

GOOD PRACTICE GUIDE

Emergency Action Planning And Rescue From Height on Tower Cranes



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Emergency Action Planning & Rescue From Height on Tower Cranes

CPA Good Practice Guide



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Foreword

The Tower Crane Interest Group (TCIG), under the auspices Construction Plant-hire Association (CPA) has since its inception, produced numerous publications such as good practice guides and technical information notes, endorsing the interest group's continual and dedicated commitment to safety and training.

The subject of rescue of personnel from height on tower cranes has been a frequent subject of identification and improvement by the interest group and the construction sector in general for many years and a regular topic of discussion at interest group meetings in order to promote, develop and implement improved working practices.

Unlike other specific technical documents produced by the group, this subject has a personal element for the sector in that the need to rescue an individual is both unpredictable and under potentially distressing circumstances. It also encompasses those from outside of the tower crane sector, such as site personnel and management, as well as the emergency services and specialist rescue organisations.

Due to the importance of both recognising that situations requiring rescue at height could potentially happen anytime, and that rescues need to be pre-planned so that any rescue can be carried out safely and in a timely manner, a comprehensive technical information note (TIN 013) was published many years ago. This was under the direction of the interest group to provide guidance on the planning, measures, methods, equipment, skills and procedures required for a successful and safe rescue. It laid out, in readily understandable terms, what employers and others need to do, should the requirement of an unpredicted rescue at height become all too real. The TIN provided further advice on the selection and training of rescue personnel, equipment maintenance requirements and further sources of information.

TIN 013 was originally devised by a very experienced team of people, representing those from the emergency services, rescue organisations, the Health and Safety Executive, construction contractors and interest group members - all with an in-depth knowledge of the issues. Having undergone a recent review, it was decided however, due to both the depth and extent of the revised content, to convert it into the Good Practice Guide format - allowing the content to be better laid out and illustrated for clearer reading, identification and extraction of key information.

This change I believe underpins the nature and importance of the subject and keeps the need for, and requirements of, rescue at height fresh in the minds of the sector.

On behalf of TCIG and CPA, I would like to thank the members of the Working Group for all the time and effort they have spent on revising this work.

Dave Holder

Chairman

Tower Crane Interest Group

Construction Plant-hire Association.



1.0 Introduction

This document's primary purpose is to provide guidance on emergency action planning and rescue of persons from height on tower cranes. Wherever tower cranes are erected, the emergency response and rescue of persons from height - although required infrequently - should be planned for.

A tower crane emergency action and rescue plan must be viable. This means safe and effective arrangements must be made onsite to deal with foreseeable situations where it would be necessary to rescue a person requiring assistance from the tower crane structure to safety. To be effective, the on-site response needs to be swift and not cause further injury or a worsening of the casualty's condition/situation.

The people requiring rescue fall into four broad categories:

- Those erecting, altering or dismantling tower cranes, i.e. the erection crew;
- Those operating tower cranes on a daily basis, i.e. the operator;
- Other people with authorisation to climb the crane; such as site managers, supervisors, photographers as well as the crane owner's managerial and supervisory staff;
- Those carrying out maintenance, inspection or thorough examination, i.e. maintenance personnel and engineer surveyors.

NOTE: *This document does not cover the rescue of non-authorised persons such as trespassers*

Whilst historically the number of incidents where rescue has been required from tower cranes has been very few, the consequences of failing to ensure that suitable rescue arrangements are in place are extremely high. Suitable and sufficient rescue arrangements should be established and maintained whilst a tower crane is being erected, dismantled and in use.

The primary duty for emergency planning, and ensuring that there are adequate resources for carrying out rescue from a height of persons on a tower crane, rests with the organisation in control of the premises on which any tower crane is sited. In the case of a construction site, this is the Principal Contractor.

