and health plan for any project where construction will take more than 500 person days or 30 working days or there is a particular risk and deliver it to the client prior to tender.
- Prepare a safety file for the completed structure and give it to the client.
- Notify the Health and Safety Authority and client of noncompliance with any written directions issued.
- Issue directions to designers or contractors or others.

3.3 Preparation of a Preliminary Safety and Health Plan

Where appropriate the PSDP must prepare a written safety and health plan. The main purpose of creating the safety and health plan at the design process is to provide such information as:

- A general description of the project.
- Any other work activities taking place on site.
- Work involving the particular risks referred to in Schedule 1 to the Construction Regulations but not limited to this list.
- The timescale for the project and the basis on which it was established.
- Conclusions drawn by designers and the PSDP having taken into account the general principles of prevention and any relevant safety and health plan or safety file.
- The location of electricity water and sewage connections to enable the installation of welfare facilities.
- The load bearing capacity of the roof and roof elements.

- Details of structural members.
- The presence of asbestos, including sprayed asbestos.
- The position and type of overhead power lines and underground services, including, where relevant, those associated with adjoining properties.
- Existing fragile materials.

3.4 Cooperation with Others

Good coordination between designers can often facilitate better safety standards at all stages of the work. A practical example is the effect of commercial roof gutter design on systems of work that will be implemented when the roof is being laid.

Roof workers and others commonly use gutters for access along the roof. The structural strength of the gutter, its width and depth and the quality of the fixings greatly affect its safety as a means of access. Where gutters are not strong enough to serve as access points, means of access will be needed which take this into account.

There are a number of instances where the design of the frame of the structure has a direct effect on the systems of work of the roof workers. For example:

- If safety running lines are proposed to be used during erection, the PSDP and the building designer should have a say on the proposed anchorage points.
- The PSDP and designers should be involved in the design, sizing and spacing of purlins and the alignment of the joints between the purlins if it is intended to use a trolley system to provide edge protection.
- The PSDP and designers should consider how the use of nets or other collective fall protection systems for the protection of workers during erection, could be accommodated in the context of applying the principles of prevention in their design.

Resolving these issues requires coordination between the designers as appropriate. It is the role of the Project Supervisor Design Process to facilitate appropriate coordination between designers.

04: ROLE OF THE DESIGNER

4.1 Introduction

Under the Safety, Health and Welfare at Work (Construction) Regulations 2013 designers have a duty to ensure that their designs give adequate attention to health and safety. Foreseeable risks should be avoided as far as possible. Priority should be given to design solutions which provide collective protective measures rather than individual protective measures.

In addition, before specifying the use of a product which may be hazardous to health, designers should consider whether a less harmful product could be used. Designers should forward relevant information to the PSDP, so that it can be included in the preliminary safety and health plan.

4.2 Duties of the Designer

Designers should:

- Identify any hazards that their design may create during construction and subsequent maintenance. For example, working at height.
- Where possible, eliminate the hazards or reduce the risk (e.g. can roof mounted equipment be placed at ground level or can guard-rails be provided to protect workers from falling?)
- Communicate necessary control measures, design assumptions or remaining risks to the PSDP so they can be dealt with in the safety and health plan.
- Cooperate with other designers and the PSDP or PSCS.
- Take account of any existing safety and health plan or safety file.
- Comply with directions issued by the PSDP or PSCS.
- Where no PSDP has been appointed, inform the client that a PSDP must be appointed.
- Comply with the provisions of the Safety Health and Welfare at Work Act 2005 which require designers to ensure that the project will be a safe construction, can be maintained safely and will comply with all relevant health and safety legislation.

4.3 Roofwork Design

The Construction Regulations give a very wide definition of design (and, correspondingly, of designer) that includes not only the preparation of drawings or specifications but also of any other “expressions of purpose, according to which a project is to be executed”. Thus, apart from those who normally think of themselves as the designers of a building, responsibility for design under the Regulations may in certain cases extend to those who design, for example, temporary works for contractors, proprietary products, etc.

Using their professional skills and judgement, designers can often eliminate hazards or, failing that, reduce their threat and simplify the control of risks on site. The designer has a responsibility to design the roof assembly to suit its expected life and the need for maintenance and roof access.

4.3.1 Fragile roofing specification for designers

Where buildings are unlikely to have regular maintenance needs and access to the roof can be strictly controlled the roof assembly should be designed to a minimum non-fragile standard – Class C to *ACR Test for Non-Fragility of Roofing Assemblies*. This publication describes a test standard which can be applied to any product which will form a roof or part of a roof and is intended to provide information about whether it can support the instantaneous loads imposed on it by a person stumbling or falling on it.

Assemblies, when tested by a competent person, may be classified as :

- Non Fragile -Class A
- Non Fragile - Class B
- Non fragile - Class C

Where roof maintenance is likely but not frequent (e.g. to clean out a valley gutter) designers should provide additional protection in the areas where maintenance will be necessary. Where roof access is regular or cannot be controlled, the relevant roof assembly must be designed to a higher classification of non-fragility (e.g. Class B to ACR [M] 001:2005) and this level of non-fragility must be expected to last for the envisaged design life of the building when the assembly is fitted in accordance with the manufacturer's instructions. Generally, rooflights (either in-plane or out of plane) should not be located in such an area.

The non-fragility classification of in-plane rooflight assemblies should be at least consistent with that of the roofing system.

Roofing materials and systems are covered by the Construction Products Regulation (No. 305/2011-CPR). CE MARKING of construction products covered by harmonised European Standards is mandatory. Manufacturers, importers and distributors have new obligations and responsibilities when placing a construction product on the market. Designers, specifiers and builders must be aware and understand the new requirements on construction products.

For information on the 'EU Construction Products Regulation(Reg (EU) 305/2011) (CPR)' see www.environ.ie.

4.3.2 Design risk management

In all cases the safety file for the building must give clear guidelines on the roofing system used and an indication of the durability and maintenance requirements of the various roofing materials that may have been used. Reference may be made in this regard to BS 5427: Part 1: 1996 *Code of Practice for the Use of Profiled Sheet for Roof and Wall Cladding on Buildings Part 1. Design*.

The principles of prevention require each designer to eliminate risk or to minimise it where it cannot be eliminated. A designer must apply those principles to the extent that it is reasonable to expect the designer to do at the time the design is prepared and to the extent that it is otherwise reasonably practical to do. The application of the principles of prevention by each designer must be an integral part of the design process at each design stage and by the design team coordinated by the PSDP. Designers need to consider not only the immediate proposed construction work but also safety during future maintenance and cleaning operations or demolition works.

Designers should be aware of technical advances within the industry which can be incorporated in their roof designs, to improve compliance with safety, health and welfare legislation. Examples of what building designers might consider include:

- How sections of the roof may, in certain cases, be prefabricated at ground level to reduce the need for working at heights.
- Elimination as far as possible of unprotected fragile areas.
- Inspection and maintenance requirements for the completed roof structure (see Section 13.2).
- Inspection and maintenance requirements of any roof mounted services which may be accessed through the roof such as air handling units, lift plant rooms etc.
- Identification and design of safe access and safe place of work for maintenance and cleaning (see Figure 4.1).
- Considering carefully the siting of plant which will require maintenance. Are there alternatives to placing it on the roof? If not, is it in the best position on the roof for the easy provision of safe access (see Section 13)?
- Considering carefully the siting of rooflights (see Figure 4.3).

Providing information relevant to construction for inclusion in tender documentation and for maintenance in the safety and health file.



Figure 4.1: Permanent walkway giving safe access on a fragile roof. (This walkway was included in the initial design).



Figure 4.2: Permanent access stairs giving safe access to different roof levels. (This permanent stair access was included in the initial design).



Figure 4.3: Lighting panels installed in the walls rather than the roof.

4.4 Examples of Positive Design Interventions.

There is a hierarchy of safeguards. The most effective precaution is to avoid or minimise working at a height. The next step is to consider whether the risk can be eliminated by the design or minimised. Priority should be given to providing collective safe design solutions, such as handrails, rather than individual protection.

Risk reduction can be achieved by designers specifying for example the use of non-fragile roofing and rooflight assemblies.

Every effort should be made to use exclusively non-fragile rooflight assembly specifications for all types of roofing systems (commercial, industrial and agricultural). The minimum appropriate standard for in-plane rooflight assemblies is Class C as outlined in the Test for *Non-Fragility of Roofing Assemblies* ACR[M]001:2005, when fitted and maintained in accordance with manufacturers' instructions.

A higher standard may be appropriate depending on envisaged access and other factors, a fact which might become apparent during a risk assessment. The rooflight assembly should have a minimum likely period of non-fragility, based on industry guidance, of at least 10 years, taking into account the likelihood of deterioration caused by the degrading effects of ultraviolet exposure, environmental pollution and the

internal or external building environment. All such factors increase the risk of a roof covering or rooflight assembly becoming fragile and this should be taken into account during the design of the building. Guidance should always be obtained from the current relevant roofing industry or rooflight industry publications. It is always prudent to regard a roof covering as if it were fragile until its true condition can be ascertained.

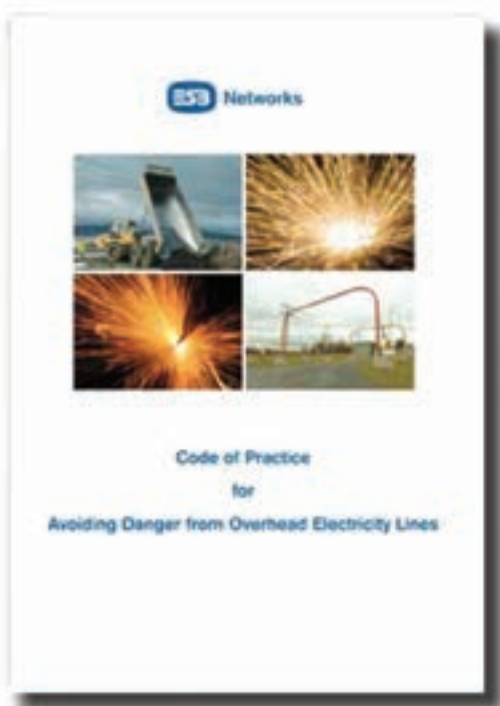
Perimeter edge protection should, where practicable, be incorporated during the design process, for example, by incorporating a parapet around the building. However, the ever increasing number of designs employing new styles of roofing (e.g. curved and highly visible roofs) means parapets may be viewed as interfering with the desired shape of the building.

Perimeter edge protection is desirable for roof construction and maintenance. Where edge protection is provided it must:

- Be of sufficient dimensions, strength and rigidity for the purposes for which it is to be used and be otherwise suitable.
- Be so placed, secured and used as to ensure, so far as is practicable, that it does not become accidentally displaced. And
- Be so placed as to prevent, so far as is practicable, the fall of any employee, or any material or object from any place of work.

If permanent edge protection is not included in a roof design, the designer should consider how the installation of temporary edge protection could be included in the design. In the case of industrial roofs this might include the design of anchorages of a strength suitable to allow the erection of secure temporary edge protection.

4.5 Electricity/Overhead Power Lines



If there are overhead electric lines crossing the site, or near the site, there may be danger to workers during the construction of the roof or to maintenance personnel accessing the roof in future.

The building designers need to consider at an early stage changing the footprint of the building or relocating lines to eliminate or mitigate the risk of contact during construction and maintenance. Designers should also advise the client of the necessity of contacting the owner of the overhead lines (generally the ESB Networks) with a view to arranging diversion, if possible, of the lines before commencement of construction or as early as possible in the construction phase of the project. Starting this process at the earliest opportunity will benefit safety on site. In addition it may minimise delays on site.

Additional guidance is provided in the joint ESB and HSA *Code of Practice for Avoiding Danger from Overhead Electricity Lines*.

4.6 Flat and Low Pitch Roofs

Access to these roofs is often simple and because they are flat, it is easy to walk around on them. Accidents can occur, not just to roof workers, but also to other persons, for example, engineers, surveyors, caretakers, etc. As stated above, the first priority is to eliminate the risk from the design, for example by specifying adequate in-built edge protection. Designers should consider the alternatives available for their effectiveness in preventing falls, as well as for their cost, aesthetic quality and construction qualities buildability.

Walkways, where appropriate, should be clearly marked on flat and low pitch roofs.

4.6.1 Edge protection

The following is a list of edge protection options in order of effectiveness. A designer should give priority to the higher levels of protection and only when these cannot be achieved consider lower levels of protection, such as fall arrest systems.

- Designed parapet (see Figure 4.4).
- Preformed sockets to support temporary edge protection guard-rails.
- Permanent protected walkway for access to plant and maintenance on the roof.
- Tightly controlled access if permanent edge protection is not reasonably practicable.
- Anchorage points for fall arrest or fall prevention systems.
- Running line systems designed, installed and tested to the relevant standards (see Appendix C).



Figure 4.4: Parapet edge protection included as an integral design feature.



Figure 4.5: Permanent guard-rails retrofitted during refurbishment work. Similar protection can be included during initial designs.

4.6.2 Nets and other collective fall arrest systems

Consideration should be given as described in Section 3.4 above to the provision of fixing points to the underside of structural members to facilitate the fixing of safety nets. Depending on the type of construction, it may be more appropriate to use other collective fall arrest systems and the design should facilitate their use.

4.6.3 Access routes

Routes for maintenance purposes across roofs should be designated by the design. This should ensure that there is:

- Continuity of edge protection.
- Unobstructed access, including the provision of bridge-ways for crossing ducts, pipes and other obstructions.
- Non-slip surfaces.
- Provision of fixings for fall arrest systems that meet technical standards.

Designers should consider the provision of permanent ladders and gantries as an alternative to temporary access or mobile access.



Figure 4.6: Examples of permanent access ladders and gantries.

4.7 Industrial Roofs

The most important issue for designers is how to eliminate unprotected fragile roofs. They should consider carefully the potential to eliminate or reduce this hazard.

Whatever rooflight and roofing sheet systems are used, the assembly should be non-fragile Class C (minimum) to ACR[M]001:2005.

The safety file should include relevant information from the supplier, such as:

- Test results on the initial material strength.
- The effects of ultraviolet radiation on material properties.
- Fixing specifications, including type, number and position of the required fixings.
- Maintenance and cleaning requirements.

Precautions should be taken to prevent unauthorised access to fragile roofs. This will normally involve people at work, but the likelihood of unauthorised public access may need to be considered as well, particularly by children. A risk assessment is likely to require signs warning of the hazard and prohibiting access except under controlled conditions (e.g. governed by a permit-to-work regime). Permanently fixed ladders can be blocked off by boards whenever access is not required.

Agricultural buildings are a specific subsection of industrial roofs (see Section 9.2.10).

4.7.1 Rooflights

Designers should consider carefully the potential to eliminate or reduce the hazard posed by rooflights. The decision on whether to include rooflights should take account of the risks during construction and the risks when access to the roof is needed later (e.g. during maintenance or cleaning).

Where in-plane rooflights are required, every effort should be made to include only non-fragile rooflight assembly specifications to Class A, B or Class C (minimum) as outlined in the *Test for Non-Fragility of Roofing Assemblies* ACR[M]001: 2005, when fitted and maintained in accordance with manufacturers' instructions.

The rooflight assembly should have a minimum likely period of non-fragility, based on industry guidance, of at least 10 years, taking into account the likelihood of deterioration caused by ultraviolet exposure, environmental pollution, and internal and external building environments. It should be noted that certain types of rooflight assemblies have predicted periods of non-fragility considerably in excess of 10 years and this should be considered when rooflight assemblies are being specified.

Other methods for design in accordance with the principles of prevention with regard to rooflights are, where practicable, to:

- Specify translucent sheets in the vertical wall of a building rather than in the roof.
- Specify the fitting of rooflights which are designed to project above the plane of the roof and which do not lend themselves to being walked upon. These reduce the risk but they should still be capable of withstanding a person falling on to them (see Figure 4.7).
- Protecting rooflights (e.g. by means of mesh or grids fitted below the rooflight or between the layers of a built up rooflight (see Figure 4.8); the mesh or grid installation should itself meet the minimum specified non-fragility (to ACR[M]0001:2005) classification when tested).

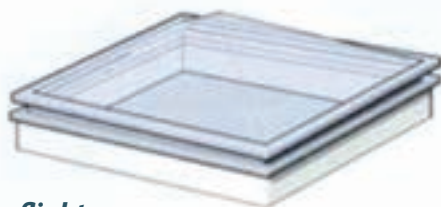


Figure 4.7: Typical out of plane rooflight



(a)



(b)

Figure 4.8: (a) Galvanised mesh reinforcement between sheets of twin skinned rooflight and (b) guard-rail fitted over a rooflight.

In-plane rooflights should not, where practicable, extend within 2 metres of valley gutters or within 2 metres of frequently used roof access routes or roof ridges (particularly in the case of hipped roofs). Where this is not practical, the designer must carry out a risk assessment when considering the location of rooflights and specify appropriate measures to be put in place to control the risk presented by them.

4.8 Roofing Assemblies

The safest option for roofing is to specify a non-fragile roof assembly. The criteria for non-fragility should be Class A, B or C (minimum) as per the *Test for Non-Fragility of Roofing Assemblies* ACR[M]001:2005, when fitted and maintained in accordance with manufacturers' instructions, taking account of the likelihood of deterioration caused by ultraviolet exposure, environmental pollution and internal and external building environment. This should be the case unless there are very particular reasons that dictate the use of other roof assemblies. These reasons should be clearly documented.

There are usually times during the laying of a built up roof (and other roof types) when coverings are fragile, for example, when not fully fixed. Designers of roofing systems need to consider this carefully and should aim to eliminate or minimise this condition. The specification of individual components (e.g. the thickness and profile of liner sheets) and, of equal importance, the fixing method, should be assessed with this in mind.

Falls through fragile roof covering, including liner sheets can be prevented by design in addition to carefully developed systems of work. In all roofs, the point at which all roof elements become non-fragile at that span (the number and quality of fixings, use of reinforcing materials, etc) needs to be absolutely clear for the combination of components used. The implications of any changes in specification should be clearly identified.

4.9 Roof Maintenance

Designers can help reduce the amount of work done at height throughout the life of the structure (refer to Section 10.3 and Section 13). For example, they could:

- Increase the maintenance-free life of roof elements.
- Locate plant and equipment at low level wherever possible. And
- Design gutter detailing with a view to reducing blockages and reducing the need for maintenance.

4.10 Designing Trussed Roofs

When designing trussed roofs designers can contribute to safe working by:

- Designing the permanent bracing so that it can be fixed from as safe a place as reasonably practicable.
- Designing the temporary bracing in the same fashion.
- Designing temporary slinging points and, as appropriate, lifting attachments which allow truss bundles to be unslung from a safe place (e.g. the eaves scaffold).
- Considering the possibility of trusses being assembled into complete roof structures or modules on the ground and lifted into position.
- Specifying slinging points for such temporary assemblies.

As with other types of roofs, this approach requires coordination by the PSDP and the PSCS between all designers involved, and also where appropriate between designers and installers.

05: ROLE OF THE PROJECT SUPERVISOR CONSTRUCTION STAGE (PSCS)

5.1 Introduction

Project Supervisors for the Construction Stage are the key players in setting practical on-site safety standards and coordinating the implementation of these standards.

The PSCS should:

- Coordinate the provision of adequate fall prevention/protection for personnel involved in roofwork or working on the roof. This will involve in most cases collective fall protection and secure edge protection being installed before installation of the roof and, as necessary, before and during other works on the roof.
- Ensure that the overall work programme gives adequate time for work to be done safely by those carrying out the roofwork taking account of anticipated weather conditions.
- Allow time to consider method statements and to deal with the implications of design changes.
- Coordinate the preparation of a work programme which reflects the need to control access to areas below roofwork where there is danger of falling materials.
- Specify clearly in the safety and health plan the resources allocated to control and manage risks such as falls from height.
- Coordinate the forwarding of relevant information to the roofing contractor.
- Coordinate CSCS records for Roofer Sheeter/Wall Cladders or Built up Roof Felters, as appropriate.
- Handover information to the PSDP for inclusion in the safety file on completion of the works.
- Coordinate measures to ensure that ground conditions are sufficiently stable and level for the safe use of mobile elevating work platforms or other types of platform as appropriate.
- Have a system in place to check that contractors and their employees are fully trained to handle the products being fitted.

5.2 Safety and Health Plan

The PSCS is required to coordinate the implementation of safe working practices on site. To facilitate this he or she should ensure that an adequate construction phase safety and health plan, prepared in accordance with current Health and Safety Authority guidelines, is in place before construction starts. The plan needs to set out how the work is to be done and the precautionary measures that are to be taken.

Site-specific safety-method statements can usefully form the basis of the construction phase safety and health plan. They are drawn up by individual contractors rather than the PSCS. The PSCS should examine contractors' method statements. He or she should be satisfied that these are relevant for the work in hand. It is not acceptable for the PSCS to merely specify that method statements be drawn up. He or she needs to establish an effective system for reviewing method statements which will enable the coordination of the implementation of safe working procedures on site (see Appendix A).

The PSCS is required to coordinate the implementation of the requirements set out in the construction phase safety and health plan and to take the necessary action to remedy matters if risks are not being effectively controlled.

The safety and health plan should also address precautions and procedures to be implemented with regard to fire in roofwork. (See Section 11.6 and *Fire Safety in Construction Work* HSG168).

Where it is not possible to avoid working at a height or to eliminate that risk in the design, the most effective precaution is to provide a safe place of work. This can be in the form of a safe working platform with physical safeguards such as guard-rails, toe boards, and barriers. This protects everyone on the platform and does not rely on people following a system of work or using special equipment which needs training to be effective. Harnesses for fall protection are low on the list specified by the principles of prevention because collective fall protection is a superior solution. If the PSCS has reason to believe that a decision taken by a designer during the design process will necessitate the use of harnesses where collective measures could have been implemented, he or she should refer that decision back to the designers through the PSDP to allow the designers to include collective protection.

06: ROLE OF CONTRACTOR AND OTHER PERSONS

6.1 Introduction

Under the Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (Construction) Regulations 2013, contractors/employers are required to avoid work at height where possible. If it is not, they must:

- Prepare site-specific safety statements that are relevant to the work being done. The safety statements would normally include specific method statements.
- Ensure that they and their employees are competent to carry out the work safely.
- Cooperate with the PSCS in implementing the construction stage safety and health plan.
- Ensure that all employees have received appropriate necessary training.
- Provide adequate supervision on site to ensure that the control measures outlined in the site specific method statement are implemented and to take appropriate action to ensure compliance.
- Consult with all employees and be satisfied that all persons carrying out roofwork are made fully aware of the safety and health measures involved in the work and make arrangements for the supervision of all the elements of the site specific method statement.
- Have a system or a nominated person in place for reporting defects or problems on site which may endanger the health and safety of their employees.

This fleshes out the general requirement for employers to provide:

- A safe place of work.
- Safe plant and equipment. And
- Safe systems of work.

Employers are also required to ensure that the safety of others, in particular members of the public, is not at risk from their work activities.

The roof itself should be erected in accordance with the relevant building regulations. At the time of writing the relevant regulations are the Building Regulations 1997–2013 (See Appendix for list of Regulations) There is also a set of 13 Technical Guidance Documents, A to M:

- | | |
|---|---|
| A | Structure |
| B | Fire Safety |
| C | Site Preparation & Resistance to Moisture |
| D | Materials & Workmanship |
| E | Sound |
| F | Ventilation |

G	Hygiene
H	Drainage & Waste Water Disposal
J	Heat Producing Appliances
K	Stairways, Ladders, Ramps and Guards
L	Conservation of Fuel & Energy (Dwellings)
L	Conservation of Fuel & Energy (Buildings other than Dwellings)
M	Access and use

Additional information on the building regulations can be obtained from the Department of Environment, Community and Local Government Internet site at www.environ.ie.

Generally materials should be fixed in accordance with the appropriate guidelines (e.g. BS 5427:Part 1:1996 and I.S. ICP2:2002 *Code of Practice for Slating and Tiling*).

6.2 Employees

Employees, including roofing and cladding workers, have responsibilities and duties under the relevant statutory provisions, in particular the Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (Construction) Regulations 2013. These include:

- Taking reasonable care of their own safety, health and welfare and that of any other person that might be affected by their acts or omissions.
- Cooperating with their employer and taking account of any training and instruction given by their employer.
- Making full use of personal protective equipment provided.
- Reporting to their employer or immediate supervisor without unreasonable delay any defects/problems on site of which they become aware which may endanger their health and safety or that of fellow workers on site.
- Not interfering with or misusing edge protection, safety nets or any other safety equipment.

07: ROLE OF SUPPLIER

7.1 Introduction

Under Section 16 of the Safety, Health and Welfare at Work Act 2005 suppliers have a duty to ensure, so far as is reasonably practicable, that items which they supply are designed, constructed, tested and examined so as to be safe and without risk to health when used by a person at a place of work. All material should be manufactured to meet the relevant EN standards or Irish standards.

Roofing materials and systems are covered by the 'EU Construction Products Regulation (Reg EU. 305/2011) (CPR)'.

CE MARKING of construction products covered by harmonised European Standards is mandatory. Manufacturers, importers and distributors have new obligations and responsibilities when placing a construction product on the market. Designers, specifiers and builders must be aware and understand the new requirements on construction products.

For information on the Construction Products Regulation see www.environ.ie.

In addition suppliers should provide information adequate to ensure that products are safely installed and used, maintained, cleaned, and dismantled or disposed of without risk to safety or health.

7.2 Technical Advances

Suppliers should closely monitor technical advances within the industry to allow them to take these in to account in the roofs they design and supply, a practice which in turn should help them comply with safety, health and welfare legislation.

Refer to Appendix F for a non-exhaustive list of technical standards, current at the time of publication.

7.3 Supplying Industrial Roofs and Components for Industrial Roofs

The most important issue for suppliers is how to eliminate unprotected fragile areas in the roof systems they supply. Whatever rooflight and roofing sheet systems are used, the assembly should be non-fragile Class A, B or C (minimum) as appropriate to ACR[M]001:2005.

The supplier if requested, should supply for use in the design and construction process and for inclusion in the safety file:

- Tests results on the initial material strength.
- Information on the effects of ultraviolet radiation on material properties.
- Fixing specifications, including type, number and position.
- Maintenance and cleaning schedule for the roof.
- Information on purlin spacing

7.4 Roofing Systems

Roofing systems should perform their function for the design life of the roof. Reference in this regard should be made to BS 5427:Part 1:1996 (see Section 4.0, Role of the Designer). The standard approach should be to specify non-fragile roof assemblies. The criteria for non-fragility should be Class A, B or C (minimum) as appropriate per the Test for *Non-Fragility of Roofing Assemblies* ACR[M]001:2005 when fitted and maintained in accordance with manufacturers' instructions. This should be the case unless there are very particular reasons which dictate the use of other materials. These reasons should be clearly recorded.

Any in-plane rooflight assembly supplied should be at least consistent with (from a non-fragility classification perspective) the properties of the general roofing system on every roof at the time of supply. The rooflight assembly supplied should normally have a minimum likely period of non-fragility (based on industry guidance) of at least 10 years, taking into account the likelihood of deterioration caused by ultraviolet exposure, environmental pollution, and internal and external building environments, though other rooflights which are predicted to have longer periods of non-fragility should also be considered if they are otherwise appropriate.

7.5 Built Up Roofs

There are usually times during the installation of a built up roof assembly when it must be treated as a fragile structure, for example when not fully fixed. Suppliers of these systems should provide information on the specification of individual components of the system and the required method of fixing to achieve non-fragility classification to ACR[M]001:2005 so that contractors can develop a safe system of work (see Section 11).

7.6 Materials Handling

So far as is reasonably practicable, suppliers should indicate the weight of items which will be manually lifted. This is to enable employers to perform an accurate risk assessment for the manual handling of loads. This is to enable employers to perform an accurate risk assessment regarding the manual handling of loads. This assessment is required under the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007).

See Section 12.8 for controlling manual handling hazards.

PART 3

STANDARD DOMESTIC DWELLINGS

08: STANDARD DOMESTIC ROOFS

8.1 Introduction

Standard domestic roofs will generally consist of traditional sloping tiled or slated roofs or flat roofs. There are hazards associated with all these types that need to be managed during the design and construction process.

The design and installation of a standard domestic roof falls under the definition of construction work and therefore all of the duties of designers and contractors under Section 17 of the Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (Construction) Regulations 2013 apply in full. Recent changes to the Construction Regulations also mean that homeowners who have construction work carried out are now clients, as defined, see also section 2.1 of this Code.

8.2 Traditional Tiled and Slated Roofs

8.2.1 Roof truss erection

A safe place of work should be provided when placing timber trusses (i.e. trussed rafters prefabricated by a specialist supplier to [I.S. EN 1995-1-1](#) or similar) on the wall plate and when fitting temporary and permanent bracing. Safe access will also be needed for fitting water tanks and services.

Prefabrication on the ground allows completed sections or whole roofs to be lifted into place by crane. This greatly reduces the need for work at height (see Figure 8.1).



Figure 8.1: Lifting pre-assembled roof into position by crane greatly reduces the need for work at height.

If you have to work at height then a safe working platform should be provided, where practicable. Where this is not practicable, collective fall protection such as nets, bean bags, air bags or other collective fall arrest systems to an appropriate standard should be used. Any equipment used to gain access to higher levels of the truss should be properly designed and stable.

Working platforms or nets can be supported by the truss members if they are stable and capable of sustaining the load. Guard-rails on platforms should be provided unless truss members provide a similar standard of protection. Work underneath should be prohibited unless effective measures are taken to protect against falling materials (see Figure 8.2).

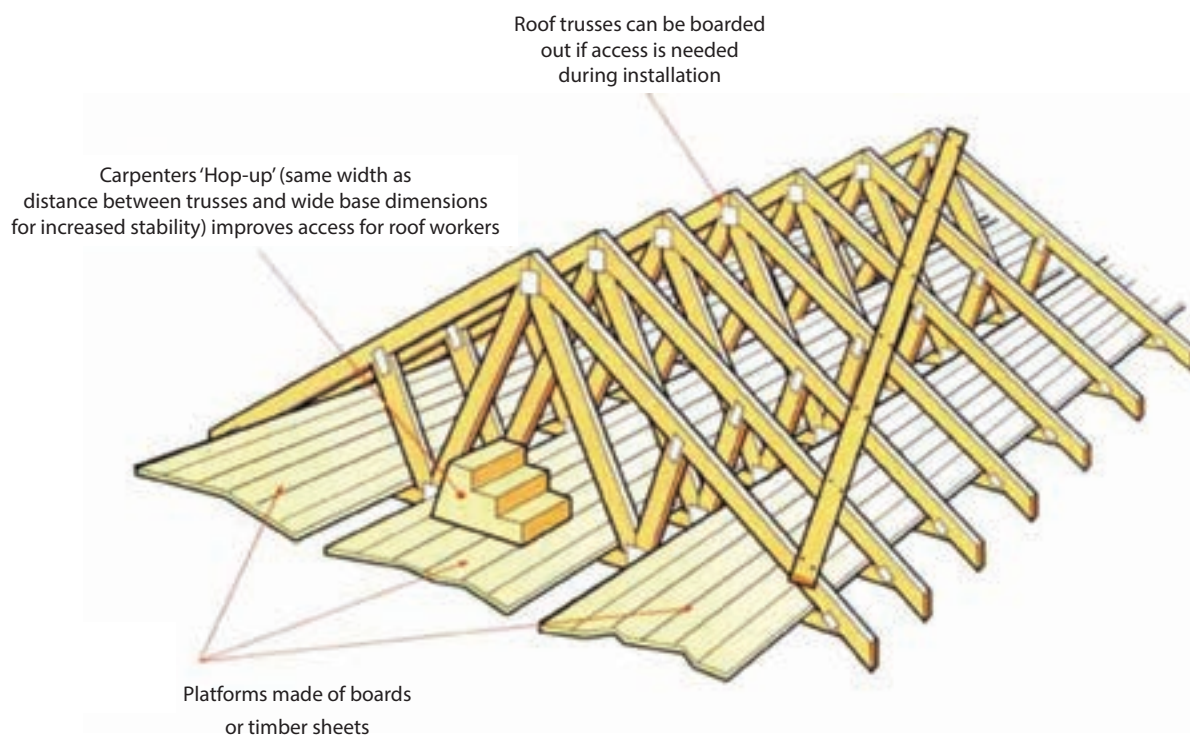


Figure 8.2: Roof trusses can be boarded if access is needed during installation (hop-up platforms can improve access).

Fall arrest equipment such as nets or harnesses should only be relied on where a working platform to the standard described above is not feasible. Where fall arrest equipment is used:

- Attachment points must be fit for their purpose.
- The risk of injury during a fall (e.g. from striking parts of the rafters or blockwork) needs to be carefully assessed.
- Working platforms should be provided in addition to the measures taken to arrest a fall.

See Appendices B and C for further information.

Trussed rafters and trussed rafter bundles should be stored so that they will be stable under foreseeable conditions (see [I.S. EN 1995-1-1](#)). If they are to be stored on a scaffold, the scaffold designers should be made aware of this. They can then consider additional loading in the scaffold design. The scaffold platform can be extended to allow for safe storage and buttressing can be included to ensure stability of the trusses.

A crane or other mechanical handling device should always be used for lifting trusses unless this is not reasonably practicable. Good planning and design will reduce the need for manual handling. For instance, site layout designs can consider the need for crane locations. Work plans can then allow for craneage areas to be clear of other activities when trusses are installed. If manual handling has to be used, then a safe system of work should be devised. Manual handling should only be used where trusses are of a suitable size and weight and where structures are no more than two storeys high. Refer to section 12.8 Ergonomic hazards for further details on manual handling.



Figure 8.3: Safety nets used to give collective protection in the erection of housing roofs



(a)



(b)



(c)

Figure 8.4: (a) Air Bags, (b) Bean Bags and (c) Decking Platform used to give collective protection in the erection of trussed roofs

Work programming should include adequate time for the supporting structure to attain sufficient strength before roof construction begins. For example, blockwork should be adequately cured. Gable

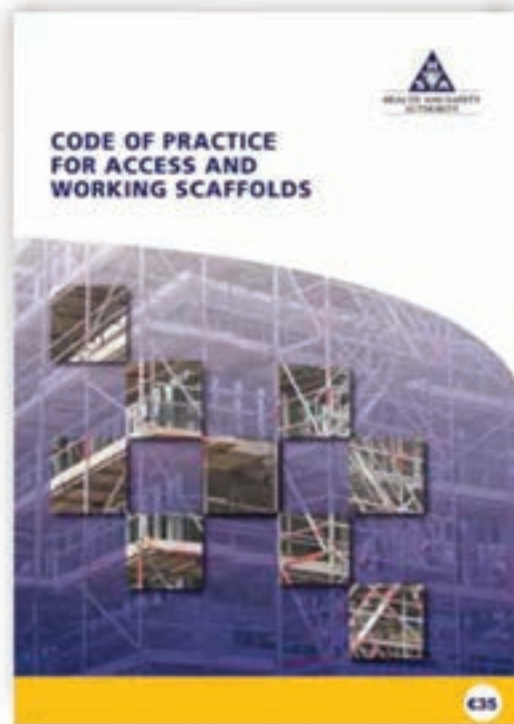
walls are usually unstable until tied into the roof assembly and can collapse during truss erection. Unless steps are taken to ensure stability, gable walls should be completed after the trussed rafter roof construction. Party wall construction in terraced units should follow the same principle unless temporary restraint is provided. Safe access for bricklayers will need to be planned for any work that cannot be done from the eaves scaffold.

8.2.2 Bracing of trusses

Operatives will be most at risk during the bracing of the trusses to ensure their stability. During this operation a platform or collective fall arrest system such as nets, airbags etc, must be in place to prevent those carrying out this operation from falling on to the floor below and sustaining serious injury. Even after the trusses have been placed they will generally be located at 400mm or 600mm centres, which still leaves the risk to roofers of falling through the trusses.

Again, a net or platform must be provided to minimise this risk. Generally, roofs of this type will have a slope. The scaffolding on the outside of these roofs must be to soffit level and the platforms must be fitted with double handrails and toe boards.

Refer to the *Code of Practice for Access and Working Scaffolds* for further details.



8.2.3 Installation of felt, battens, tiles or slates

Care must be taken not to overload the scaffolding with material such as tiles, felt and battens. They should only be loaded on the scaffold in the quantities required and should be evenly spread on the scaffolding and on the roofs. Care must be exercised to ensure that slates and tiles are not left loosely spread on roofs when there is a risk of high winds. Generally, they should only be spread in manageable quantities and they should not be left spread on the roof and unfixed overnight or for any period during windy weather.

8.3 Flat Roofs

On flat roofs, falls most frequently occur:

- From the edge of a completed roof.
- From the edge where work is being carried out.
- Through openings or gaps.
- Through fragile material.

case study

Roof worker removing dead leaves as part of snagging work on the flat roof of a school, sustained fatal injuries when he fell 4.5 metres from an unguarded edge.

Where the design of the roof does not provide permanent edge protection, temporary edge protection will normally be required, for example by means of guard-rails and toe boards that should when erected:

- Give protection during the full course of the work.
- Be strong and rigid enough to prevent people from falling and be able to withstand the other loads which are likely to be placed on them.
- Should be fixed to a structure that is capable of supporting them.
- Be designed in such a way that it is not necessary to remove them in order to work at the edge of the roof.

Temporary edge protection systems should be in accordance with I.S. EN 13374: 2013.



Figure 8.5: Temporary flat roof edge protection. Adjustable supports enable work to progress with protection in place.

Ideally, if the height of the building allows, guard-rails should be supported at ground level as they will then create no obstructions to work on the roof (see Figure 8.6). For a higher structure, they can be supported by an upstand at the edge of the roof, if this has adequate strength (see Figure 8.7). Guard-rails can also be supported by frames, counterweights or scaffolding on the roof.

Guard-rails should be capable of resisting reasonably foreseeable horizontal and vertical loadings. In any case, guard-rails should be capable of resisting a downward load of not less than 1.25kN (127kg) without breaking, disconnecting or deflecting more than 200mm and they should be capable of resisting a point load of 0.3kN (30.5kg) without an elastic deflection of more than 35mm.

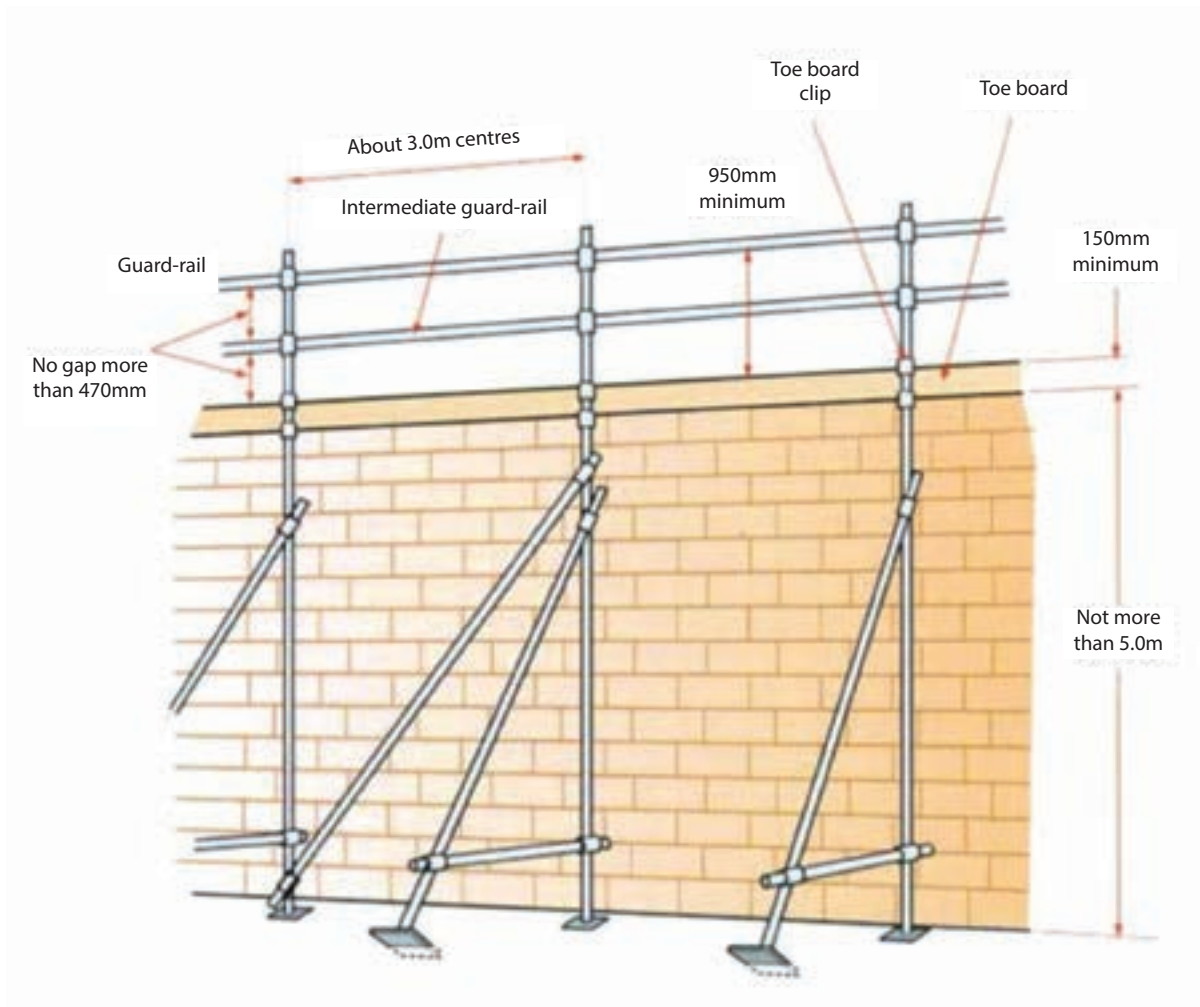


Figure 8.6: Flat roof edge protection supported at ground level. Ground level supports allow work at roof level without obstruction.