The emergency action and rescue plan prepared by the principal contractor should:

- consider all persons who may require rescue whilst the crane is at the site whilst the crane is being erected, dismantled, in-service, maintained or thoroughly examined;
- be specific to the crane and site;
- provide clear procedures that are understandable and be capable of being followed by the rescue team;
- include measures and arrangements to minimise the rescue being required in the first place;
- include arrangements for casualty assessment prior to rescue;
- be capable of being enacted in good time without unnecessary delays;
- take account of the safety of those undertaking the rescue;
- include the selection, training and competency assessment of team members;
- include arrangements for selection and routine inspection of rescue equipment;
- take account of variable weather conditions and lighting levels;
- include arrangements for communication between rescue team members;
- be regularly reviewed whilst the crane is on the site and amended where necessary to ensure that rescue arrangements remain valid and viable.

2.0 Legislation

Health and safety legislation requires that safe systems of work be in place for all work activities, along with the duty to provide a means of safe rescue, arise from:

- The Health and Safety at Work, etc. Act 1974 (HSWA), Sections 2 and 3;
- The Work at Height Regulations 2005 (WAHR), Regulation 4(2);
- The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER), Regulation 5(1)(d);
- The Management of Health and Safety at Work Regulations 1999 (MHSW), Regulation 3;
- The Construction (Design and Management) Regulations 2015 (CDM), Regulation 30 – Emergency Procedures; and
- The Health and Safety (First Aid) Regulations 1981.

The primary duty for ensuring that there are viable emergency action plans, and adequate resources for carrying out rescue from a height of persons on a tower crane, rests with the organisation in control of the site on which a tower crane is sited. In the case of a construction site, this is the principal contractor as defined by the Construction (Design and Management) Regulations 2015 (CDM), Regulation 13.

The Health and Safety (First Aid) Regulations 1981 require employers to provide adequate and appropriate equipment, facilities and personnel to ensure their employees receive immediate attention if they are injured or taken ill at work.

3.0 Responsibility for Emergency Action Planning and Rescue

The organisation in charge of the site - the principal contractor on a construction site, should ensure that adequate arrangements and resources are in place for rescue of persons from tower cranes. These should be in place during erection, operation of the crane, maintenance, thorough examination, and dismantling.

The principal contractor should consult and liaise with the tower crane supplier and the employer of the competent person undertaking thorough examination to ensure that rescue arrangements they are providing are adequate and viable. In most instances, whilst arrangements for rescue during the erection, alteration and dismantling phases may be planned and implemented by the tower crane supplier, the principal contractor retains the duty to ensure they are in place.

Consultation and discussions on rescue arrangements with the tower crane supplier and the organisation providing thorough examination should take place before the crane is erected. The arrangements should be agreed between the parties for the time the tower crane(s) is to be on site, together with any variation in arrangements at different stages of the project. All agreed arrangements should be fully documented.

As a construction site constantly changes, all risk assessments and rescue arrangements, including any on-site resources, should be frequently reviewed by the principal contractor to ensure that they are still valid and viable. This is particularly important on sites where there may be only one crane erected or where rescue team members, who were present at the early stages of the project, are no longer on site.

4.0 Circumstances Requiring Emergency Action and or Rescue from Height

The following table summarises the activities during which persons may require emergency action and rescue from height, the persons who may assistance and the types of emergencies that may precipitate the need for rescue:

Activity	Person requiring emergency action and rescue					Type of emergency			
	Erector	Operator	Maintenance Persons	Competent Person	Visitors	Suspension from fall arrest system	Equipment failure	Medical emergency/ injury Major/Minor	Partial collapse of tower crane structure
Erection	✓					✓	✓	✓	✓
Use		✓					✓	✓	✓
Alteration	✓					✓	✓	✓	✓
Maintenance			✓			✓	✓	✓	✓
Thorough Examination				✓		✓	✓	✓	✓
Dismantling	✓					✓	✓	✓	✓
Other					✓	✓	✓	✓	✓

Table 1: Circumstances Requiring Rescue from Height

Table 1 indicates that the circumstances requiring emergency action and rescue from height fall into two categories:

- a) During erection, alteration and dismantling of the crane when the people who may require rescue are members of the crane supplier's erection team;
- b) During use, maintenance and thorough examination of the crane when those that may require rescue are the operator, visitors to the crane (e.g. safety advisors, managers, etc.), maintenance persons and 'competent persons' carrying out thorough examinations.