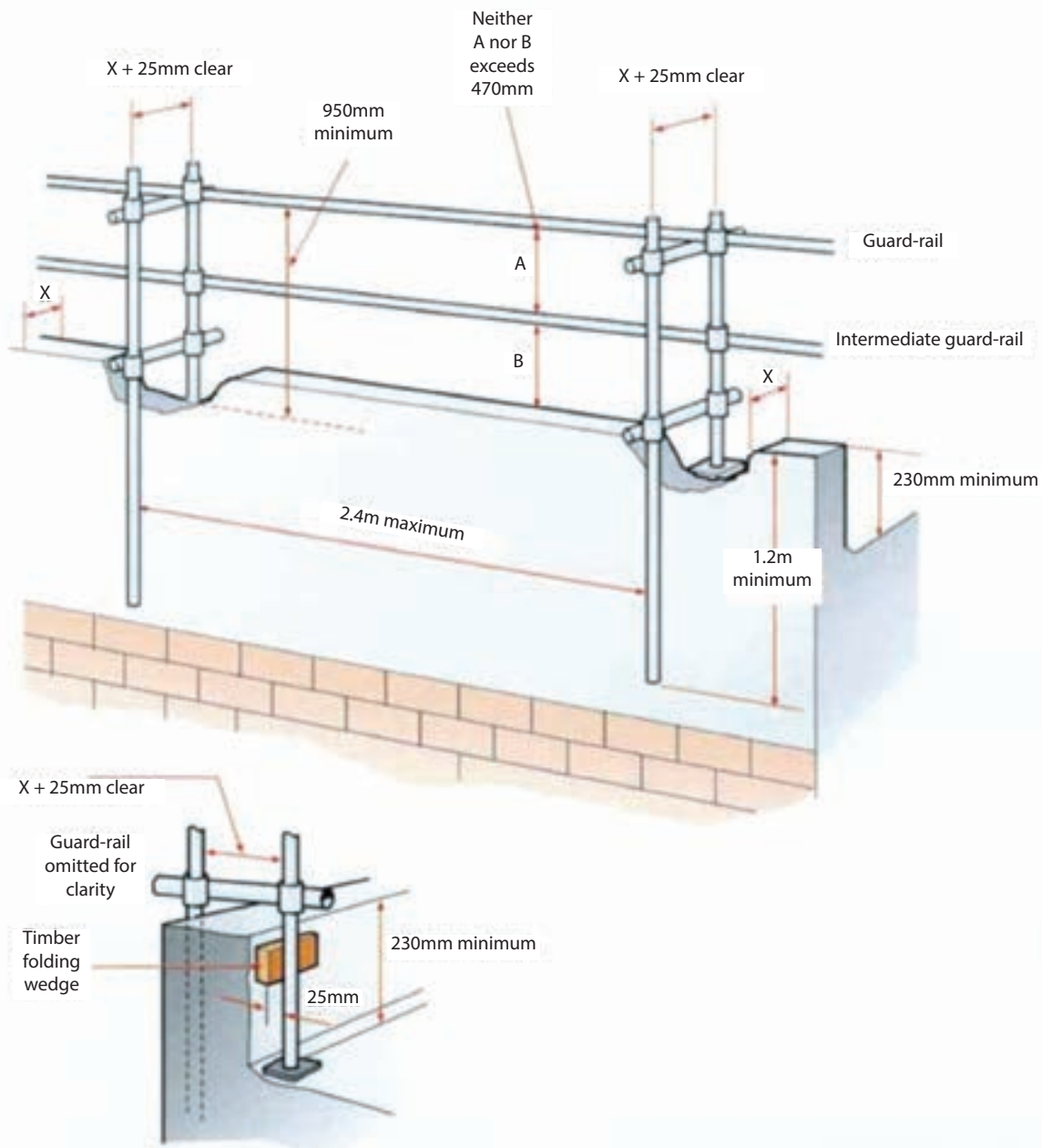


Figure 8.7: Flat roof edge protection supported on the roof edge upstand. The roof upstand must have adequate strength.

8.4 Sloping Roofs

Sloping roofs for the purposes of this code of practice are defined as having a slope greater than 10 degrees and less than 70 degrees.

On traditional pitched roofs, most falls occur:

- From the eaves.
- From the roof, typically slipping down the roof, then falling from the eaves.
- From the roof, falling internally, for example during roof truss erection or demolition (stripping) of roofs.
- From gable ends.

Falls from sloping roofs are more likely if the pitch is steep, if the surface is slippery or conditions windy. Moisture, ice, snow, moss and lichens all increase the risk of slipping.

The potential loading on edge protection when a person slides down a pitched roof onto it is much greater than when falling against it on a flat roof. Make sure that the scaffold supplier knows the roof pitch when specifying edge protection.

case study

Construction worker carrying out roof work on a single storey roof measuring 2.6m from eaves to ground level. Having completed roof battening and felting he was distributing the roof slates from a crate when he fell. Leading edge protection or other fall protective measures were not provided.

The level of edge protection provided should be determined by the risk assessment for the scope of work to be undertaken and the work environment.

A scaffold platform at eaves level provides a good standard of edge protection, a working platform and storage space for materials. Brick guards will be necessary if materials (e.g. roof slates) are stacked above toe board height. They also reduce gaps between guard-rails but need to be designed for this purpose, taking account of the pitch of the roof, and the need to be securely fixed (see Figure 8.8 below).

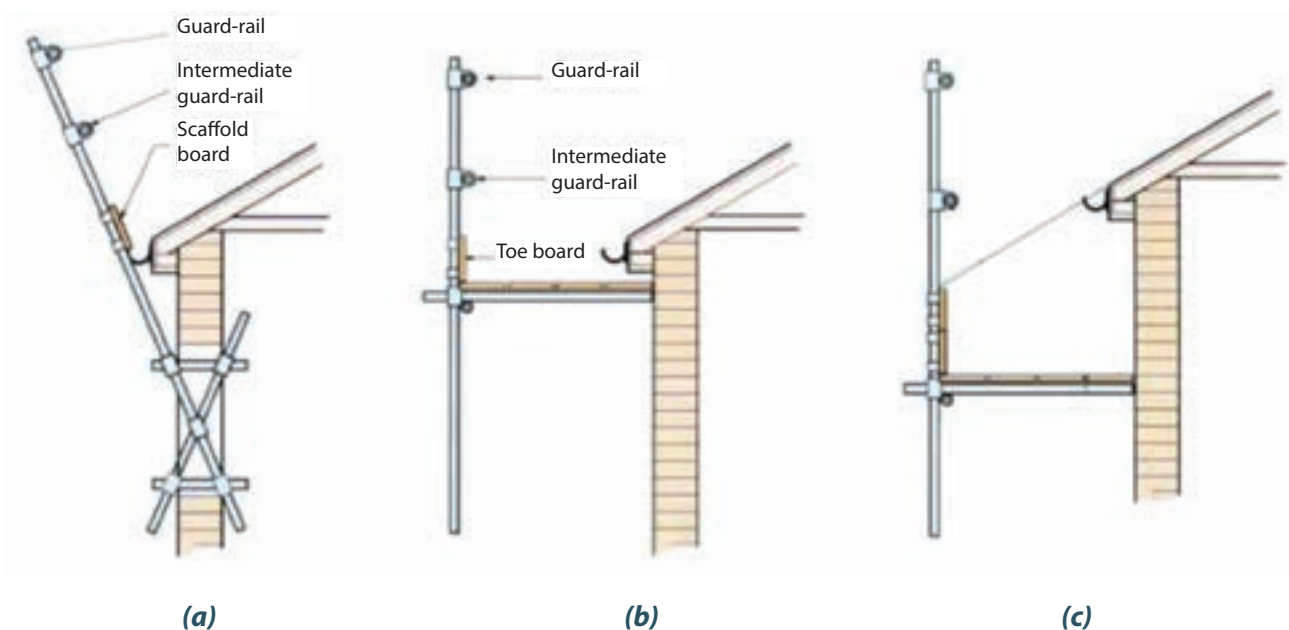


Figure 8.8: Typical sloping roof edge protection. Barriers shown in (a) can be useful where space is limited but they are not capable of sustaining loads as large as (b) and (c), which also provide a working platform.

Where independent scaffold edge protection is not reasonably practicable, barriers can be attached to the structure instead. Barriers must be high enough and strong enough to stop a person who is rolling or sliding down a roof slope (see Figure 8.8).

With some long, steeply sloping roofs, edge protection may prevent a fall from eaves level. But it may not prevent serious injury if a roof worker falls from a position high on the roof slope. Additional precautions may be required (e.g. work platforms cantilevered out from an independent scaffold). If this is not practicable, then fall arrest or fall prevention systems may be appropriate (see Appendix C). In all cases, the edge protection should be designed to minimise injury as well as to prevent a further fall. Safety netting can be incorporated into edge protection to absorb some of the energy of impact. However, netting on its own is no substitute for appropriate edge protection.

For work of short duration on a pitched roof (e.g. replacing a few tiles or slates) the decision on whether or not to erect edge protection will depend on a number of factors (see section 13.5).

For work on chimneys, a properly designed chimney scaffold should be used (see Figures 8.9 and 8.10 overleaf).



Figure 8.9: Chimney scaffold



Figure 8.10: Proprietary system for access to roof and chimney.

8.5 Solar Panels

Solar panels are becoming an increasingly common installation in domestic dwellings.

The National Standards Authority of Ireland (NSAI) has published a Building Services Code of Practice – Part 2: Thermal Solar Systems.

This publication gives recommendations for the design, commissioning and maintenance of solar water heating systems for domestic buildings.

It is generally recommended that solar panel systems should be given maintenance at least every three years or at intervals recommended by the manufacturer.

CIBSE have a design and installation guide for solar panels. This provides additional guidance on managing risks associated with solar panels.

Solar panels fall under the provisions of the Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (Construction) Regulations 2013. Accordingly designers should ensure, so far as reasonably practicable that the solar panels are designed to be safe and are capable of being installed and maintained safely. Similarly the contractor installing the solar panels and the person maintaining the panels should ensure that they are carrying out these tasks safely.

Sustainable Energy Ireland maintain a registered list of products and installers, under the Greener Homes Scheme.



8.6 Maintenance

Undertaking any work on a roof is hazardous including roof maintenance work..

Roof maintenance includes upkeep and repair of the roof and would include the following activities:

- Cleaning of the roof and gutters.
- Repairing or replacing damaged gutters, fascias, soffits, tiles, slates, etc.
- Repointing of ridge tiles or chimney copings.

A further example is where additional equipment is installed or maintained on the roof (e.g. satellite dishes and roof aerials).

While this type of work is often of short duration, it is hazardous and the appropriate controls must be identified and implemented.

PART 4

COMMERCIAL INDUSTRIAL AND AGRICULTURAL BUILDINGS

09: COMMERCIAL AND AGRICULTURAL BUILDINGS

9.1 Introduction

Generally roofs can be split in to two broad categories: industrial roofs and traditional tiled or slated roofs. Roofs can be categorised also in accordance with their pitch (i.e. flat roofs with a slope range of 0 degrees to 10 degrees and sloping roofs with a slope range of 10 degrees to 70 degrees).

Industrial roofs will generally be fitted to warehouses, factories, large retail units, etc. These are generally steel framed, with roof cladding which can be:

- Built up on site from liner sheets, insulation and top sheet.
- Built up on site from structural decking, insulation and a weatherproof membrane.
- Factory assembled insulated panels which are laid as a single layer, for example, composite panels.

Roof pitches are usually low (10 degrees or less) although steeper pitches are used for some applications.

This section explains the hazards characteristic of different roof types and the precautionary measures required to deal with them.

9.2 Commercial and Industrial Roofs

9.2.1 Systems of work

The system of work needs to include all stages of the job, including delivery of materials (see Appendix A). Simply loading out the frame with packs of sheets, as delivered, leads to workers travelling around the roof, past open edges, to get the correct length of sheet.

In drawing up the system of work, the following commonly occurring incidents should be kept in mind and appropriate control measures should be recorded where applicable.

Falls during industrial roofing commonly occur:

- Through fragile rooflights.
- Through other fragile roof covering.
- Through gaps in the partially completed roof.
- Through liner sheets which are not fully fixed.
- From the leading/working edge.
- From the edge of the roof or the gutter.
- From the frame (e.g. when loading out roof sheets).

9.2.2 Ways of minimising travel on the roof

Ways of minimising travel on the roof include:

- Use of lifting equipment to deliver materials to the working position or to loading bays.
- Providing access points convenient to the working positions (see Figure 9.1).



Figure 9.1: Access point to roof convenient to working position.

- Splitting packs of roof sheets to produce mixed packs in correct sequence for fixing.
- Back loading sheets onto the completed (load bearing) sections of roof (See Figures 9.2(a) and 9.2(b))



Figure 9.2(a): Delivery of sheets to roof level onto the completed load-bearing section and behind the leading edge. (Note the rooflights include mesh protection rendering the assembly non-fragile.)

Figure 9.2(b) Scaffold loading bays can help to reduce the movement of materials on the roof. Suitable barriers should be provided to prevent falls at the open edge when loading is not taking place.

Plan safe working positions and the means of access to and from those positions. Do not forget people who accept and unslung loads and who deliver sheets to the working position. For example:

- Provide working platforms on the roof, fitted with guard-rails and toe boards.
- Use mobile access equipment.
- Use safety nets or other collective systems.

It is not acceptable for the open steelwork or gutters to be used as the access to the place of work without taking further precautions against a fall.

9.2.3 Weight of material

The weight of material on a roof should be limited to the amount that the structure can carry safely. Galvanised purlins can twist and collapse under heavy loading. Sheets should be lashed to prevent their being dislodged or blown away. If necessary, stops should be used to prevent them slipping.

9.2.4 Perimeter edge protection

Falls from the edge of the frame can be prevented by edge protection. If permanent edge protection has not been specified and erected at an early stage then this is usually provided by an independent scaffold or barriers connected to the frame. An independent scaffold gives a higher standard of protection and also a good standard of access along the structure. It also assists material loading and storage, for example when used with a fork lift or telehandler.

9.2.5 Built up roofs

Lining out the roof as quickly as possible in order to 'weather proof' the shell means the roof workers have to return in a second pass to lay the insulation and top sheets. The PSCS and roofing contractor should consider how this approach affects safe systems of work. If it is used, they need to highlight that of metal, fibre cement and rooflight liners will be in a state of temporary fragility. Adequate resources need to be allocated to achieve a safe system of work (e.g. by the use of safety nets).

9.2.6 Roof openings

Falls through openings (e.g. for smoke vents) are a common cause of serious injuries and death. Designers can help by eliminating or reducing the number of openings. If there is a need for openings in the roof, the use of safety nets or other suitable equipment should be considered at the tender stage by the PSCS to protect both the gaps and the leading (working) edge.

9.2.7 Leading edge protection

Controlling risk of falls at the leading (working) edge needs careful planning. The hierarchy of protection methods should be considered:

- Temporary barriers at the leading edge (e.g. trolley systems).
- Birdcage scaffolds or walk-on platforms.
- Safety nets or other collective fall arrest systems.

Because openings are created during industrial roofing, fall arrest will almost always be required in addition to working platforms. Safety nets are the preferred solution for fall arrest in this situation. They give the roof workers maximum freedom of movement, provided that they do not work beyond the boundary of the nets. They can be installed in such a way as to minimise fall distances (see Appendix B). They are effective where design details such as hips make other safety systems complex and difficult to manage. In a fall involving a safety net the chance of injury is reduced as compared with a similar fall using a harness or involving a birdcage scaffold. Nets protect not just the leading edge, but also openings, fragile areas, etc (see Figure 9.3).



Figure 9.3: Industrial roofwork: Use of safety nets.

Temporary barriers will be needed to control access to areas where fall arrest or fall prevention systems have to be worn. Where running line systems are relied upon, access to the roof (e.g. during work breaks and at the end of the working day) need to be controlled.

Temporary leading edge devices (e.g. purlin trolleys) are available and have been widely used. If locked in position, they can provide an effective guard-rail at the leading edge when work is not in progress. The disadvantage is that installing and moving the systems can be high-risk operations. When being used as a working platform, they often provide little protection while laying and fixing sheets, as once the sheets are fixed, trolleys have to be moved, creating another gap in which to lay the next sheet.

In most situations, additional measures (usually in the form of fall arrest such as safety nets) are required to protect those using trolley systems from falling through the gap created to lay a new sheet or through fragile material such as partially fixed liner sheets.

Trolley systems rely on the alignment of the supporting steelwork and the quality of the joints between purlins for the trolleys to run freely. Attempting to free trolleys that have jammed can be dangerous (see Figure 9.4). They are not suitable where design details such as hips, dormers etc. do not allow adequate support over the full length of the trolley.



Figure 9.4: Trolleys can sometimes become difficult to move which can force operators into dangerous positions

Where trolleys are used:

- There should be a safe system for installing and/or assembling them on the roof specified in the method statement.
- The trolley attachment/locking system should be appropriate to the purlin design.
- A safe system for moving trolleys should be established.
- The joints between the purlins must allow the trolley to slide freely. Even minor misalignment can cause the trolley to jam and lead to unsafe systems of work.
- There should be a safe means of access to the trolley.
- When used as edge protection, the trolley must always be locked in position so that it can resist the overturning moment of a person falling onto the guard-rail.
- If there is risk of falling from the end of the trolley (e.g. at an unprotected ridge) a suitable barrier should be provided.

9.2.8 Fragile roofs

Fragile roof accidents are not inevitable. Careful planning, suitable equipment, competent workers and a high level of supervision can prevent them.

Assume that the roof is fragile, unless confirmed otherwise by a competent person.

Falls through fragile roof covering cause many fatal accidents in the construction industry. These deaths occur both during construction and maintenance and involve a range of fragile roof covering.

A person must not pass across or work on or from roof covering which is liable to fracture if his or her weight (or the person's weight plus the weight of anything he or she is supporting or carrying) were to be applied to it and if it is so situated that if it were to be fractured the person could fall a distance liable to cause personal injury. A risk assessment must be performed if work is to be done on or adjacent to fragile roofs and the appropriate control measures must be recorded and implemented. Depending on the circumstances, such control mechanisms may involve railing off the fragile area, the use of adequately supported crawling boards, ladders and duck-boards or doing the required work from a mobile elevating work platform or other secure platform.

Assessment of fragility by a competent person needs to take account of real life conditions as well as theoretical conditions. For example, the decision on what constitutes an acceptable minimum distance between fixings and the edge of the sheet should take into account foreseeable errors in positioning at any underlap). Selecting roof covering which does not depend on the number or quality of fixings avoids these factors. This is particularly relevant to liner sheets and rooflights in built up roofs.

Some roof products have been identified as fragile or have failed under the weight of a person, so you should not assume that the existing roof is non-fragile; for example here are some roof coverings which have failed fragility tests in the past:

- Rooflights.
- Liner sheets on built up roofs.
- Unreinforced fibre cement sheets.
- Glass (including wired glass).
- Wood wool slabs.

Falls through fragile roof covering are a particular problem in building maintenance. Everyone with responsibility for this type of work, at whatever level, should treat fall prevention as a priority. This is particularly important for small, short-term maintenance and cleaning jobs.

The long-term solution to this problem lies with designers and their clients specifying non-fragile roof assemblies in new and refurbished structures (see section 2.1). However, the problem will remain in existing buildings for many years. Workplaces will also have to deal with temporary 'fragility' of partly fixed roofs, and deteriorated and damaged structures. The practice of temporarily fixing fragile roof coverings and supporting structures should be avoided. Clients or occupiers should consider a permit-to-work system to control access to roofs with fragile coverings.

If possible, work should be arranged so as to avoid working on or passing near fragile roof areas. If this is unavoidable, it is essential to identify all fragile areas and decide on and implement stringent precautions. This applies to all operations on the roof, whether construction, maintenance, repair, cleaning or demolition (see Figure 9.5).



Figure 9.5: Cleaning a fibre cement roof using a self-contained water fed brush unit. There is no need for access onto the roof sheets and the guard-rails prevent workers falling onto them. (Note: waste water is filtered before disposal).

Some roof coverings can give a false sense of security to those who are working on or passing by them. They may be capable of carrying some distributed load, giving the impression that they can bear a person's weight. But they might NOT carry a concentrated load (e.g. the heel of a person walking, or a person stumbling and falling).

For example, asbestos and other unreinforced fibre cement sheetings are liable to shatter without warning under a person's weight, even when newly installed. Such sheeting will also become more brittle with age. A common but fatal belief persists that it is safe to walk along the line of the roof bolts above the purlins. This is walking a tightrope: one false step or loss of balance can lead to disaster. It should NOT be assumed that double skin roofs are safe: each layer can fail independently.

Plastic rooflights discolour with age. In the past, they may have been painted to reduce glare, making them very difficult to identify. In some cases, insulation has been applied to the exterior of a roof which has substantial load bearing capacity, but which also contains fragile rooflights. This results in the rooflights being obscured. In roofing surveys, look out for signs of repair, etc (see Figure 9.6) which might disguise fragile parts of a roof.



Figure 9.6: *In some light conditions it is difficult to distinguish the rooflights from the metal sheets on this type of roof. Also the valley gutter is very narrow and rooflights extend down to gutter level. Both of these features increase the risk during cleaning maintenance and refurbishment.*

The fragile parts should be clearly marked and the information recorded and included in any safety and health file for the building or any permit-to-work/access system for the roof. Warning notices should be erected at access points (see Figure 9.7).



Figure 9.7: Typical fragile roof warning sign

Wood wool slabs are liable to fracture beneath a person's weight. The following would normally be treated as fragile:

- Wood wool slab less than 75mm thick without nylon net reinforcement.
- Wood wool slab with a nylon net reinforcement but less than 50mm thick.
- Wood wool slabs which are wet or have been damaged previously.
- All straw board slabs, but especially those affected by water.
- All slabs where it is not possible to determine either their condition or the specific type which has been used.

9.2.9 Preventing falls through fragile roof areas

In some situations the structure supporting the roof covering may deteriorate so much that the roof can become 'fragile' and might fail catastrophically. In such a situation (e.g. where timber deterioration is a possibility) a thorough survey is essential.

Prior to commencing work on a roof that maybe fragile, the contractor should undertake a thorough risk assessment, taking into account the condition of the roof, the environment around the building, the operation of the building and the access arrangements. The risk assessment should detail the proposed control measures that must be implemented before work commences.

A safe working platform on the roof, and safe access to the working position must be provided.

To prevent falls through existing fragile roof covering:

- Platforms or coverings **MUST** be provided and used to support the weight of any person **ON** fragile roof covering.
- Guard-rails or coverings are required to prevent a person who is passing or working **NEAR** roof covering from falling through.

Stagings (of a minimum 600 mm width) fitted with guard-rails can be used where the roof pitch permits. There should be a sufficient number available to allow the work to be carried out safely. Operators should not have to continually move stagings to progress over the roof.

Depending on the situation, a combination of ladders, crawling ladders, crawling boards and duck boards may also be used when work is to be carried out adjacent to fragile roof covering.

Where it is not practicable to maintain guard-rails on both sides of the staging, other precautions will be required, for example:

- Safety nets and other collective fall arrest systems (see Figure 9.8). These give maximum freedom to workers on the roof and can protect people working below (e.g. in a refurbishment project). See Appendix B.
- Birdcage scaffolds.



Figure 9.8: Safety netting providing protection for rooflights during minor roofwork.

Fall arrest or fall prevention systems can also form part of the system of work. They rely on operator training and a high level of supervision. The quality of the attachment system is critical. There are also minimum heights below which the system will be ineffective. In this case, a person may hit the floor before the restraint is fully operational. See Appendix C for further guidance.

Precautions must also be taken to prevent falls from roof edges and working leading edges.

Where a valley or parapet gutter is used for access, precautions should be taken to prevent a person falling through fragile roof covering in an adjacent roof. Where access along gutters is necessary on a regular (even if infrequent) basis, then permanent protection should be provided. Where practicable, this should provide collective rather than individual protection. Fixed covers, for example, are preferable to running line systems (see Figure 9.9).

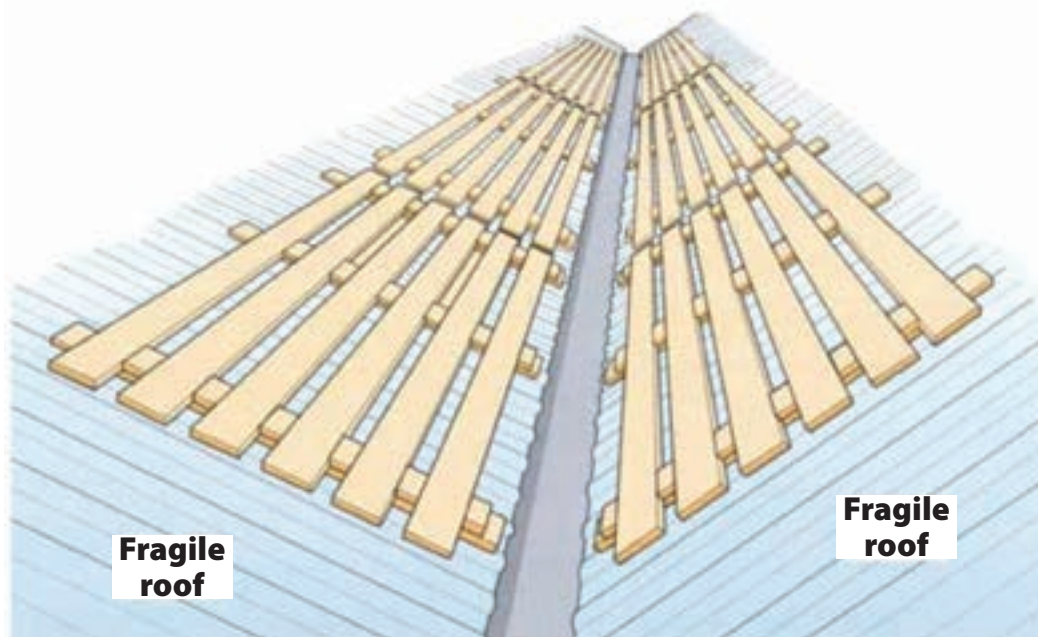


Figure 9.9: Permanent protection installed at valley gutter. (The protection should be supported by at least 3 rafters beneath the roof sheets.)

Covers should extend far enough up the roof to provide protection to anyone falling against them. This is normally up to 2 metres, depending on the roof pitch: shallower pitches will require more extensive coverage than steeper ones. Remember that protection such as safety nets or a birdcage scaffold is needed when covers are being installed and removed. Valley gutters which are overhung by roof sheets so much that there is not enough space for a person's feet should not be used for access along the roof. It should be possible to clean the gutters without removing walkways or covers.

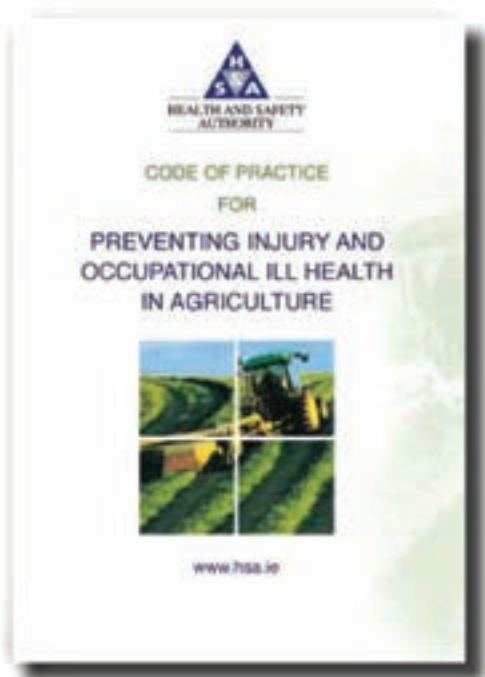
Rooflights should not extend within 2 metres of valley gutters. Where fragile rooflights have already been fitted in this position and access is needed, permanent protection of the rooflights should be considered.

Precautions should be taken to prevent unauthorised access to fragile roofs. This will normally involve people at work, but the likelihood of unauthorised public access may need to be considered as well, particularly by children. A risk assessment made under the Safety Health and Welfare at Work Act 2005 is likely to require signs warning of the hazard and prohibiting access except under controlled conditions (e.g. governed by a permit-to-work/access regime). Permanently fixed ladders can be blocked off by boards whenever access is not required. Figure 9.7 illustrates a suitable sign which should be fixed at the approaches to roofs with fragile roof coverings.

Such signs should be durable, securely fastened and properly maintained. Any signs used should meet the requirements of the Safety, Health and Welfare at Work (General Application) Regulations 2007 Part 7 Chapter 1 Safety Signs. Such signs are NOT an alternative to a designer's duty to eliminate hazards from his or her design where possible and to apply the general principles of prevention to it. Their function is to warn of dangers on existing buildings and where the load bearing properties of the roof coverings are unclear because of ageing, etc.

9.2.10 Agricultural building roofs

These roofs are a specific subsection of industrial roofs in general.



The requirements stipulated earlier for industrial roofs and roofs in general (with the proviso noted in Section 9.2.11) also apply to agricultural roofs.

These include collective fall protection as given by nets to the standard outlined in Appendix B. However, statistics suggest a high level of fatal and non-fatal accidents occur because of falls from or through existing roofs on agricultural buildings and those under construction.

Contributory factors to these falls are a lack of awareness of the hazards involved in these type of roofs, and the inexperience of those accessing the roofs for construction, maintenance and repairs and dismantling of roofwork. Section 1.4 shows that seven people have been fatality injured carried out roofing activities in the agricultural sector. A large portion of these fatalities occurred whilst carrying out repair work.

A key to the management of safety in agricultural roofwork is the preparation of an adequate risk assessment which outlines the measures required to control the risks associated with the work. Guidance is available in the *Code of Practice for Preventing Injury and Occupational Ill-Health in Agriculture*.

These risk assessments, as in other industrial roof construction, should identify the methods of access and egress from the workplace which will minimise travel on the roof, the various materials used in the process of installing a roof and whether they be fragile or non-fragile and the various methods of controlling the risk of falls at the leading (working) edge. They also should take into account the life-span of the structure inasmuch that elements of the roof will need to be maintained and may need to be dismantled to accommodate future changes/adaptations to the building as a whole.

The planning at pre-construction stage, whilst examining the various risks associated with the different activities, should also take into account the competence of the personnel linked to the project, for example:

- That the designer designs a building that can be constructed and maintained safely.
- That the contractor builds the roof in accordance with a safe system of work. And
- That the end user is competent to implement the maintenance requirements.

The designer of agricultural buildings should only specify materials that are consistent with the non-fragile assembly criteria set out in other Sections of this document (except as noted for spaced roofs).

case study

A part time retired farmer fell 9m through Perspex sheeting when he was cleaning his shed with a power hose.

Useful guidance on certain materials suitable for agricultural buildings may be obtained from the Department of Agriculture, Fisheries and Food's web site: www.agriculture.gov.ie.

The construction of new agricultural roofs has similar characteristics to that of other industrial buildings and those characteristics have been identified earlier in this Section.

A key area associated with agricultural roofs is the level of natural light which enters the building and which is regarded as beneficial for animal welfare and storage of foodstuffs. The practice in the majority of agricultural buildings has been to provide natural light by the use of fragile rooflight assemblies. This code of practice and the principles of prevention as outlined in the Safety, Health and Welfare at Work Act 2005 (and other initiatives within the industry) requires designers to only specify (except as noted in 9.2.11), assemblies that are non-fragile. These specifications are Class A, B or C (minimum) as appropriate in accordance with the *Test for Non-Fragility of Roofing Assemblies* as mentioned earlier in this code.

9.2.11 Spaced roofing

The use of spaced roofing as a means of providing controlled ventilation is necessary in certain forms of agricultural building. This system of roofing is specified as essential for certain building circumstances in the Department of Agriculture, Fisheries and Food's Minimum Specifications for the Structure of Agricultural Buildings S102.

The nature of this roof system, which involves leaving continuous gaps beside individual roof sheets, means that the requirements of ACR[M]001:2005 for non-fragility may not be met and that, this roof assembly must be treated as fragile. Thus, the required warning notices and access precautions outlined in Section 10.2.2 must apply for this form of roof assembly.

This code of practice recognises that while the installation of spaced roofs in agricultural buildings does not meet the standard of Class A, B or C in ACR [M]001:2005, it will lead to the greater longevity of the roofing materials. However, the materials used for this type of assembly should be of in equivalent specification to materials used to give a non-fragile assembly if the roof is not in the spaced roof configuration.

10: MAINTENANCE

10.1 Introduction

Maintenance is included in the definition of construction work and therefore all of the duties of client, designer and contractor apply. Refer to the HSA *Clients in Construction – Best Practice Guidance* and the *Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013* before undertaking maintenance work on a roof or procuring a maintenance contract.

Many accidents occur during maintenance and cleaning of roofs. This work should only be carried out by experienced operatives who are competent at working at height safely (see Section 14).

A high proportion of deaths are caused by falls through fragile roof covering. Any work on fragile roofs, however trivial it may seem, should be carefully assessed, planned and supervised. Factors to be taken into account when assessing the risk include:

- Rooflights which may have been obscured by paint.
- Any repairs carried out in the past, especially if fragile roof sheets have been used for 'patching' an otherwise non-fragile roof (such practices are highly dangerous).
- Metal roof sheets which may have deteriorated with age and become fragile.
- Wood wool slabs which may have been weakened by water damage.

A good survey, together with local knowledge, will help to identify such problems. If in doubt, assume the roof is fragile. The precautions described for working on or near fragile roof covering should be rigorously followed, whatever the size of the job.

A typical example is the cleaning of valley gutters on an asbestos cement roof or a roof containing fragile rooflights. Systems are available to provide long-term protection for these regular operations and should be considered for existing roofs.

All persons accessing roofs for maintenance purposes should wear suitable nonslip safety footwear and high visibility vests, and avoid trailing rain-proof clothing. The alternative is to provide extensive temporary protection for each operation. This can be less cost-effective and its use requires rigorous supervision (see Figure 10.1).



Figure 10.1: Access systems for short-term maintenance work on a fragile roof

10.2 Roof Maintenance

On existing buildings, the hazards associated with maintenance must be considered. This is particularly the case for maintenance done on roofs or on plant and equipment mounted on roofs.

The hazards associated with such maintenance must be identified and the risks assessed. If the risks cannot be eliminated the control measures to minimise the risk must be recorded. During maintenance the possibility of fire must also be addressed.

10.2.1 Maintenance of fragile rooflights

Every year a number of accidents occur which involve falls through fragile rooflights during maintenance. Anyone who controls a workplace in which workers are vulnerable to falls through fragile rooflights must ensure that a warning notice is affixed at all access points to those lights.

Refer to Section 9.2.8 for further details.

The person in control of the place of work where personnel are exposed to such risks must consider the feasibility of replacing fragile rooflights with non-fragile rooflights. If this is not reasonably practicable other options must be evaluated such as preventing falls by installing mesh or grid supports underneath or over the rooflights.

10.2.2 Maintenance of fragile roofs

There are still many roofs in use which could fracture when subjected to a person's weight or a person plus a load. These roofs must not be accessed by anyone unless a written risk assessment has been completed and a safe system of work document has been drawn up.

The fragility of any such roof should be clearly signposted at all access points and any person accessing the roof must be made aware of its fragile properties. Signs warning of the roof fragility must be installed. Such signs are not an alternative to eliminating risks but must be installed if the elimination of the risk is not reasonably practicable.

If access must be gained adequate supports must be put in place. Such supports include properly supported crawling boards, adequately supported ladders and frames or similar measures. Standing on the line of fixing bolts is not a safe method of work or a safe method of access and should not be relied upon for support.

10.2.3 Plant and equipment

Plant such as air-handling units, chillers etc. are routinely placed on the roofs of buildings. The maintenance of such plant must be considered, not only by the employer of the personnel undertaking maintenance of the plant but also those in control of the workplace, where the plant is located.

If the edge of the roof does not have significant protection, plant should not be located close to it. If plant is already located close to an edge, and maintenance of this plant must be carried out, the risk to the maintenance personnel must be assessed. The employer of the maintenance personnel must liaise with the person commissioning the maintenance to assess if moving the plant is reasonably practicable. If moving the plant to a safer area is not reasonably practicable a safe system of work must be in place to minimise, as far as reasonably practicable, the risk to the maintenance personnel. Generally, the employer of the maintenance personnel will need to liaise with the person or persons in control of the roof to put in place a safe system of work. The person commissioning the work must cooperate with the maintenance personnel and their employers to eliminate risk as far as is reasonably practicable.

If plant is located away from an open edge, or can be relocated away from it, an exclusion zone may be established, depending on the nature of maintenance work being done. Such exclusion zone should prevent personnel having to go within 2 metres of an edge.

Note: An exclusion zone will probably involve external parts of the plant, which must be maintained or accessed, being located a distance of more than 3 metres or more from any open edge. Cages should also be installed on ladders on plant, if the height of the plant warrants their installation.

10.3 Designing for Maintenance on New Buildings

Maintenance of roofs, and maintenance work on roofs, must be considered during the design process of a project. The designers should first, as noted in Sections 3 and 4, ensure that unnecessary risks for future maintenance personnel are excluded from the design. If personnel will be accessing the roof then handrails should be designed and installed, if practicable. As outlined in Section 10.2.3, the location of plant and equipment must be considered during the design process and should be positioned in such a way as to minimise the risk of personnel being injured or killed from falls.

Proposed safe maintenance strategies, where relevant, must be included in the safety file, which is given to the client after completion of the project. The safety file must include the input from designers and the PSDP, as necessary, on the designing of safe maintenance.

Sections 3 and 4 set out in more detail the role of the designers and PSDP in designing to appropriate standards for the safety of maintenance operations.

PART 5

WORKING SAFELY

11: WORKING SAFELY

11.1 Introduction

This section outlines issues for working safely on roofs. It sets out how to create a safe place of work, including safe access and egress for operatives, as well as how to move materials to and from the roof. Irrespective of the work activities to be undertaken on the roof, safe systems have been developed and are available. When planning the work, you should consider the work environment and assess the risks involved. This section will help you identify appropriate controls to put in place before work starts.

11.2 Creating a Safe Place of Work on the Roof

For all roofwork, whatever its nature or extent, a safe place of work should be provided.

Risk assessments and safety method statements should identify working positions, access routes (both to the roof and along the roof) and show:

- How falls are to be prevented
- How danger from falling materials to those at work below and to the public is to be controlled.
- How risks to health will be controlled.
- How other risks, identified at planning and survey stages, are to be controlled, for example handling hot bitumen.
- What equipment will be needed.
- What skill, knowledge, relevant experience and training is needed.
- Who will supervise the job 'on site'.
- How other occupational hazards, such as lone working, will be controlled.
- How changes in the work will be dealt with without prejudicing safe working.
- Who will check that the system is effectively controlling risk (see Appendix A for further details).

case study

Workers were using a home-made, unsecured person-basket on the forks of a teleporter to access the roof of an industrial unit. The person basket had been prohibited from use by the HSA two weeks earlier. When Inspectors arrived on site for a return visit, workers lay down on the roof in an attempt to hide. As there was no safe means of egress from the roof these workers had to be evacuated from the roof by the fire brigade. A High Court order was sought and granted to close the entire site. Site remained closed for over two months. Company had to pay 75% of the High Court costs.

11.3 Fall Arrest Systems

Fall arrest systems do not prevent falls, but they can reduce injury once a fall has happened. There are two basic types:

- Those that give general protection (e.g. safety nets).
- Those giving individual protection for example fall arrest or fall prevention systems attached to a suitable anchorage point. (This should only be considered as a last resort, when all other collective protective systems have been considered).

All fall arrest systems must be properly installed and maintained by a competent person (see Appendices 2 and 3 for further information).

Safety nets, once properly rigged, are considered one of the best forms of fall arrest available and can protect everyone within the area of the net. They also allow maximum freedom of movement on the roof. They should be installed beneath the working position and as close as possible to reduce the potential fall distance. They are particularly suited to open span structures such as portal frame buildings with minimum obstructions.

Fall arrest or fall prevention systems should only be used when all other forms of collective protective measures (e.g. handrails) have been deemed to be impracticable. The fall arrest components need to be suitable for the individual, who should be trained to fit and use them. They only protect an individual when they are used and when properly fitted and only while they are attached to a suitable anchorage point. There must be enough clear space below the work position to allow the fall to be arrested safely (see Appendix C).

There must also be an effective system in place to rescue anyone whose fall has been arrested by the fall arrest system. This will include a safe system of work to retrieve the casualty as soon as possible to prevent injury from suspension trauma.

I.S. EN 365: 2006 provides specific guidance on the use of fall arrest equipment, including instructions for use, maintenance, inspection and repair.

11.4 Openings in the Roof

Openings are often left in the roofing system for vents, rooflights, glazing etc. These may be left out in some cases for follow on trades to work on at a later stage. In this situation temporary covering for these openings should be dealt with in the safety and health plan.

case study

A roofer was completing a roof. There were safety nets in the last bay that was being completed. However, other safety nets had been removed, in particular from under from under 1.2 metres openings in the roof. The worker fell through the unprotected opening and down a distance of 3.5 metres. The worker suffered serious injury.

11.5 Safe Access to the Roofs

Safe access to the roof requires careful planning, particularly where work progresses along the roof. Typical safe means of access are:

- Independent scaffolds.
- Fixed or mobile scaffold towers.
- Mobile access equipment.
- Ladders.



Figure 11.1 Providing safe access and a safe working platform at roof level (source Office of Public Works, National Monuments).

11.5.1 Mobile access equipment

There is a wide range of mobile elevated work platforms (MEWP). For work of short duration, such as inspection and minor maintenance, a MEWP can provide safe access to the roof. Risks associated with scaffold erection can often be avoided if mobile access equipment is used rather than scaffolding. However, the equipment chosen should be appropriate for the ground conditions on the site and suitable ground conditions should be in place before this type of equipment is used. The manufacturer's advice on the maximum wind speed at which it can be safely operated should be followed. Equipment should be maintained in a safe condition and be operated only by competent trained personnel.

11.5.2 Ladders

Ladders may provide safe access, but their use is not always appropriate. Factors to be considered include:

- The length of the ladder required. Very long ladders are heavy to handle and may need staying to reduce flexing in use.
- The need to carry materials, small components, tools, etc. Both hands should be free when climbing a ladder.

When ladders are used, they need to be of the right type (a suitable grade of industrial ladder). They should be in good condition and effectively secured to prevent movement. Permanent means of securing ladders at identified access points can improve ladder safety. Those who use, inspect and secure ladders should be competent to do so.

The HSA have published an [information sheet on using ladders safely](#).