NOTE: Any onsite intervention must always be conducted within the safe limitations of the onsite rescue team and onsite first aider competency. It may be necessary to wait for professional rescue and clinical assessment/care if it is suspected the casualty is suffering a major illness or injury

5.0 Preventative Measures

On the basis that prevention is better than cure, the first consideration when planning for rescue are the measures that can be taken to minimise the risk of rescue being required in the first place. Such measures can include:

- a) Regular personnel medical fitness assessments (see *Medical Fitness to Operate Construction Plant - Good Practice Guide - Construction Industry Plant Safety Group* (free download from www.cpa.uk.net);
- b) Site monitoring of any changes in personnel attitude or health, including mental health;
- c) Ensuring that operator breaks, and refreshment are taken at appropriate intervals to combat fatigue and low blood sugar;
- d) Personnel awareness of any potential issues through free confidential helplines etc;
- e) Personnel (especially operators) encouraged to report as soon as they start to feel ill, so that they can climb down the crane before their condition deteriorates;
- f) Competence (experience, knowledge and training) of personnel;
- g) Regular radio communication between the operator and crane supervisor and/or slinger/signaller, even when the crane is idle between lifts (see BS 7121- 1:2016, Annex F);

NOTE: *The lifting team should agree a timeframe which constitutes prolonged breakdown in comms procedure i.e., back up radio, mobile phone*

- h) Allocation of a 'buddy' to monitor personnel's safe progress during ascending and descending the crane (see CPA TCIG TIN 034);
- i) Personnel working outside collective protection on tower cranes should always wear short lanyards to limit fall distance and facilitate rescue;
- j) Fitment of a passenger hoist to the crane to eliminate the need for the operator to ascend and descend using the mast ladders.

6.0 Consultation with the Local Fire and Rescue Service

The principal contractor should consult with the local fire and rescue service to understand their capabilities and how they can support any onsite rescue. It is recommended that the findings of the consultation are used in the formulation of the site emergency response and rescue plans.

NOTE: UK Fire and Rescue Services consider rescue from tower crane as a specialist rescue provision. Capabilities and response times may vary as specialist teams may have extended travel distances.



Figure 1: Hertfordshire Fire and Rescue Service - Specialist rope rescue team conducting onsite tower crane rescue training

7.0 Casualty Assessment and Stabilisation

The emergency response plan should include early notification to the emergency services of the emergency. The plan should consider how emergency service responders/paramedics are to be met on arrival and escorted to the casualty.

On-site first aiders should be familiar with how to access the tower crane safely and swiftly to carry out initial assessment, provide immediate casualty care (including the use of a defibrillator) and advise on the need for further assistance. They should continually monitor the patient, keeping them warm and stable whilst a rescue is undertaken.

If the initial assessment made by the site First Aider finds that casualty has suffered a major illness or injury, it is recommended that rescue is not attempted until an assessment has been made by an emergency service responder/paramedic. Where practicable, the casualty should be stabilised before they are moved.

NOTE: *In some situations, an initial rescue may be necessary to recover the casualty to a place of safety to enable the assessment to be undertaken*

Casualty assessment and treatment may simplify the rescue method. After assessment and possible treatment, the casualty may be able to climb down with assistance from the crane whilst being closely monitored and supervised.

It is essential that a competent first aider is always available on site whilst the tower crane is being erected, operated, maintained, thoroughly examined, and dismantled. When available, the site should also consider including nurses or first aiders with enhanced competencies in the response team.

The First Aid responders should be included in any training sessions for the rescue team. Whilst they may not be directly participating in the recovery process, it is important that they are familiar with the arrangements and the potential impact the process may have on the casualty.