11.5.3 Roof ladders

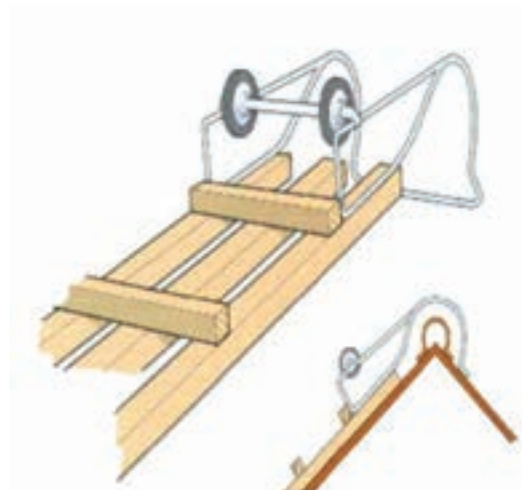
On most sloping roofs, suitable roof ladders or crawling boards will be essential, in addition to edge protection. Where a high standard of edge protection is provided, it may be safe to work without a roof ladder. This may apply if the pitch is shallow and the surface provides a particularly good foothold. The decision in each case should be based on a risk assessment.

Roof ladders or crawling boards should be:

- Designed and fabricated to be fit for purpose.
- Strong enough to support workers when spanning the roof covering.
- Long enough to span the supports as appropriate.
- Secured or placed to prevent accidental movement.

The anchorage at the top of the roof ladder should be by some method which does not depend on the ridge capping as this is liable to break away from the ridge. The anchorage should bear on the opposite slope by a properly designed and manufactured ridge iron or be secured by other means (see Figure 11.2).

Figure 11.2 Roof ladder. The ridge iron should be large enough to clear the ridge tile.



Eaves gutters should not be used as a footing or to support a roof ladder.

As an alternative to roof ladders, timber battens used for slated and tiled roofs can provide a reasonably secure foothold provided that:

- They are of good quality.
- They are sufficiently sized and spaced to allow a secure foothold.

The age and condition of exposed battens should be examined before they are used for footholds.

A roof ladder will always be required at some stage (e.g. towards the end of the job when the battens are covered by slates or tiles).

11.6 Escape in the Event of Fire

The PSCS/Contractor should also consider how to coordinate escape from the roof in the event of fire. This must be adequately addressed in the safety and health plan.

A fire could result from:

- Construction work on a roof (e.g. welding or hot work using bitumen). Or
- Activities inside a building including those involving refurbishment.

In either case the means of escape must be adequate. How complex this needs to be depends on the level of risk of being trapped if there is a fire. It could mean, for example, ensuring that mobile access equipment is always available in case of an emergency, or the provision of additional (tied) ladders.

Further guidance is given in the HSE booklet *Fire safety in construction work: Guidance for clients, designers and those managing and carrying out construction work involving significant fire risks HSG168*.

11.7 Materials Handling

Well planned materials handling has a significant impact on roofwork safety. For example, it can:

- Minimise the amount of time spent working at height.
- Reduce the amount of travelling around the roof to collect materials.
- Reduce injuries caused by handling heavy and unwieldy components (e.g. roof trusses).

It can also increase productivity and reduce waste.

Detailed solutions are available in Section 12.8 and Appendix E.

11.8 Mechanical Handling

Sufficient resources should be allowed to ensure that cranes or other mechanical handling devices are available when needed.

Code of practice for safety in roofwork

Where small lifting appliances such as a gin wheel, gantry hoist or scaffold hoist are mounted near the edge of a roof, suitable guard-rails and toe boards should be installed. This safeguards those using the appliance from falling.

Lifting appliances of this type need a secure anchorage. When counterweights are used they must be adequate to allow a safety factor of not less than three. If the lifting appliance is a gin wheel, an allowance for the force exerted by the person who is raising the load should be made (see Figures 11.3).

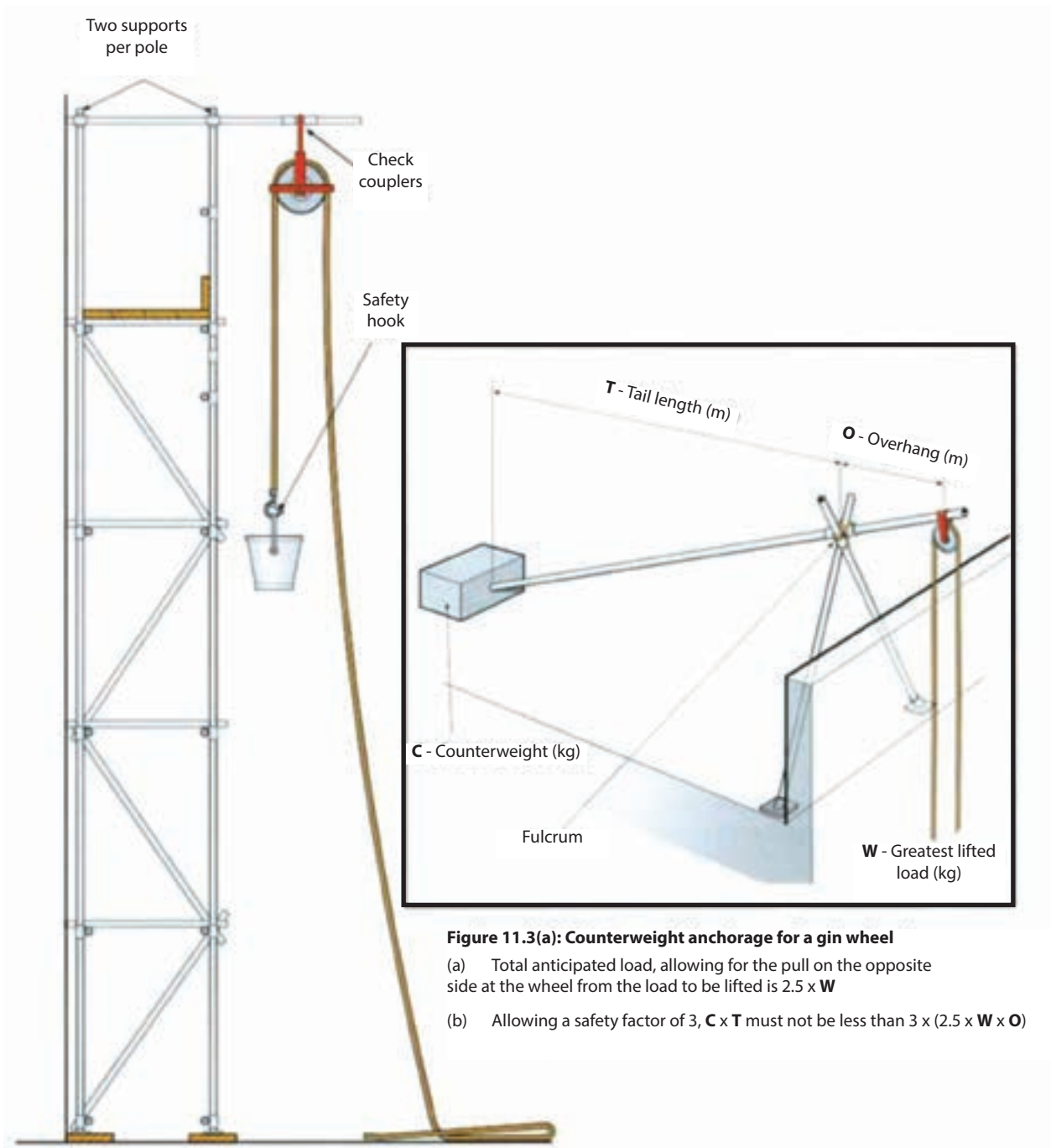


Figure 11.3: Properly erected gin wheel

Counterweights should be secured to the tail of the appliance so as to prevent removal or interference. Rolls of felt, blocks of bitumen, etc, which are liable to be removed and used in the roofing operation, should not be used as counterweights.

Where practicable, guard-rails and toe boards should be maintained in position when material is being raised or lowered. If, in exceptional circumstances, they must be removed, any person who needs to be near the edge (e.g. signalling or assisting in moving the load) should wear a safety harness attached to a suitable anchorage point (see Appendix C).

All hooks used in lifting operations should be fitted with safety catches.

Every lifting appliance should be properly installed, maintained and inspected and operated at all times within its safe working load. Access to the area below a lifting point should be controlled (e.g. by providing an exclusion zone).

11.9 Falling Materials

Other workers and the public are at risk when materials such as roof sheets, fixings, tools, roof tiles, roofing felt and hot bitumen fall from roofs.

Access by other trades needs to be controlled when roof workers are working overhead and there is risk of falling materials. This should be considered in the programming of overlapping work packages. Exclusion zones should be considered where work is carried out below roof workers; alternatively effective measures will be required to prevent injury, such as the provision of a birdcage scaffold or suitable debris netting (see Figure 11.4).



Figure 11.4: Debris netting in addition to safety netting may enable work to be carried out safely below roof workers

11.10 Weather Conditions

Adverse weather conditions need to be kept in mind and suitable precautions taken. Rain, ice or snow can turn a secure footing into a slip hazard. A roof should always be inspected before work starts to see if conditions have changed and to check whether it is safe to work. A sudden gust of wind can lead to loss of balance. Roof sheets and, in some circumstances, roofing felt should not be fixed in windy weather as people can easily be thrown off balance while carrying a sheet up to or on the roof. Also, material should be secured to prevent the hazard of wind borne flying debris causing injury to workers or members of the general public.

When deciding whether to continue or suspend work consider:

- Wind speed.
- The measures which have already been taken to prevent falls from the roof.
- The position and height of the roof and the size of the material being handled.
- The materials being used (e.g. those with a large surface area that could catch the wind and be moved or fall from the roof).

An anemometer should be available to measure wind speed on the roof if large sheets are being handled (see Figure 11.5).



Figure 11.5: Using an anemometer to check wind speed at roof level.

Guidance on work in windy conditions has been published by the U.K. National Federation of Roofing Contractors (www.nfrc.co.uk). This guidance includes recommended maximum wind speeds for particular roofing and cladding operations.

Sites should be inspected at the end of the working day to ensure that loose materials, especially sheets, off-cuts and fixings, are not left on the roof.

11.11 Electricity and Roofwork

If there are overhead electric lines crossing the site, or near the site, there may be danger of a contact or near contact with, for example, scaffold tubes, metal roof sheets or ladders, which could cause flashover.

Designers need to consider changing the footprint of the building or advising the client to organise the relocation of lines to eliminate the risk of contact during construction and maintenance. If, during the construction phase of a project, overhead lines which cause risk have not already been relocated the PSCS should coordinate the arrangements for an application to be made in writing for lines to be diverted. If the lines cannot be diverted then the lines must be switched off for all work involving a risk of direct or indirect contact.

Use of portable electrical tools can create hazards. For example, metal roof sheet edges can damage cable insulation. All electrical supplies to portable tools should be obtained from properly constructed and installed plugs and sockets of the industrial type. Where possible, battery operated tools should be used. If this is not practicable, a reduced low voltage system, (sometimes referred to as 111 volt centre tapped to earth (CTE) system) should be used for all portable equipment with a rating of 2 kV A or less. All electrical equipment should be properly installed and maintained. See Regulations 74–85 of the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016, the Health and Safety Authority Guide to those Regulations and the recommendations of the *Code of practice for the distribution of electricity on construction and building sites* (BS 7375: 1996).

11.12 Safe Loading

Excessively heavy materials stored on roofs can give rise to dangers from overloading roof structures. The capacity of the roof to sustain such local loads should be confirmed with the designers and included in the safety and health plan.

11.13 Protecting the Public

The public may be at risk from falling materials during roofwork. Precautions should always be taken to prevent materials falling where they may cause danger to anyone. This is particularly important where members of the public pass close to or below roofwork. Adequate control measures should also be in place to prevent materials being blown by the wind and putting workers and the general public at risk. These include removing loose materials from the roof or tying down items that could become airborne.

Precautions are also needed to prevent people from being struck by any materials or tools that may fall and cause injury. Birdcage scaffolds and debris netting can both be used to retain falling materials. Whatever system is chosen, it should be capable of retaining whatever is likely to fall. If material is stacked on a scaffold platform above the height of the toe board, proprietary brick guards will be needed to prevent material falling on to other workers or the public below. Where the public pass below or near to the scaffold then scaffold fans, tunnels or similar arrangements may be required.

Material may also fall through gaps in the working platform or between the working platform and the building. Sheeting, combined with a second layer of scaffold boards or plywood sheets, can be used to prevent this (see Figure 11.6). Care should also be taken not to overload the scaffold. Any additional loading/alteration to standard configuration should be incorporated into the scaffold design. If there is any risk of drips of hot bitumen falling from the roof edge, physical protection or barriers at ground level may be necessary.

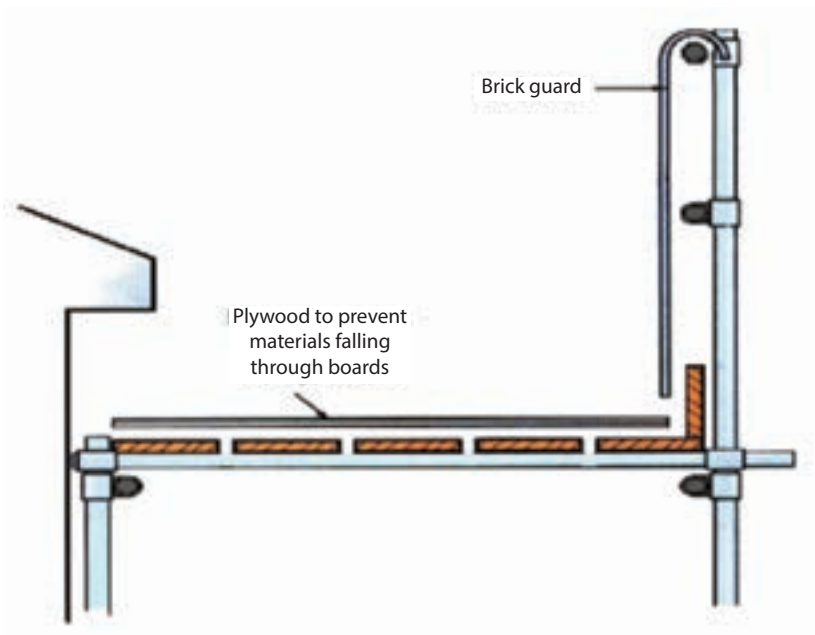


Figure 11.6: Suitable protections where the public could be at risk from falling objects or materials.

Special precautions will be necessary where children may be put at risk (e.g. at or near schools or play areas) to keep them off scaffolding etc. Where possible, planned roofwork in school buildings should be done during non-class times such as school holidays.

Waste materials such as old slates, tiles etc, should never be thrown from the roof or scaffold. They should be lowered in skips or baskets designed for the purpose which will not spill material if snagged. Alternatively, enclosed debris chutes can be used. Chutes should be closed off to prevent their use when the skip below has been removed. Skips should be covered where necessary to protect the public from dust and flying materials (see Figure 11.7).



Figure 11.7: Waste chutes make waste handling easier and safer.

Materials should not be hoisted over the public. To prevent this choose one of the options below:

- A different place for hoisting should be found,(e.g. at the rear of the premises).
- Different means of raising materials may be used.
- A time may be chosen when the footpath etc, can be closed (by agreement with the local authority).

12: CONTROLLING HEALTH HAZARDS

12.1 Introduction

Health hazards in the roofing industry can be grouped under the headings of chemical, physical, biological and ergonomic hazards. Often the focus is on managing physical hazards, such as working at height, at the expense of managing other hazards. This section will focus on measures that you can take which will be suitable to deal with all health hazards and thus make the workplace safer for your employees.

12.2 Designing for Health

Before specifying a product which may be hazardous to health, designers should consider whether a less harmful product could be a reasonable option for use. If substitution is not reasonably practicable, relevant information should be included in the preliminary safety and health plan on products and/or substances causing a particular risk to the workforce or public.

For example, a designer should consider the weight and dimensions of components such as wall and roof panels, so as to minimise manual handling risks. Refer to Appendix A for examples of safe systems of work. Designers should also consider alternative substances in use in the roofing industry such as bioasphalt, a less toxic substitute to asphalt.

12.3 Welfare Facilities

Good welfare facilities should always be provided on construction sites. They are the fundamental means of controlling exposure to a number of common hazardous substances (e.g. lead).

Basic requirements are:

- A supply of hot and cold running water and soap for washing.
- Bowls/sinks big enough to allow hands and forearms to be washed easily before eating or drinking.
- Clean towels.

Further information:

- *Guide to the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016.*
- *Guide to the Safety, Health and Welfare at Work (Construction) Regulations 2013*

12.4 Chemicals

Chemicals can exist in the form of:

- Solids: dusts, fumes, fibres.
- Liquids: mists.
- Gases: vapours.

Chemicals enter the body by three main routes: the lungs, the skin, and the mouth and throat. They can also enter through the eyes, however the effects observed are usually confined to the eye rather than system-wide. Hazardous chemicals may include those used in the work process (glues, paints etc) or those generated from the work processes (waste products, dust etc). The examples provided in this document of chemicals used in the roofing industry is not exhaustive. Employees in the roofing industry may also be exposed to other chemicals in the course of their work, and the additive effect of more than one chemical must be considered during risk assessment.

The classification of chemicals is based on their physical and chemical properties (e.g. oxidising, explosive etc), their effects on human health (e.g. irritant, sensitising, specific target organ toxicity, carcinogenic, mutagenic or toxic to reproduction) and their environmental effects. All substances or mixtures that are classified as hazardous under the Classification, Labelling and Packaging (CLP) Regulation (EC No. 1272/2008) require a hazard pictogram, signal words, hazard and precautionary statements on the label. This is usually the first indication that a product is hazardous.

The Safety, Health and Welfare (Chemical Agents) Regulations 2001 to 2015 require employers to assess the risk of exposure to any chemical agent at work and to put in place appropriate control measures to reduce exposure to as low a level as is reasonably practicable.

The regulations require employers to:

- Prevent or control exposure to hazardous substances following risk assessment.
- Provide specific protection and prevention measures.
- Ensure arrangements are in place to deal with accidents, incidents and emergencies.
- Provide information, training and consultation.
- Provide health surveillance where required, and keep exposure records.

Risk assessment forms an integral part of controlling health risks. The following steps should be taken :

- Make an inventory of the substances used (solvents, epoxy resins, glass wool, etc) in the roofwork processes and those generated by the roofwork (e.g. wood dust).
- Collect information about these substances (i.e. the harm they can do and how this can happen). Safety data sheets (SDS), which must be provided by the supplier of a chemical, and labels are an important source of information.

- Assess exposure to the identified hazardous substances, looking at the type, intensity, length and frequency of exposure to workers, including the combined effects of hazardous substances when used together and the related risk. Find out if substances have occupational exposure limit values (OELVs) (*Health and Safety Authority Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2011* (S.I. No. 619 of 2001, gives the official list of OELVs).
- Evaluate the risks taking current precautionary measures into consideration, and examining possible future measures, where prevention is not reasonably practicable. For example a combination of measures including total or partial enclosure, extraction equipment, general ventilation, instructions from manufacturers, systems of work and handling procedures, and personal protective equipment (PPE) could be used.
- Document and implement findings.
- Update and review as required.

The effectiveness of the control measures must be maintained by regular inspection, testing and maintenance of plant and equipment (including any PPE). Monitoring employees using health or medical surveillance will need to take place, when required (e.g. exposure to lead). Adequate training and information about the risks and the necessary precautionary measures (e.g. controls and emergency procedures) must be given to the workforce and the risk assessment must be recorded and communicated to them.

There are a number of pieces of legislation concerned with chemical safety in the workplace. One of these is REACH (EC) No. 1907/2006, a European regulation which has been put in place to ensure better protection of human health and the environment from the manufacture, import and use of chemicals. It aims to do this in a number of ways, including the standardisation of substance information requirements and increased availability of information on all chemicals in the workplace.

Under REACH safety data sheets (SDSs) now include further information on the safe handling and use of chemicals. This extra information is included on what are known as exposure scenarios and are attached to SDSs. REACH requires employers and employees to follow the advice on risk management measures given in the exposure scenario. In order for the suppliers of chemicals to be able to assess what harm the chemicals may cause, they may need information from the users about how the chemicals are handled and used in the workplace. If chemicals are used in ways different to those cited in the exposure scenario, then the users must pass this information on to their supplier.

Further information:

- See *Guidelines to the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001* (S.I. No 619 of 2001), for further information on chemical risk assessment.
- REACH and CLP regulations information on the Health and Safety Authority's website (www.hsa.ie).
- The ECHA website (<http://echa.europa.eu/downstream>) where you will find guidance documents and fact sheets for Downstream Users.

12.5 Common Chemical Hazards

Some chemicals/substances used or encountered in the roofing industry can pose a significant risk to health. These risks can be reduced by elimination or substitution, but where this is not possible, appropriate personal protective equipment (PPE) must be used. Examples of chemicals that may be used or encountered during roofing activities are as follows.

12.5.1 Bitumen and asphalt

Bitumen is produced by the refining of crude oil (petroleum oil). It is widely used in the construction and maintenance of roads, and also in roofing construction. Bitumen itself is transported as a hot liquid (up to 230 degrees centigrade) and is mixed with aggregate and applied as a hot mix.

The chief risk associated with its use is burns as a result of accidental contact with the products. Burns from hot bitumen can be avoided by the use of appropriate protective equipment (coveralls, protective gauntlets, footwear and eye protection).

Fumes are released during the working of hot bitumen and concern has been expressed about the possible effects on health of breathing these fumes.