8.0 Rescue Plan

The principal contractor should prepare a Rescue Plan that records the outcome of the planning process. The plan should:

- consider all persons who may require rescue and whenever they may require rescue whilst the crane is at the site;

Note: Details of persons and circumstances in which rescue is required is provided in **Table 1**

Note: The plan needs should take account of the operational times of the crane and time for the operator to climb and descend from the crane

- be specific to the crane and site;
- provide clear procedures that are understandable and be capable of being followed by the rescue team;
- include arrangements for early notification to the emergency services;
- include arrangements as to how emergency service responders/paramedics are to be met on arrival and escorted to the casualty;
- include details of measures and arrangements to be taken to minimise the rescue being required in the first place, and prioritise safe and swift access to a person in need of help;
- include sufficient arrangements for casualty assessment by a competent first aider prior to rescue;
- include review measures to confirm the plan devised is capable of being enacted in good time without unnecessary delays;
- take account of the safety of those undertaking the rescue and the casualty;
- include a list and description of rescue equipment to be provided and instructions of how and where it can be used;
- include arrangements safe storage, and routine inspection of rescue equipment;
- include a list and description of PPE to be issued to the rescue team and first aiders and where it is to be stored;
- include the selection, training, and competency assessment of team members;
- take account of variable weather conditions and lighting levels;
- include arrangements for communication between rescue team members;
- be regularly reviewed whilst the crane is on the site and amended where necessary to ensure that rescue arrangements remain valid and viable;
- include arrangements to ensure that a copy of the plan, or any subsequent revisions, is provided to members of the rescue team, those who may require rescue, the tower crane supplier and the employer of the competent person undertaking thorough examination of the crane.

9.0 Rescue Arrangements

9.1 Rescue arrangements for tower crane erectors

The principal contractor should seek confirmation from the tower crane supplier that the tower crane erection team are competent in the use of their own rescue equipment with which they can raise or lower a member of their team who may have fallen and is stranded, or is injured or unwell, as needed. All members of the erection team should have the necessary competence (skills, knowledge, training and experience) to carry out a rescue of a team member safely. This will include both initial and refresher training.

Due to the heightened risk that rescue may be required, the rescue equipment should be located close to the scene of work operations during the crane erection to enable swift deployment. The tower crane supplier should ensure that the rescue equipment provided to the erection team is inspected and maintained as recommended by the equipment manufacturer.

9.2 Rescue arrangements for crane operators and other people with authorisation to climb the crane

The rescue arrangements for crane operators and other people with authorisation to climb the crane should consider:

- the locations where a casualty may require assistance - see **Table 1**;
- who will undertake the rescue - see **Section 9.3**;
- and potential methods of rescue - see **Section 10**.

9.3 Rescue arrangements for persons undertaking maintenance and thorough examination

9.3.1 General

The rescue plan prepared by the principal contractor should consider persons undertaking maintenance and thorough examination. Maintenance of tower cranes is generally undertaken by the tower crane supplier. Thorough examination can be undertaken by persons employed by the tower crane supplier and/or by persons employed by independent engineering inspection bodies.

Prior to maintenance or thorough examination, the principal contractor should discuss and agree with the respective employer how rescue will be facilitated. The rescue arrangements should consider the nature of the maintenance or examinations being undertaken, the equipment supplied and the crane(s) being maintained or inspected.

9.3.2 Jib inspection

Where a jib inspection is to be carried out, the risk assessment undertaken as part of the planning process should consider:

- a) Whether the crane operator is going to be available for the duration of the work to monitor the maintenance personnel/competent person and raise the alarm in the event of rescue being required and, if not, the need for a second person to avoid the hazards of lone working;
- b) Whether the inspection can be carried out from the trolley basket of a saddle jib tower crane, in which case rescue provision is unlikely to be required;
- c) If the jib is accessed by a walkway, the need to assess the suitability of the walkway using the following criteria:
 - What is the size and nature of the jib to be inspected?
 - Is there good access?
 - Can the jib be lowered so that it is level for easier access?
 - Is a walkway fitted along the whole length of the jib?

- Are “anti-slip” provisions made on the painted/smooth areas?
 - Is there a handrail as well as a safety line?
 - Is there an inspection basket for the jib nose?
 - Is there an anti-fall provision on ladders (to A-frame, etc.)?
- d) The type of personal fall protection being used;
- e) Whether deployment of fall arrest protection equipment could leave the operative some distance below the crane's structure, requiring a rescue;
- f) Whether the potential for pre-syncope has been addressed by the supplier (harness type, training, stirrups);
- g) Whether use of a short fall arrest attachment that will only allow a small fall, permitting the operative to self-rescue in most cases;
- h) The competence (experience, knowledge and training) of personnel undertaking the work.