Bitumen, like some other oil-derived products, contains low levels of chemicals known as PAHs (polycyclic aromatic hydrocarbons), some of which are known to cause cancer. The bitumen industry is required to reduce the content of PAHs in the product to levels considered to be safe for normal handling and use. Nevertheless, care must be taken to avoid breathing in bitumen fumes during hot work, as prolonged exposure may present a risk to health.

- Bitumen products are normally used in the open air where there is good ventilation and the risk of breathing in fumes is minimised. However, particular attention must be paid to: Situations where natural ventilation is limited, that is in enclosed spaces, or where ventilation is restricted by adjacent structures, and increased levels of hydrogen sulphide can be released.
- Workers who may be required to work in close proximity to bitumen boilers.

In these circumstances, respiratory protective equipment may be needed to reduce exposure to fumes. Suppliers of bitumen products will be able to provide detailed advice on appropriate personal protective equipment to control inhalation of fumes and also to prevent contact with the skin. The Health and Safety Authority has set an Occupational Exposure Limit Value (OELV) of 0.5mg/m³ (8hr-Time weighted average) or 10mg/m³ (15 minute reference period) for Asphalt (bitumen) fumes (inhalable fraction).

Further information:

- Refined Bitumen Association (UK) code of practice at www.bitumenuk.com.

12.5.2 Glues, solvents and sealants

If hazardous glues, solvents or sealants are used (e.g. epoxy resins, polyurethanes etc) an assessment of the risks and associated control measures must be made. Possible exposure routes include:

- Breathing in associated dust or fumes.
- Absorbing through the skin and eyes.
- Ingesting (e.g. eating or smoking with contaminated hands).

Epoxy resins can cause skin sensitisation usually affecting exposed areas such as the hands, arms, face and throat, and respiratory sensitisation following inhalation. A substance causing skin or respiratory sensitisation will lead to an allergic or hypersensitive response following even minimal contact. They may also cause skin, eye and respiratory irritation.

The following recommendations are given for reducing or preventing epoxy sensitisation:

- Avoid contact with incompletely cured epoxy resins.
- Wherever possible, use one-part rather than two-part epoxies to reduce the risk of dermal contact during hand mixing.
- If using two-part or pre-mixed epoxies, choose those supplied in single or twin cartridges, or mix the two components with an automated internal mixer or dispensing equipment.
- Whenever possible, replace harmful epoxies with epoxy systems which are less likely to cause sensitisation.
- Provide proper ventilation to prevent airborne-related skin and eye contact or inhalation.
- Protect damaged skin, including even small wounds and abrasions, from epoxy compound exposure because of increased risk of skin sensitisation.
- Wear appropriate protective clothing and equipment particularly effective gloves (e.g. fluorinated rubber gloves). This should be mandatory. Respiratory equipment may also be required.
- Polyurethanes are made with diisocyanates such as MDI (Diphenylmethane diisocyanate) or TDI (Toluene Diisocyanate). Depending on the end product being made, the chemical formulations may also contain other ingredients such as catalysts, blowing agents and possibly flame retardants. These various combinations allow the manufacture of a range of product types: Rigid and flexible foams.
 - Rigid and flexible integral skin foams.
 - Elastomers.
 - Adhesives.
 - Coatings.
 - Sealants.

MDI and TDI are harmful to inhale and irritating to the eyes, respiratory system and skin and may cause sensitisation by inhalation and skin contact. . The Health and Safety Authority has set an OELV of 0.02mg/m³ (8hr-time weighted average) or 0.07mg/m³ (15 minute reference period) for MDI and an OELV of 0.001 ppm (8hr-time weighted average) or 0.003 ppm (15 minute reference period) for TDI.

Possible control measures include:

- Brush application rather than spraying.
- Ventilation to dilute or extract fumes.
- A suitable mask that will absorb vapour before it is breathed in.
- Gloves to prevent skin contact.

- Adequate and accessible welfare facilities.

It is important to note that sensitisation is non reversible.

Further information:

- European trade association for producers of diisocyanates and polyols (www.isopa.org).
- *Guidelines on Occupational Asthma* (www.hsa.ie).

12.5.3 Asbestos

Work with asbestos-containing materials (ACM) can release small fibres into the air. Breathing in these fibres can cause fatal diseases. Provided the asbestos material is intact and in good condition, and is not likely to be easily damaged or disturbed, it should not pose a risk to health by releasing fibres into the air.

Roof workers may come into contact with a number of asbestos-containing materials, some of which are listed below.

Asbestos cement products:

- Corrugated cement sheets for roofing and cladding.
- Roof tiles, slates and ridge capping.
- Flat sheeting for partitioning, cladding, and lining to walls and ceilings.
- Moulded products such as rainwater gutters, drain pipes, soffits and fascias.

Detailed guidance on removal and cleaning of asbestos cement roofs and other cement based products can be found in the Health and Safety Authority's guidance document *Asbestos containing materials (ACMs) in Workplaces - Practical Guidelines on ACM management and abatement* http://www.hsa.ie/eng/Publications_and_Forms/Publications/Chemical_and_Hazardous_Substances/Asbestos_Guidelines.pdf

Other products containing asbestos include:

- Asbestos insulation board used for ceiling tiles, partitioning board, cladding or insulation on walls.
- Sprayed asbestos on structural roof members and applied as a coating to asbestos cement sheets.
- Asbestos pipe insulation in roof spaces.

The specific legislation dealing with work with asbestos in Ireland is the Safety Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 to 2010.

The REACH Regulation (EC) No. 1907/2006 prohibits the placing on the market, the supply and use of any type of asbestos fibres and of products containing asbestos fibres.

The Health and Safety Authority has set an Occupational Exposure Limit Value of 0.1 fibres/cm³ of air (8hr-Time weighted average) for the six regulated asbestos types.

The following requirements should be considered prior to work on site:

- ACMs must be identified on site before work commences.
- Risks to health must be assessed and decisions made on what precautions need to be taken.
- Work must be planned to avoid disturbing the ACMs. ACMs should only be worked on if absolutely necessary.
- A written assessment of the likely risk of exposure of employees to asbestos and a written plan of work must be prepared.
- The Health and Safety Authority must be notified 14 days in advance if the OELV of 0.1 fibres/cm³ of air will be exceeded or other certain criteria cannot be met.
- Exposure to asbestos must be prevented or at least all must be done that is reasonably possible to keep the amount of asbestos fibres in the air to a minimum – this is achieved by using specialist asbestos contractors for all work activities involving significant risk of exposure to asbestos fibres (e.g. work with asbestos insulation board, sprayed asbestos, asbestos pipe lagging or other asbestos insulation materials). Specialist contractors must use suitable controls (e.g. enclosures, dust extraction equipment and decontamination units). The presence of sprayed asbestos coating on the inner surface of an asbestos cement roof significantly alters the risk associated with work on asbestos cement sheets.
- Information, instruction and training must be provided so that the risks and the precautions are known and understood.
- Respiratory protective equipment must be issued when necessary, its necessity explained and its correct use ensured including appropriate face fit testing and fit checking procedures.
- The selection of suitable RPE must be based on the risk assessment. All RPE must be CE marked and traceable to a European Standard.
- Suitable disposable protective clothing must be issued.
- Adequate washing facilities and suitable places for eating and drinking must be provided.
- Waste containing asbestos must be disposed of properly.

Further information

- Health and Safety Authority publication *Asbestos containing materials (ACMs) in Workplaces - Practical Guidelines on ACM management and abatement*.
- Asbestos information on www.hsa.ie.
- Asbestos information on www.hse.gov.uk

12.5.4 Silica

Crystalline silica is a basic component of soil, sand, granite, and many other minerals. Quartz is the most common form of crystalline silica.

Crystalline silica can be encountered in roofwork during cutting of roof tiles. The use of power tools for cutting roof tiles can generate high concentrations of very fine crystalline silica dust in the working environment.

Exposure to silica dust can cause irritation to the eyes, nose and throat like most other dusts, resulting in watering of the eyes, sneezing or coughing. However, inhalation of very fine (respirable) crystalline silica dust can also cause irreversible scarring of the lungs – a disease called silicosis.

Workers may develop any of three types of silicosis, depending on the concentration of airborne silica:

- Chronic silicosis, which usually occurs after ten or more years of exposure to crystalline silica at relatively low concentrations.
- Accelerated silicosis which results from exposure to high concentrations of crystalline silica and develops five to ten years after the initial exposure.
- Acute silicosis, which occurs where exposure concentrations are at their highest and can cause symptoms to develop within a timescale of a few weeks to four or five years after the initial exposure.

Exposure to respirable crystalline silica should be reduced so far as is reasonably practicable and, in any case, below the Occupational Exposure Limit. The Health and Safety Authority has set an Occupational Exposure Limit Value of 0.1mg/m³ (8hr-Time weighted average) for respirable crystalline silicate.

If it is not practicable to avoid the use of power tools, then the exposure to airborne dust must be eliminated or reduced to acceptable levels.

Priority should be given to controls that will remove dust at the source. A most effective way of reducing exposure to dust generated by power tools is by using wet methods. Tools fitted with a water supply for dust suppression are widely available and should be considered for use where practicable. Where water suppression techniques are not practicable, the use of tools fitted with dust extraction can reduce exposure at the source but often are not as effective as wet methods. Where it is not practicable to use wet methods or tools fitted with dust extraction, or where the use of such tools does not reduce exposure sufficiently, respiratory protective equipment should be used.

Further information

- See *Agreement on Workers' Health Protection Through the Good Handling and Use of Crystalline Silica and Products Containing It* www.nepsi.eu/.

12.5.5 Lead

Roof workers can be exposed to lead when carrying out hot work/cutting/joining lead materials or when removing or repairing old lead roofs. Aside from the chemical hazard posed by lead, its weight can also give rise to manual handling risks (see 12.8 Ergonomic Hazards). Roofwork can involve working with lead flashing, lead sheeting and rain water goods, and lead paint on structural steelwork.

Lead exposure can cause tiredness, abdominal cramps and constipation. Prolonged exposure can cause anaemia and nerve damage.

The Health and Safety Authority has set an Occupational Exposure Limit Value of 0.15mg/m³ (8hr-Time weighted average) for lead.

The specific legislation dealing with work with lead in Ireland is the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 to 2015. These regulations require the assessment of any work which may expose people to 'significant' levels of lead.

Further information:

- Health and Safety Authority Publication -*Safety with Lead at Work Guide*.

12.5.6 Man-made mineral fibres (MMMMF)

Man-made mineral fibres (MMMMF) include glass fibres, mineral wool (slag and rock wool), and ceramic fibres. Glasswool and rockwool are widely used as roof insulation materials.

Working with glasswool and rockwool, without precautions, can result in mechanical irritation to the eyes, nose, throat and skin. Oils and binding resins are used in the manufacture of these materials and these may cause chemical irritation. However, regular exposure to high levels of MMMF might also lead to long-term health effects.

The Health and Safety Authority has set an Occupational Exposure Limit Value of 5mg/m³ (8hr-time weighted average) for mineral wool/MMMF (excluding refractory ceramic fibres). Insulation and removal activities can create relatively high levels that may exceed the limit if suitable precautions are not taken. Airborne concentrations will depend on the degree of enclosure of the work area and the type and duration of work undertaken. It is also important to contain the spread of airborne MMMF into adjacent work areas. MMMF is currently classified as a suspected human carcinogen

When working with MMMFs such as glasswool or rockwool, protective overalls should be worn to avoid skin irritation. Suitable gloves should be tucked under overall cuffs and eye protection should be worn. Respiratory protection such as a FFP2-type disposable filtering half-mask for short, low-exposure interventions should be worn. It is important to implement additional preventive measures described in accompanying safety data sheets or other handling advice provided by the supplier.

12.6 Physical Hazards

12.6.1 Noise

Exposure to loud noise at work can cause irreversible hearing damage which may be accompanied by tinnitus, a sensation of noises or ringing in the ears. There are many noisy tasks in construction. This means that roof workers may be exposed not only to the noise that their work is making, but also to the ambient, or background, noise of other tasks on site. Some of the main sources of noise in construction are, impacting tools, explosives, pneumatically powered equipment and internal combustion engines.

Anyone who is exposed to noise is potentially at risk. The higher the noise level and the longer you are exposed to it, the more risk you have of suffering ill effects from noise. As a rule of thumb you may be at risk if you have to shout to be clearly heard by someone two metres away. If there are reasonable grounds

for believing that a roof worker is at risk from excessive noise a risk assessment needs to be made which may include noise measurements. The purpose of this risk assessment is to enable an employer to make an informed decision about whether action is necessary to prevent or adequately control exposure of his or her employees to noise in the workplace.

Roof workers should choose power tools emitting the least possible noise, taking account of the manufacturers data and should ensure that these tools and their attachments are properly maintained. Ideally roof workers should be rotated through a variety of tasks so that they are not undertaking the same noisy task for extended periods.

Suitable hearing protection should be worn by roof workers exposed to loud noise for excessive periods of time. This protection should be appropriate for the type and duration of the noise and should be compatible with other protective equipment (hard hats etc.).

Protection that reduces the noise level at the ear excessively should be avoided, since this over protection may cause difficulties with communication and interfere with the hearing of warning signals. Users may become isolated from their environment leading to safety risks and may have a tendency to remove the hearing protection and therefore risk damage to their hearing.

Further information:

- *Guide to the Safety, Health and Welfare at Work (General Application) Regulations 2007, Chapter 1 of Part 5: Control of Noise at Work (www.hsa.ie).*

12.6.2 Vibration

Hand-arm vibration is vibration transmitted into your hands and arms when you use hand-held powered work equipment. Excessive exposure to hand-arm vibration can cause hand-arm vibration syndrome (HAVS) and carpal tunnel syndrome. HAVS affects the nerves, blood vessels, muscles and joints of the hand, wrist and arm. It can become severely disabling if ignored and includes vibration white finger, which can cause severe pain in the affected fingers.

You are at risk if you regularly use hand-held or hand-guided tools and machines such as concrete breakers, hammer drills, chain saws, sanders, grinders, disc cutters, chipping hammers and needle guns.

The level of exposure to mechanical vibration may be assessed by means of observation of specific working practices and reference to relevant information on the equipment used in the particular conditions of use, including the information provided by the manufacturer of the equipment. A sensible approach to vibration assessment is to first obtain details of the equipment used and the usage time. Decisions can then be made on whether the equipment is suitable for the job and, if it is, for what length of time it can be used before the operator is exposed to excessive vibration.

Roof workers should use power tools that are suitable for the task, that are vibration insulated and that along with their attachments are well maintained, and wear gloves to keep their hands warm, thus helping to maintain circulation. Ideally roof workers should be rotated through a variety of tasks so that they are not undertaking the same vibratory task for extended periods. Users of vibration tools should be trained in the risks involved and how to minimise their exposure

Anti-vibration gloves are available commercially. But they have not proved particularly effective and should not be relied on to provide protection from vibration.

Further information:

- *Control of Vibration at Work. Guide to the Safety, Health and Welfare at Work (General Application) Regulations 2007 (www.hsa.ie).*

12.6.3 Environmental – temperature extremes

Changes in body temperature caused by extreme environmental work conditions can lead to stress or illness caused by heat or cold. If not treated in time, both heat and cold stress/illness can develop into life threatening situations.

Heavy work in high temperatures (e.g. roofwork) can cause muscle cramps, dehydration, sudden collapse, and unconsciousness.

Freezing temperatures can lead to fatigue, irregular breathing, confusion, and loss of consciousness.

12.6.4 Non-ionising radiation

Roof workers are exposed to sunlight. They are, therefore, at particular risk from the effects of ultraviolet radiation on the skin. Simple precautions can significantly reduce the risk of skin cancer, for example, suitable clothing and use of sunscreens.

12.7 Biological Hazards

Roof workers are potentially at risk from exposure (infections) to various biological agents, especially when working in older roof spaces. This exposure risk is often overlooked or underestimated.

Biological hazards may include:

- Leptospira or 'Weils' disease which is caused by a bacteria found in the urine of rats.
- Health risks associated with coming into contact with pigeon droppings (e.g. histoplasmosis, cryptococcosis, and psittacosis).

Employers are required, under the Safety, Health and Welfare at Work (Biological Agents) Regulations 2013, to assess the risk of 'incidental exposure' to biological hazards, which would include the examples above. Depending on the level of suspected contamination, it may be necessary to seek specialist advice. Good occupational hygiene practices should be implemented. These would include:

- Hand hygiene.
- Covering all new and existing cuts and grazes.
- Avoiding hand-mouth or hand-eye contact.
- Taking rest breaks and meal breaks away from the main work area.
- Wearing appropriate protective clothing.
- Disposing of all contaminated waste safely.

Employers are required to raise awareness amongst employees on measures to reduce exposure to

biological hazards by employee education and training. These measures include amongst others:

- The need to wear appropriate PPE.
- The need for employees to cover all new or existing cuts and grazes with waterproof dressings and/ or gloves before starting work.
- The need to, wash immediately with soap and running water and apply a waterproof dressing to any cuts or grazes which occur while in work.
- The need to ensure good personal hygiene.

12.8 Ergonomic Hazards

Manual handling remains widespread in the construction industry in Ireland and continues to be a causal factor in a considerable number of injuries sustained by employee. A 2009 research report produced by the Health and Safety Authority entitled *Manual Handling in the Irish Construction Industry* clearly showed that there are tasks being carried out on construction sites which expose individuals to a medium or high level of risk of musculoskeletal injury and ill health.

The report made a number of recommendations that need to be considered:

- Avoidance of manual handling tasks by eliminating features from the design which create manual handling hazards. Designers need to be aware of manual handling issues that may arise out of certain design features, construction methods or use of certain products.
- Carrying out risk assessments to identify and develop a safe system of work when undertaking a manual handling construction task. Alternative ways of working that can reduce exposure to musculoskeletal injury or ill health need to be considered including handling aids or devices and better planning of work activities to ensure that tools, product and equipment are available when and where required.

In Section 12.8.1 you will find an example of a risk assessment on handling cladding sheets which has been prepared in order to:

- Act as a guide to conducting a task specific manual handling risk assessment.
- Create awareness of the need to consider better ways of working through closer examination of construction tasks which currently require high levels of manual handling.
- Encourage construction workers, contractors and designers to seriously engage in investigating solutions that would contribute to reducing the risk of musculoskeletal injury when handling loads such as cladding sheets.

This approach can pose a challenge to the construction industry but it is a challenge that needs to be met and it will require everyone to work together in adopting a joined-up approach when planning construction projects and activities.

Lifting and moving loads by hand is one of the most common causes of injury at work. Handling heavy materials in awkward positions (e.g. lead sheets, rolls of roofing felt and long roof sheets) is a particular problem for roof workers.

Many manual handling injuries result from repeated operations, but even one bad lift can cause serious injury.

Employers are required to avoid manual handling which creates a risk of injury, particularly back injury. Where it is not reasonably practicable to avoid manual handling, employers have to carry out a risk assessment, reduce the risk of injury as far as is reasonably practicable, and give information about the weight of loads. To aid this process, suppliers should mark on their products the weights of items which it is envisaged could be manually lifted.

The Safety, Health and Welfare at Work, (General Applications) Regulations 2007, Chapter 4 of Part 2, outline the requirements that must be adhered to in relation to manual handling.

The work tasks conducted in the construction sector require people to engage in many different types of work activity. In some cases this will require a person to engage in a work practice which may involve a significant amount of physical activity. Manual handling is a physical activity which takes place in every workplace and in many cases the activity does not cause a problem; however, it is important to be aware that manual handling has the potential to be a workplace hazard where the activity requires someone to handle very heavy loads or conduct the activity in a confined space with little or no room for movement.

Traditionally there has been great emphasis placed on the need to provide manual handling instruction and training to employees working in the construction sector. This training largely focuses on the need to adopt an appropriate safe technique when completing a lifting activity. As a result of this approach little or no attention has been given to reviewing or assessing the manual handling work activities completed to determine if there are improvements that could be put in place to avoid or reduce the need for manual handling activity.

This section provides guidance on useful interventions that can be made to address the issue of injuries caused by manual handling in the construction sector.

The section aims to:

- Explain in simple and practical terms the manual handling risk assessment process.
- Illustrate through extended examples and case studies how a manual handling risk assessment can be completed.

12.8.1 The manual handling risk assessment

As a first step it is important to conduct a walkthrough of the site and put together a list of work activities that involve significant manual handling. In completing this walkthrough it is important to consult with the workers who do the job as they are best placed to explain how the job is carried out. There are five stages in a manual handling risk assessment process and these are explained below. An example of the Manual Handling Risk Assessment Worksheet is provided in Appendix E.

Stage 1: How is the manual handling task carried out?

This will involve collecting information on how the task is performed and identifying the key stages in the task. This should be a team effort, involving consultation with those who normally do the job. This information would normally be found in a method statement. The person carrying out the assessment should have a thorough practical understanding of the type of manual handling tasks being carried out.

For example, consider construction workers who are tasked with installing roof cladding sheets. The task involves manual handling activities and there will be a number of steps, including repeatedly lifting heavy sheets of roof sheeting across the roof. The person undertaking the manual handling risk assessment would need to consider how this work is going to be completed.

Stage 2: Collect all technical details

It is important to collect good quality information about the task, including technical and general information. Technical information may include:

- **What is the load?**
In this case it is a composite panel, a cladding sheet which is made up of two metal sheets with an insulation infill.
- **Information on the load weight**
The weight of the cladding sheets can vary greatly depending on width, depth, length and type of sheet. (Composite panels 100mm depth range between 11-14kg per square meter approximately).
- **Information on the size of the load**
The length and width and depth of the cladding sheets will vary and will depend on the specification given at the early stage of the project.
- **The number of manual lifts required to complete a task**
In this case there will be a number of lift activities and manipulation activities particularly when the cladding sheets are taken from the stockpile and rotated to the correct orientation.
- **The workers**
The construction workers will have to carry the cladding sheets across the roof which will have some uneven surfaces. This work will also be carried out at a height where winds are stronger and temperatures can be lower.

It is always good practice to take photographs of the work task as it makes it easier to visualise potential hazards. All this data can be collected while observing the task and you can then sit down with others to write down all the relevant information. Remember that the information that you collect at this stage in the risk assessment process is critical to understanding whether or not there are manual handling risk factors that will need attention and what improvements could be put in place.

Stage 3: Identify the problems or risk factors that need to be improved

In this example of the handling of cladding sheets, there are a number of risk factors to be identified, including:

- The cladding sheets are too heavy, each man is lifting and manipulating in excess of 25 to 30kg weight and in an awkward posture.
- The cladding sheets are difficult to grasp.
- The cladding sheets are unwieldy.
- The physical effort is too strenuous as the construction workers have to manipulate the load away from the trunk when rotating the load to its correct orientation.
- The way the cladding sheets are stored at the stockpile prevents the handling of the cladding sheets with good posture.
- The cladding sheets are stored in a location away from the point of use and therefore there is a long distance over which they must be carried.

- The work surface has trip hazards.
- The activity involves over-prolonged physical effort particularly during the manipulation and rotation of the sheet to the correct orientation.
- The construction workers have to bend down when placing the heavy cladding sheet into position.
- The placing of one sheet involves multiple lifts.

Once these risk factors are identified, it is necessary to investigate possible solutions.

Stage 4: What improvements can we put in place?

Efforts should be made to investigate if the work activity can be organised to allow the use of mechanical or other means to avoid or reduce the need for the manual handling of loads by employees in the workplace. It is necessary to evaluate the controls that are feasible for each problem. For the handling of cladding sheets. Three examples of possible control measures that could be considered are discussed below:

- **Orientation of Cladding Sheets**
In the example above the construction workers had to lift the cladding sheet unit from the bale, manipulate the unit and rotate it by 180 degrees to ensure it was in the correct orientation before carrying it across the roof. Consideration should be given to working with the suppliers of the cladding sheets to determine if the cladding sheets could be brought on site stacked in the correct orientation. This would eliminate the need for the construction workers to rotate the units.
- **Mechanical handling of Cladding Sheets**
Mechanical aids are available which can eliminate a significant amount of manual handling of cladding sheets. Cladding sheets are being designed now with environmental factors in mind, leading to more heavily insulated sheets. The manual handling of roof panels should be the exception rather than the norm.

There are many types of mechanical lifting aid which can provide solutions. Sheets which are delivered interleaved can also be flipped mechanically using vacuum devices and then hoisted to roof level.

Below are examples of mechanical aids at work.



Figure 12.1: Mechanical aids for rotating and lifting cladding sheets.

- **Specification of Cladding Sheet**

The specification of the dimensions of cladding sheets will impact on the weight of a cladding sheet unit. Designers need to consider the implication of their design specification and be aware of manual handling issues that may arise out of certain design features or, construction methods or through the use of certain products. This is another example of an improvement that should be considered. A design risk assessment should always be carried out in regard to the materials being specified by the designer.

There may be other improvements that should be considered. The rationale for deciding on a control measure must be clearly set out, outlining why other control measures were not possible and how the suggested control measure will help to avoid or reduce the risk of injury.

Consultation is necessary to ensure that all parties are working together to determine whether the recommended control measures are practical, to solicit feedback on other possible controls and to ensure the effective implementation of the plan of action.

The introduction of any control measure such as a mechanical aid or a new work layout means the introduction of a new system of work. Therefore a new system of work must also be assessed to ensure that any new hazards are identified and controlled.

The improvements or solutions suggested in the case study are not exhaustive and it may be feasible to develop an alternative solution to meet the specific needs of your business without having a negative impact on the health of the people involved in the handling activity.

Stage 5: Review the effectiveness of the control measures or solution

Effectiveness is the degree to which the control measures have avoided or reduced the risk of injury. This will depend on how promptly the changes were implemented and the level of worker acceptance.

Further information see the following HSA publications:

- An Introduction to the Management of Manual Handling in the Construction Sector
- Reducing the Manual Handling of Roof Panels
- The Guide to the Safety, Health and Welfare at Work (General Application) Regulations 2007 Chapter 4 of Part 2: Manual Handling of Loads.
- The Health and Safety Authority guidance document Management of Manual Handling in the Workplace.

13: TYPES OF ROOFWORK

13.1 Introduction

This Section considers the different safeguards which are required in different types of roofwork. All roofwork is potentially dangerous however limited the time scale. A thorough risk assessment must be completed before undertaking any roofwork, irrespective of the duration of the work to be undertaken.

13.2 Inspection

Inspection of roofs (e.g. prior to refurbishment) must be done with care by those trained and experienced in assessing the risks involved. Ideally, the work should be carried out from a safe place. This could be from an adjacent structure using binoculars or from mobile access equipment or from a secured ladder. Some investigations can be carried out from below if the roof structure is exposed. If people must go onto a roof, they will be exposed to high risks and high safety standards will be required (see Figure 13.1).



Figure 13.1: Powered access for the inspection of a large fragile roof.

13.3 Refurbishment

Roof refurbishment can be complex and is always a high risk activity. It demands careful planning. Such planning should include:

- Any fragile elements in the roof, such as asbestos cement sheets, glazing, plastic rooflights or wood wool slabs, should be clearly identified as early as possible.
- The clear identification of the precautions to prevent people falling through fragile parts of the roof. These need not always be complex, but must be effective. They include the protection of people who work on or pass by fragile material.

- A risk assessment of the relative hazards of refurbishing or replacing fragile roof coverings. For example, the decision on whether to clean and seal or replace an existing asbestos cement roof should take into account the additional risks and cost of future maintenance. Where cleaning is carried out, a safe system must be adopted (see Section 12.5.3 Asbestos).
- Close liaison with the client where premises remain occupied during refurbishment.
- A structural survey, where necessary, to confirm the strength or stability of roof members.

13.4 Stripping and Dismantling of Roofs

Stripping roofs to reclaim slates or tiles and timber during demolition can often involve high risk tasks. An independent scaffold should be provided at eaves level. This gives safe access to the roof and room for storage of materials. The scaffolding contractor should be informed of the intended loading and care must be taken not to exceed this. It may be necessary to give specific guidance to site supervisors on the maximum number of tiles or slates per scaffold bay. Any additional scaffold loadings should be incorporated into the scaffold design.

Timber battens deteriorate with age. They should not be used as footholds unless they have been inspected by a competent person to confirm that they have sufficient residual strength.

As the roof is stripped, steps must be taken to prevent internal falls, for example through the roof supports. The best option is often the use of mobile access equipment, so long as ground conditions are suitable. Alternatively safety nets or work platforms erected under the work area may be used.

Mechanical handling devices and waste chutes are particularly necessary for demolition where large quantities of waste and reclaimed materials are removed from roofs. Demolition of buildings with fragile roof sheets or liners require careful planning. It is vital when a client appoints a contractor that the client is satisfied that the contractor has the necessary competence and resources. Resources include the time needed to plan and carry out the work safely (see Section 2, Role of the Client).

13.4.1 Stripping and dismantling of asbestos cement roofs

Asbestos cement sheeting is a fragile material and cannot be relied upon to support the weight of a person. If the asbestos cement sheets are in good condition and it is possible to provide safe access, preferably from underneath (e.g. using scissors lifts), the sheets should be taken down intact. However, when using this method, the sheets should not be dropped or damaged and should be dampened while you work on them to suppress fibre release.

Power tools should not be used to cut the fixing bolts as this could lead to damage to the asbestos sheeting, generating high levels of airborne asbestos fibres. The bolts should be opened or cut using a bolt crows. The sheets should be lowered on to a clean hard surface and double wrapped in heavy gauge polythene. The asbestos cement waste and debris should be removed from site as soon as possible to prevent it being crushed underfoot or by moving vehicles. For advice on waste disposal you should contact your local authority or the Environmental Protection Agency.

case study

A construction worker suffered fatal head injuries when he fell through a corrugated Perspex roof sheet on to a concrete floor some 3 metres below. He was part of a crew that had just arrived on the site for the purpose of removing the roof covering. The roof covering included corrugated asbestos cement sheets with some sheets of corrugated Perspex for roof lights. Safe systems of work which might have included the use of safe working platforms, nets and crawling boards were not used to prevent a fall through the fragile roof materials.

The law requires that you have a plan or method statement for the removal of asbestos sheets. This plan should include information on the method of removal and method of dust suppression, details of the selection, use and decontamination of personal protective equipment, and respiratory protective equipment and any other relevant information specific to the job. Facilities to allow employees to wash thoroughly need to be provided after working with asbestos cement. The nature and size of these facilities depends on the nature and degree of exposure to asbestos. The need for air monitoring should be determined as part of the risk assessment of the work. It may be required where a large quantity of asbestos cement has been handled or where significant contamination has occurred.

If a secure platform cannot be provided and collective fall protection cannot be installed, remote demolition may be undertaken in certain very limited circumstances. This could be by a machine such as a pusher arm, or by deliberate controlled collapse. Where it is necessary to carry out this type of activity you should contact the Health and Safety Authority before the demolition commences.

13.5 Short Duration Work

The risk assessment should identify the duration of work to be undertaken. The access and work equipment that you provide may be influenced by the duration of the work. However, in all cases you must ensure that site operatives and members of the public are protected. There are additional factors that you need to consider; for example, the number of people working on a roof for a short duration may determine the requirement for edge protection or other precautions during such work. In some circumstances for work of short duration it may not be reasonably practicable to install edge protection. In cases such as this alternative safe systems of work must be identified and implemented. The decision on the precautions to be taken will depend on an overall assessment of the risks involved, which should include:

- The complexity of the work.
- The pitch of the roof.
- The condition of the roof.
- The weather conditions.
- The risk to those putting up edge protection.
- The risk to other workers and the public.



Figure 13.2: *Simple mobile access used for short term work at parapet level.*

Appropriate and certified mobile access equipment can provide a safe working platform in some situations (see Figure 13.2). Where this is not practicable, travel restraint or fall arrest should be considered.

Travel restraint can prevent a fall by physically restricting the movement of a person to the confines of a safe area. It should not be possible to reach any unprotected edge, hole or fragile material when relying on this system. Fall arrest is not the same as travel restraint. Fall arrest relies on minimising injury once a fall has occurred. In both cases, specialist advice should be sought from the supplier of the equipment on anchorage point requirements. Supervision and training are needed to ensure that the system of work adopted is understood by all and is maintained. See Appendices 2 and 3 for further information on fall arrest.

14: TRAINING

14.1 Introduction

Roofwork is potentially hazardous and roof workers need appropriate knowledge, skills and experience to do it safely.

Workers should be trained in safe working practices. It is not enough to hope that they will 'pick up' safety on the job from other workers: they might simply be learning someone else's bad habits.

Employers need to satisfy themselves of their employees' abilities before carrying out activities and provide appropriate training where it is needed. Employees will need training in the risks they will encounter (such as recognising fragile roof covering) and safe systems of work to control them.

14.2 Training

The minimum acceptable standard of training for those erecting standard non-truss type roofing (see Section 9) is the approved Construction Skills Certification Scheme (CSCS). There are three types of roofing activities which require the CSCS training, Roof Cladding, PVC Built up Roof Felt and Bitumen Built Up Roof Felt. In certain cases it may be appropriate to demonstrate competence to this level in order to be granted the relevant certification. This will depend on the experience of the candidate for certification and the training requirements of the role. This standard is mandatory under the Safety, Health and Welfare at Work (Construction) Regulations 2013.

In the situation of a trainee roofer, it is permissible for the trainee to carry out roofwork activities under the supervision of a competent person. The trainee must also be identified as a trainee and is permitted to carry out roofwork for the purpose of gaining experience.

In the case of roofing, supervision is necessary to ensure that a trainee's safety is protected at all times and that the skills necessary to safely complete the job are adequately taught. To achieve this, the supervisor must ensure that the trainee roofer can be organised, directed, observed, communicated with and monitored.

In considering the nature, scale and complexity of the roofing activities, the roofing contractor must at all times ensure that a trainee roofer is undertaking work that is within his or her training, knowledge, experience and capabilities.

Under no circumstances should a trainee roofer be performing duties without supervision. A competent person is a person who has been fully trained, has acquired the necessary knowledge and practical experience and has received the necessary instructions for the installation and maintenance of the type of roof being worked on.

Suitable training must also be given to any other personnel working on the construction of traditional tiled and slated roof. Personnel involved in roofwork erection may also need training in setting up and using the equipment for the job. Typical examples would be:

- Erecting a tower scaffold.
- Setting up a hoist or MEWP.
- Rigging and inspection of the safety nets.

Those not involved in roofwork erection may also erect nets so long as they are competent to do so. Formal training should be made available to those erecting and inspecting/certifying nets, and those setting up and operating mobile elevating work platform which are to be used on site. The type of work carried out by personnel may require that they undergo periodic refresher training. Any such training should be at intervals of less than four years.

Generally, formal refresher training will be required periodically, depending on the work being carried out by personnel. However, this training should not be at greater intervals than four years.

Training or assessment in the erection of mobile tower scaffold should be undertaken under the auspices of the CSCS scheme. If net erectors or MEWP drivers have not been formally trained they should be directly supervised by an appropriately trained person and should be in possession of a letter from their employer stating that they are a trainee under supervision and giving the date on which they began to do this type of work.

Managers and supervisors must be competent to deliver safety standards on site. As a consequence they will need health and safety training to enable them to:

- Assess and prioritise the risks on a particular project.
- Design safe systems of work that are appropriate to specific site conditions.
- Prepare clear, simple safety method statements that can be used and understood by site workers.

Everyone who uses personal protective equipment (PPE) should know how to use it effectively. They should know, for example:

- How to inspect the equipment to ensure that it will operate satisfactorily.
- How to fit and use a fall arrest or fall prevention system, following the manufacturer's recommendations.
- How to check the face fit of a respirator, or respiratory protective equipment (RPE).
- How to safely store personal protective equipment.

The Safety, Health and Welfare at Work (Construction) Regulations 2013 require contractors to have a safety officer in place if they have an aggregate of more than 30 employees employed on several sites or more than 20 employed on a single site. The safety officer's role is defined in Regulation 26 of the Safety Health and Welfare at Work (Construction) Regulations 2013.

Employers should keep up with changes in technology, work methods, industry guidelines and legislation, and ensure, so far as is reasonably practicable, that their employees are adequately trained to deal with changes in the work environment.

APPENDICES

APPENDIX A

Issues to be Considered When Developing Method Statements for Industrial Roofwork

Introduction

This appendix is not a method statement. It indicates the issues that method statements need to consider for industrial roofwork. A similar analytical approach is appropriate for other roofwork.

Roofwork is a high risk activity which requires the closest attention to detail at all stages of the work. Before work starts there a job-specific method statement should be written which is understood and, agreed upon by all parties carrying out the work. Those with a supervisory role in the work must also understand it. Rigorous supervision is needed to ensure that the agreed method is followed in practice. In general, the employer must provide direct supervision for his or her employees. However, the PSCS will also have a role in coordinating safe working practices on site. The systems of work must be agreed between the employers and the person in overall control of the place of work. There should also be a system to allow necessary changes to be made and confirmed.

Method statements should be clear and concise and include simple sketches.

The following general questions are particularly relevant to a low pitch industrial roof. This is not an exhaustive checklist, but is intended to act as a prompt when method statements are prepared and reviewed.

Non standard or unusual systems will require special consideration. There may also be risks specific to an individual site that will need to be addressed (e.g. the presence of overhead power lines).

Risk of falling (e.g. getting on/off ladders at eaves)

Access to roof: have access points been discussed with the roofing gang in order to reduce travel over the roof to a minimum? If ladders are used (as opposed to towers) are means available for hoisting smaller components which are raised by a crane? Has the stability of long ladders been considered? (e.g. will they need staying?) to reduce whip?

Risk of falling when walking past open edges to fetch materials

Materials handling: how are roofing packs loaded out onto the roof? Is this planned so as to reduce travel when fetching sheets and does it allow for protected routes/safe means of access? Splitting packs of different sheet size and reassembling them at ground level can save travel at height. Back loading sheets onto the completed roof can reduce travel past open edges.

Risk of falling from steel frame when unslinging

Cranes: if one is used, who will accept the load or unslung it? How will they be protected from falling? Has the use of mobile access equipment been considered for this task?

Risk of falling outside building frame exists at all stages of work: gable ends are particularly hazardous

Edge protection: does the programme ensure that eaves, gable ends and other open edges are protected before work starts? Protection will also be required at ridges unless work progresses at the same rate on both roof slopes. What are the access arrangements for those installing edge protection?

Risk of falling on both sides of gutter (i.e. inside and outside building frame)

Gutter fixing: how will workers be protected from falling? Peripheral edge protection erected for roof workers will not be sufficient at this phase. Has the use of mobile access equipment been considered as a first priority? If the use of a running line or harness and lanyard is specified, who will erect and test the line?

Risk of falling from partly completed roof

Leading edge protection: how will this be achieved? Has the use of safety nets been considered in the light of legal duties and risk assessment for the total roofing operation? Stagings used as working platforms should be stable and of adequate width with handrails/running lines specified to suit the working practices. Work done kneeling/bending needs careful attention as the operator's centre of gravity can extend over the leading edge. What method is specified for moving stagings?

Is the method of work to be adopted when laying the first sheet specified? E.g. Some architectural features such as hip ends will require modifications to the working methods. These should be fully described.

Has fixing of ridge capping/flashing been included in the system of work? Is effective edge protection provided at the gable end of the ridge?

Does the method statement make it clear at what stage of construction materials such as liner panels become load-bearing? The number and type of fixings required should be stated. Until this is achieved, they **MUST** be treated as fragile materials (i.e. unable to sustain a person's weight) and protection provided as above. Netting installed to the standard outlined in Appendix B should provide collective fall protection where it is not reasonably practicable to operate from a safe working platform.

Have any fragile materials been specified by the designer? If so, this design decision should be reviewed by the designer as a matter of urgency in light of the duties imposed under the Safety, Health and Welfare at Work (Construction) Regulations 2013.

For refurbishment work on existing roofs, are there any fragile materials on the roof, (e.g. rooflights)? These will have to be protected. How will this be achieved? If covers are to be used, are they strong enough, taking account of the span required? How will they be fixed and what is the system for their removal?

Zoning of the roof into working and non-working areas can reduce the number of rooflights that need to be protected. The system for marking out the zones and for progressing the work should be specified.

If barriers marking the edge of the zones are within 2 metres of fragile material, they must be strong enough and rigid enough to support the weight of a person who loses their balance.

Zoning should take account of travel to the working area by the roof workers and also the need for materials to be moved around the roof. The system should ensure that all rooflights within working zones and adjacent to access routes are protected.

Systems control

Communications: what are the arrangements for ensuring that the method statement is communicated to and agreed with the roofing gang?

Supervision: what are the arrangements for ensuring that the work proceeds according to the method statement?

Modifications: what are the arrangements for agreeing any modifications to the method statement and ensuring that these are communicated to the roofing gang?

Validation: what are the arrangements for ensuring that the company safety adviser or other nominated competent person has reviewed, and is satisfied with, the system of work proposed?

APPENDIX B

Use of Safety Nets

Introduction

Safety nets can be effective in reducing the potential for serious or fatal injury from falls. They provide collective, as opposed to individual safety protection and eliminate the need for the individual to make their own safety arrangements. They allow a broad range of activity to continue with minimum restriction.

Safety nets have high-energy absorption capability and, therefore, offer a 'soft landing' that minimises injury. They should always be fitted as close as is possible to the underside of the working platform.

Lightweight, square mesh nets offer the flattest span (less than 10% sag). In most roofwork it is possible to position a safety net so that, even at the point of maximum sag, it is less than 2 metres from the roof surface. In this position the net is an effective guard and this standard should be achieved wherever possible.

Safety nets overlaid with an appropriate fine-mesh debris cover can also protect those who have to work or pass below. Consideration should be given to the type of materials likely to fall (e.g. fixings or tools) when selecting the overlay material. Safety nets have the additional advantage that materials are contained by the net and do not bounce.

Safety nets can be effectively employed to:

- Prevent injuries caused by falls from leading edges, through fragile panels or through temporarily fixed materials in new build roofing.
- Guard rooflights and fragile roof materials during cleaning, maintenance and replacement of the roof.
- Prevent injuries caused by falls during roof truss erection (e.g. when fitting diagonal bracing).

Safety nets should be manufactured to the requirements of the European Standard I.S. EN 1263: 2002 Part 1 *Safety Requirements Test Method*. The safety nets should be erected in accordance with I.S. EN 1263: 2002 Part 2 **SAFETY REQUIREMENTS FOR THE POSITIONING LIMITS**. The standard describes four basic types of safety nets. The nets described in this guidance are Type S. This is the standard horizontal safety net with border cord that is designed to be sized and fixed to the building structure. I.S. EN 1263: Part 2 covers the main technical information for the use of such nets.