NOTE: *The assessment of competence can be assisted by the review of training and experience records*

Best practice is to have all maintenance, inspection and thorough examination activities on a jib carried out by two people who have the competence to rescue each other if needed.

10.0 Rescue Options and Methods

There several options for dealing with an emergency which requires a person to be recovered to safety from height to ground level. These include after medical assessment, escorting a casualty down the crane's access ladders, lowering a casualty, raising a casualty or self-rescue with specialist equipment. The casualty's recovery may be accomplished in stages with an initial rescue to a place of safety and then, after medical assessment, a second phase recovery to ground level. In some instances, more than one recovery method or technique may be necessary.

It is essential that:

- the planning undertaken by the principal contractor considers all potential methods and techniques;
- sufficient persons are available to undertake the rescue without placing the casualty or rescuers at risk;
- the chosen method of rescue is communicated to all rescue team members;
- the rescue team consider the condition and the location of the casualty before commencing a rescue;

10.1 Rescue by escorting the casualty down the crane's tower access ladders

After medical assessment, a casualty with minor injury or illness may be able to be climb down the ladder system whilst being escorted by the rescue team.

The advantages of using the tower crane's access ladders are:

- The route will be familiar to the rescue team and casualty;
- The route has collective fall protection throughout its length;
- There are safe places for rescuers to stand, above and below the casualty;
- The ladders are inclined with rest platforms provided at intervals not exceeding 10m;
- The rescue personnel have can pause the descent at any time to administer further first aid or for any other reason.

The disadvantages of using the tower crane's access ladders are:

- The casualty may deteriorate during the decent;
- Each additional ladder and rest platform on the crane will increase the overall rescue time.

NOTE: *The number of ladders that must be navigated can be reduced if a high level bridging walkway is installed between the building under construction and the crane*

NOTE: *If the casualty requiring rescue is part way up a crane that is positioned in a lift shaft, the only method of rescue that is available may be to escort the casualty down or up the ladder system to the nearest egress point*

10.2 Rescue by use of a special purpose crane passenger lift

Special purpose passenger lifts are available that can be a fitted to the mast structure of some tower cranes. When fitted, they can be used to take a casualty from the upper termination point just below the slew ring to ground level.

The advantages of using a passenger lift include:

- Rescue team members and emergency service personnel can ascend the crane very quickly;
- The casualty can be taken to ground level without the use of other specialist equipment and a full rescue team.

The disadvantages of using a passenger lift include:

- The size of the lift may restrict the casualty to be transported in a vertical position;
- The size of the lift may not permit a first aider to accompany the casualty in the hoist;
- The casualty will still have to be taken through the slew ring opening if the casualty is on the upper slewing structure;
- The casualty will still have to be taken up or down the ladder if the casualty is on the ladder system, as the lift will only have entry and exit points immediately below the slew ring and at the base of the crane.



Figures 2: Example of a Passenger Lift

10.3 Rescue by man-riding carrier suspended from a crane

Rescue can be made from most cranes with the use of a specially designed man riding rescue carrier (see **Figure 2**) which can be suspended from the crane on which the rescue is being carried out or from a nearby tower crane or mobile crane. The advantage of this system is that the casualty can be speedily recovered to the ground without the use of any special rope rescue techniques.

If rescue by a man riding carrier is selected:

- The rescue carrier will have to be stored in a suitable position on the site where it can be reached, or brought within reach, of all the cranes on the site;
- All crane operators on site will all have to be trained and familiarised to use all the tower cranes on site as the casualty could be the operator of the crane that is required to facilitate the rescue. If a mobile crane is to be used to lift the carrier, both that the crane and operator must be always be available and the planned crane berthing location kept clear of obstructions;

- The rescue carrier should be large enough to allow the rescue stretcher and casualty to remain horizontal. If a small carrier is used, the stretcher and casualty will have to be secured in the vertical position. The stretcher should not be positioned onto the top of the guard rails of a standard sized man riding carrier;
- The carrier should have sufficient capacity for the rescue stretcher, casualty, first aider and at least one rescue team member;
- The rescue plan should consider how persons will escape/evacuate in the event of tower crane power/equipment failures.