Design and technical details

When rigging safety nets it is important to maintain their energy absorbency. If there are too many fixing points, the net becomes more rigid and imposes larger loads on the user, the structure and the net itself. Too few fixing points and the net will sag too greatly and deflect too much under load. The manufacturer's recommendations and the British standard code of practice should be followed on the number and spacing of fixing points. Checks need to be made to ensure that the supporting structure is capable of resisting the expected anchorage loads.

Wherever possible nets should be rigged so as to prevent falls of 2 metres or more. If they are to be used for the arrest of falls greater than 2 metres, they should have:

- An area greater than 35 metres².
- A minimum side length (width) greater than 5 metres.
- Maximum support spacing of 2.5 metres.
- An individual anchor point capacity of 6 kN, applied at 45° to the horizontal.
- A combined capacity over an adjacent series of anchor points of 4 kN, 6 kN, 4 kN.

Adequate clearance must be allowed below the net to allow it to function properly. The manufacturer's recommendations should be followed for the minimum clearance that should be free of all obstructions. (Safety Nets. Part 1 Safety Requirements Test Method EN 1263: Part 1 2002).

Safety nets must extend beyond the leading edge of the work by at least the minimum catching width. This is linked to fall height (see Table 1).

Table B1: Fall heights and catching widths

Fall height	< 1.	< 3.0m	< 6.
Catching width	> 2.	> 2.5m	> 3.

The maximum general fall height is 6 metres. However, this is reduced to 3 metres within 2 metres of the supported edge of the safety net, to take account of the reduced capacity for energy absorption near the fixed edge.

Planning

When planning the use of safety nets, the technical aspects should be considered. It is feasible fix safety net attachment points (e.g. welded lugs) on to primary steel work, which will be used when erecting the building. These would then be available to support safety nets required for building maintenance or perhaps eventual demolition of the building.

Erection

Safety nets can be connected by designed attachment points or by flexible tie ropes to primary steelwork of suitable capacity, or to other selected anchorage points. Nets can be moved and removed as the work progress demands.

The risk to riggers erecting, moving and dismantling nets should be assessed and a safe system of work established. Access equipment such as mobile towers or mobile elevating work platforms (MEWPs) should be capable of resisting any sideways loading during net installation. In existing buildings there may be permanently installed access equipment. This may be used if suitable for the imposed loads. Roped access techniques may be appropriate in some buildings.

This is specialised work and should only be undertaken by those trained in it and competent to carry it out. The International Industrial Rope Access Trade Association (IRATA, www.irata.org) has published a Guidelines on the use of Rope Access Methods For Industrial Purposes in 1997 (ISBN 0 9523227 14).

Those who erect nets should be aware of the relevant standards, be trained and be competent to carry out the work safely. This may require the use of specialist installers and riggers, especially where large nets are being used. The minimum level of training is set out in Section 14 of this code of practice.

Material should not be allowed to fall into nets. Rubbish should not be thrown into nets. Loose or sharp material should not be stacked loosely above the nets. Any material supported above the net should be independently secured.

Technical advancements in collective protection devices

New systems of safe work platforms for roofwork which incorporate fall protection are being developed.

For example walk-on systems provide a continuous surface under the roof, providing safe access for construction workers. Secondary protective measures are used in conjunction with the walk-on system: either safety nets under the walk-on system or individual fall arrest protection.



Contractors are required to adapt safe systems of work to take account of technical progress. Before work begins on a roof contractors should use their risk assessments to determine the most appropriate control measures for the roofwork tasks.

APPENDIX C

Use of Fall Arrest or Fall Prevention Systems

Introduction

A fall arrest system should be the last choice for protection against falls from height. There is still a possibility of injury in an arrested fall. The system relies on the user accepting the discipline of ensuring that the equipment is consistently and effectively used. There will be circumstances, however, when it is not reasonably practicable to provide physical measures to prevent a person falling. In such cases, a full body harness attached to a suitably anchored system incorporating some form of energy absorber may be the only precaution available. This at least ensures that if a fall occurs, it is safely arrested.

General provisions

Fall arrest systems come in a variety of forms. These range from a single lanyard or retractable fall arrester attached to a fixed anchorage point to a number of lanyards with mobile attachment points on a single horizontal flexible anchorage line or a proprietary multi-span cable system. All should be used with full body harnesses. The system should incorporate some form of energy absorbing or energy dissipating element to ensure that the forces of deceleration on the user do not exceed 6 kN. Fall arrest systems serve as personal protective equipment (PPE) against falls from height.

The provision and use of fall arrest equipment is subject to the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016. There are a number of European standards that specify the requirements for fall arrest systems and components, namely:

- PPE against falls from a height. Part 1 specification for guided type fall arrestors on a rigid anchorage line I.S. EN 353: Part 1 2002.
- PPE against falls from a height. Part 2 specification for guided type fall arrestors on a flexible type anchorage line I.S. EN 353: Part 2 2002.
- PPE against falls from a height. Lanyards I.S. EN 354: 2010.
- PPE against falls from a height. Energy absorbers I.S. EN 355: 2002.
- PPE against falls from a height. Work Positioning Systems I.S. EN 358: 2000.
- PPE against falls from a height retractable type fall arrestors I.S. EN 360: 2002.
- PPE against falls from a height. Full body harnesses I.S. EN 361: 2002.
- PPE against falls from a height. Connectors I.S. EN 362: 2005.
- PPE against falls from a height. Fall arrest systems I.S. EN 363: 2008.
- PPE against falls from a height. Test methods I.S. EN 364: 1993.
- PPE against falls from a height. General requirements for instructions for use and for marking I.S. EN 365: 2006

A suitable anchorage point is vital when using a fall arrest system such as safety harnesses. This could be a single fixed anchorage point or a flexible anchorage line. The adequacy of all anchorages, including the ability of the supporting structure to carry the anchorage loads, should be verified by calculation or by testing. For example, the structural adequacy of a guard-rail to resist fall arrest forces should be assessed before a lanyard and harness are anchored to it. Anchorages should generally be installed as high as possible, preferably above the user and never below foot level. Retractable type fall arresters should generally be anchored at chest height or above; however occasionally they may be anchored at ground levels when they have been appropriately tested.

In order for a fall arrest system to function correctly there must be adequate clearance below. For example, a system comprising a full body harness and a 2 metre long lanyard with an energy absorber anchored at foot level could require up to 6.25 metres of clearance below the anchorage. This is made up as follows:

- 2 metres – original length of the lanyard plus shock absorber.
- 1.75 metres – maximum allowable extension of the shock absorber.
- 2.5 metres – allowance to cover the displacement of the full body harness and the clearance below the feet of the user after the arrest.

When a flexible anchorage line system is used, allowance must also be made for the sag of the line between anchorages.

However, lanyards have been developed which require less clearance than the 6.25 metres stipulated above. If 6.25 metres clearance cannot be achieved the use of such lanyards may be necessary to ensure a safe system of work.

Consideration should also be given to how a person would be rescued after an arrested fall, particularly from high structures. A system of work must be in place in order to rapidly (within a period of minutes) rescue a worker whose fall has been arrested by a harness.

Adequate information, instruction, training and supervision should be given when a fall arrest system is used. For example:

- How to wear the harness and adjust it to the body.
- How to manage the lanyard and other equipment.
- How to fall so as to minimise the risk of injury.
- How to rescue oneself or assist others after a fall.
- How to inspect the equipment and recognise significant defects.
- How to assemble the system correctly, including recognition of the importance of safe anchorages.

Fall arrest systems are not fool proof and their safe usage is not always a matter of common sense. Without proper training in fitting, using and maintaining them, and their installation and equipment limitations, all that a fall arrest system can provide is a false sense of security.

Anyone working alone should not undertake work at heights involving fall protection by harnesses. This is to ensure that there will be someone in place to raise the alarm in the event of a person being suspended in a harness in order to effect a rescue of that person.

APPENDIX D

Inspection of Energy-Absorbing Lanyards Made from Webbing or Rope

Introduction

An energy absorbing lanyard (hereafter referred to as a lanyard) is a line for connecting a full body harness to an anchorage point with an in-built device that reduces the impact of a fall.

General provisions

There is a wide range of possible causes of degradation of man-made fibres used in webbing and rope lanyards (including abuse, general wear and tear, edge/surface damage, ultraviolet light, dirt, grit or chemicals).

IS EN 365:2006 Personal protective equipment against falls from a height. General requirements for instructions for use and for marking (under revision) gives general requirements for periodic inspection and instructions for use and marking of PPE against falls from a height. To counter the causes of degradation described in paragraph 2, the standard states that components should be examined at least twelve monthly. This is sometimes taken to be annually, although manufacturers of textile products usually recommend inspection more frequently than this.

Research by the HSE's Health and Safety Laboratory (HSL) on man-made fibre webbing and rope lanyards has confirmed the range of causes of degradation and highlighted that there is no well-defined boundary (usable life) separating those lanyards which are safe from those which are not. Therefore lanyards need to be subject to an effective inspection regime to maintain their safety for use as protection against falls. The paragraphs below give recommendations for the frequency and type of inspection which may be needed.

Duty holders should establish a regime for the inspection of lanyards which should include: the lanyards to be inspected, the frequency and type of inspection (pre-use checks, detailed inspection and, where appropriate, interim inspection), who will carry out the inspections, action to be taken on finding defective lanyards, training of users and competent persons to carry out the inspections. Duty holders should also consult manufacturer's instructions.

It is essential that the person carrying out any inspection is sufficiently independent and impartial to allow objective decisions to be made, and has appropriate and genuine authority to discard defective lanyards. This does not mean that competent persons must necessarily be employed from an external company, although many manufacturers and/or suppliers offer inspection services and training in the inspection of their products.

Duty holders may wish to provide additional lanyards to use as replacements in the event that defective lanyards have to be taken out of use.

Special consideration may need to be given to lanyards which are on hire, to ensure that they are subject to detailed inspections (and interim inspections if appropriate) within the period specified in the regime. Hirers should be informed of any use or damage which may affect the safety of the equipment (e.g. use with chemicals).

Lanyards should be subject to:

- Pre-use checks.
- Detailed inspections. And
- As appropriate, interim inspections to identify defects or damage affecting safety.

Pre-use checks

Pre-use checks should be carried out each time the lanyard is used. These checks are essential and may best be done by the person who will use the equipment. The person doing the checks must be competent to do them.

Checks should be tactile and visual. The whole lanyard 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 a few minutes.

Detailed inspections

These are more formal in-depth inspections to be carried out periodically at minimum intervals specified in the duty holder's inspection regime. The inspection regime should be drawn up by a competent person. Detailed inspections should be recorded. It is recommended that there is a detailed inspection at least every six months. For frequently used lanyards it is suggested that this is increased to at least every three months, particularly when lanyards are used in demanding environments (e.g. demolition, steel, erection, scaffolding, steel skeletal masts/towers with edges and protrusions).

Interim inspections

These are in depth inspections and may be appropriate in addition to pre-use checks and detailed inspections. Interim inspections are those which are required to be carried out between detailed inspections because the duty holder's risk assessment has identified risks that could result in significant deterioration affecting the safety of the lanyard before the next due date of the detailed inspection. Whether an interim inspection needs to be carried out and the frequency of interim inspections if required will depend on use. Examples of situations where interim inspections may be appropriate include risks from transient demanding working environments involving paints, chemicals or grit blasting operations or acidic or alkaline environments if the type of fabric the lanyard is made from cannot be determined (some fabrics offer low resistance to acids or alkalis). Interim inspections should be recorded.

Examples of defects and damage

The following defects and damage have the potential to result in the degradation and/or weakening of the lanyard:

- A knot in the lanyard, other than those intended by the manufacturer.
- Surface abrasion across the face of the webbing and at the webbing loops, particularly if localised.

- Abrasion at the edges, particularly if localised.
- Cuts to the webbing, rope or stitching, particularly at the edges (e.g. where the lanyard may have been choke hitched around steel work).
- Chemical attacks which can result in local weakening and softening – often indicated by flaking of the surface. There may also be a change in the colour of the fibres.
- Heat or friction damage indicated by fibres with a glazed appearance which may feel harder than surrounding fibres.
- Damaged or deformed fittings (e.g. karabiners, screwlink connectors, scaffold hooks).
- Ultraviolet degradation which is difficult to identify, particularly visually, but there may be some loss of colour (if dyed) and a powdery surface.
- Partially deployed energy absorber (e.g. short pull-out of tear webbing).
- Contamination (e.g. with dirt, grit, sand etc.) which may result in internal or external abrasion.

Other factors

Any lanyard that has been used to arrest a fall should never be re-used. It should be withdrawn from service immediately and destroyed. All lanyards should be indelibly and permanently marked with their technical standard applicable at the time of manufacture, EN 355, for example I.S. EN 355: 2002 or BS EN 355: 2002. They should be uniquely identifiable so that they can be easily associated with their respective inspection documentation.

Action by duty holders

Lanyards should be withdrawn from use and passed to a competent person for a detailed inspection to decide whether they should continue to be used or destroyed if:

- There is no evidence that a lanyard has been inspected by a competent person within the last six months.
- Identification is not evident.
- A lanyard is still in use and marked to the old British Standard, BS 1397: 1979 Specification for industrial safety belts, harnesses and safety lanyards (i.e. pre CE marking).
- After a pre-use check or interim inspection, a lanyard is thought to be defective, or if there is any doubt about its safety.

APPENDIX E

Manual Handling Risk Assessment Worksheet

Introduction

This worksheet leads you through the five steps necessary to successfully manage manual handling hazards.

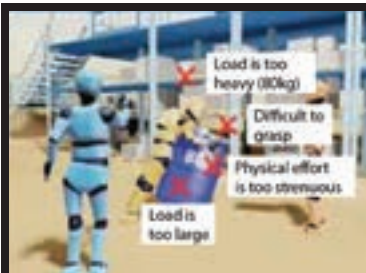
Step 1: How is the task carried out?



Step 2: What are the technical details of the task?



Step 3: What are the problems/risks (refer to schedule 3 in S.I. 299 of 2007)?



Step 4: What improvements can be made (actions to take to avoid/reduce handling)?



Step 5: Are the improvements effective?



As part of the five-step manual handling risk assessment process, it will be necessary to identify the risk factors which are relevant to a particular task. The checklist is a useful aide memoir to identify risk factors as part of the risk assessment process. The information collected can then be used to identify what improvements can be put in place to avoid or reduce manual handling in a task.

Table E1: Manual handling risk assessment checklist

Risk Factors	Yes	No	Comment
Is the load too heavy?			
Is the load too large?			
Is the load unwieldy or difficult to grasp?			
Is the load manipulated at a distance from the trunk?			
Is the load positioned in a manner requiring a bending or twisting of the trunk?			
Is the physical effort too strenuous?			
Is the physical effort only achieved by a twisting movement of the trunk?			
Is the physical effort required likely to result in a sudden movement of the load?			
Is the physical effort made with the body in an unstable posture?			
Is there enough room, particularly vertically to carry out the activity?			
Is the floor uneven?			
Does place of work prevent handling of load at safe height or with good posture?			
Are there variations in the level of the floor?			
Is the floor unstable?			
Does the activity involve over frequent or over prolonged physical effort?			
Are there excessive lifting, lowering or carrying distances?			

APPENDIX F

Statutory Provisions

www.irishstatutebook.ie

Safety, Health and Welfare at Work Act 2005 (Number 10 of 2005)

Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016

Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013)

Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006 and 2010

Chemicals Act 2008 and 2010 (Chemicals Act 2008 (Number 13 of 2008) & Chemicals Act 2010 (Number 32 of 2010))

Irish Standards

www.nsai.ie

I.S. EN 353-1: 2002	PPE against falls from a height. Specification for guided type fall arrestors on a rigid anchorage line
I.S. EN 353-2: 2002	PPE against falls from a height. Part 2 specification for guided type fall arrestors on a flexible type anchorage line
I.S. EN 354: 2010	PPE against falls from a height – Lanyards
I.S. EN 355: 2002	PPE against falls from a height – Energy absorbers
I.S. EN 358: 2000	PPE against falls from a height – Work positioning systems
I.S. EN 360: 2002	PPE against falls from a height – Retractable type fall arrestors
I.S. EN 361: 2002	PPE against falls from a height – Full body harnesses
I.S. EN 362: 2005	PPE against falls from a height – Connectors
I.S. EN 363: 2008	PPE against falls from a height – Fall arrest systems
I.S. EN 364: 1993	PPE against falls from a height – Test methods
I.S. EN 365: 2006	PPE against falls from a height – General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging, as amended in 2006

I.S. 360: 2004	Code of Practice: Safe use of cranes in the construction industry – Part 1: General
I.S. 361 2013	Code of Practice for the Safe use of Tower cranes and self-erecting cranes
I.S. EN 490: 2011	Concrete roofing tiles and fittings for roof covering and wall cladding.
I.S. EN 795: 2012	Personal fall protection equipment - Anchor devices
I.S. EN 1263-1: 2002	Safety nets – Part 1: Safety requirements; test methods
I.S. EN 1263-2: 2002	Safety nets – Part 1: Safety requirements for the positioning limits
I.S. 3213: 1987	Code of Practice for the storage of LPG cylinders and cartridges, as amended by Amendment No. 2: 1993
I.S. EN 1991-1-1: 2002	EUROCODE 1: Actions on Structures - PART 1-1: General Actions - Densities, Self-weight, Imposed loads for buildings (including Irish National Annex: 2013) Latest Version 2002 NA 2013
I.S. EN 1991-1-4: 2005	EUROCODE 1: Action on Structures - PART 1-4: General Actions - Wind Actions (including Irish National Annex) Latest Version 2005 AMD 1 2010
I.S. EN 1991-1-6: 2005	EUROCODE 1 – Actions on Structures - PART 1-6: General Actions – Actions during execution (including National Annex) Latest Version 2005 COR 2013
I.S. EN 1991-1-7: 2006	EUROCODE 1 – Actions on Structures - PART 1-7: General Actions – Accidental actions (Including Irish National Annex) Latest Version 2006 COR 2010
I.S. EN 1995-1-1	EUROCODE 5: Design of Timber Structures – Part 1-1: General – Common rules and rules for building (including Irish National Annex)
I.S. EN 12691: 2006	Flexible sheets for waterproofing. Bitumen, plastic and rubber sheets for roof waterproofing. Determination of resistance to impact
I.S. EN 13374: 2013	Temporary edge protection systems. Product specification, test methods
I.S. EN 13859-1: 2010	Flexible sheets for waterproofing. Definitions and characteristics of underlays. Underlays of discontinuous roofing, as amended in 2008
I.S. EN 14963: 2006	Roof coverings. Continuous rooflights of plastics with or without upstands. Classification, requirements and test methods
I.S. ICP 2: 2002	Code of Practice for slating and tiling

British Standards

www.bsi-global.com

BS 5534: 2003	Code of practice for slating and tiling (including shingles), amended 2010
BS 6100-6: 2008	Building and civil engineering. Vocabulary
BS 6037-2: 2004	Code of practice for the planning, design, installation and use of permanently installed access equipment. Travelling ladders and gantries
BS 7883: 2005	Application and use of anchor devices conforming to BS EN 795
BS 8103-2: 2009	Structural design of low rise buildings. Code of practice for masonry walls for housing
BS 8213-4: 2007	Code of practice for the survey and installation of windows and external doorsets and rooflights
BS 8410: 2007	Code of practice for lightweight temporary cladding for weather protection and containment on construction works
BS 8411: 2007	Code of practice for safety nets on construction sites and other works
BS 8747: 2007	Reinforced bitumen membranes (RBMs) for roofing. Guide to selection and specification
BS 9250: 2007	Code of practice for design of the airtightness of ceilings in pitched roofs

Health and Safety Authority Codes of Practice

www.hsa.ie

Code of Practice for Avoiding Danger from Overhead Electricity Lines

Code of Practice for Access & Working Scaffolds

Construction Safety Code of Practice For Contractors with Three or Less Employees

Health and Safety Authority Guidance

www.hsa.ie

Clients in Construction – Best Practice Guidance (revised)

Guidance to the Safety, Health and Welfare at Work Act 2005

Guidance to the Safety, Health and Welfare at Work (Construction) Regulations 2013

Guidance to the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016

Safe use of Work Platforms/Trestles

Guidelines on Preparing Your Safety Statement and Carrying Out Risk Assessments

Asbestos-containing Materials (ACMs) in Workplaces, Practical Guidelines on ACM Management and Abatement

Guidelines on Safety Consultation and Safety Representatives

Electricity Supply Board

www.esb.ie/esbnetworks

Code of Practice for avoiding Danger from Overhead Electricity Lines

An tSeirbhis Oideachais Leanunaigh agus Scileanna (SOLAS)

www.SOLAS.ie

Health and Safety Executive (UK) Guidance

www.hse.gov.uk

HSG 33 Safety in Roofwork

HSG 141 Electrical Safety on Construction Sites

HSG 151 Protecting the Public - Your Next Move HSG 268 Fire Safety in Construction Work

INDG 147 Keep Your Top On

INDG4 02 Guide on the Safe Use of Ladders and Stepladders

L22 Safe Use of Work Equipment – Provision and Use of Work Equipment Regulations

Building Research Establishment (UK)

www.bre.co.uk

BRE Digest 284 Wind Loads on Canopy Roofs

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The future availability and accuracy of the references listed in this publication cannot be guaranteed.

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