Detailed guidance on the use of cranes or the raising or lowering of persons is given in:

- Clause 23.1 of BS 7121-1:2006, Code of practice for the safe use of cranes - Part 1: General;
- Annex H of the CPA Best Practice Guide on the Safe Use of Top Slew Tower Cranes.



Figure 3: Example of a purpose-designed rescue man-riding carrier

10.4 Rescue by use of davits or derricks

Tower cranes are available that can be supplied with davits or derricks which can assist in lowering a casualty to the ground (see **Figures 4 and 5**). In general, the pre-installed lifting equipment (winch, sheaves and rope) on the davit or derrick are not used during rescue. Instead, the davit or derrick is utilised as an anchor point in conjunction with rope rescue equipment. The davit or derrick should be assessed to ensure that it has an adequate rated capacity (safe working load) and should be subject to thorough examination at a maximum interval of six months.

NOTE: *Davits and derricks are typically provided by the crane manufacturer for the lifting of goods and are not certified (CE or UKCA Marked) for lifting persons*

Davits and derricks allow the rescue team to attach the rescue stretcher work whilst they remain within an area with collective fall protection. The stretcher can then be raised and slewed over the side of the crane to a position where it can be safely lowered to the ground or an adjacent structure.

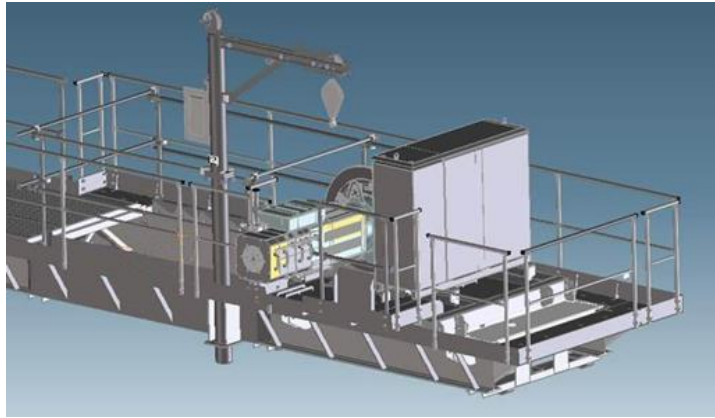


Figure 4: Lifting davit positioned on rear jib



Figure 5: Lifting jib and rescue stretcher

10.5 Rescue by a high reach MEWP

Rescue can be accomplished by a Mobile Elevated Work Platform (MEWP). The MEWP should:

- Have sufficient reach to reach the areas on the crane where rescue will be required;
- Have sufficient lifting capacity to account for the casualty, rescue stretcher and a MEWP operator;
- Be immediately available if rescue is necessary;
- Be operated by a trained and competent operator, who should be available when required without any delays.

The MEWP will have to be positioned on firm level ground close to the crane. The area that the MEWP will be stored when not in use should be kept clear of any obstructions that would prevent the MEWP being rapidly deployed.

10.6 Rescue by lowering a stretcher

Rescue can be accomplished by lowering a rescue stretcher suspended from the crane structure with ropes to the ground or a safe area such as an adjacent building or structure (see **Figure 3**).



Figure 6: Casualty being prepared for lowering in a rescue stretcher



Figure 7: Casualty being lowered in a rescue stretcher

Transitioning a stretcher over collective protection can be made safer and easier by using a high point anchor and deviation pulley (see **Figures 8 and 9**). An anchor point, above the position where the rescue will be made, will reduce the effort needed to get the stretcher over the edge. A tag line or guide rope should be used to keep the stretcher and casualty away from the crane and any adjacent structures.



Figure 8: Transitioning a casualty in a rescue stretcher into the lowering position



Figure 9: Lowering a casualty in a rescue stretcher from the rear jib

10.7 Rescuing a casualty in a fall arrest harness

Rescuing a casualty suspended in a fall arrest harness may require working outside areas where there is collective fall protection (see **Figure 10**).

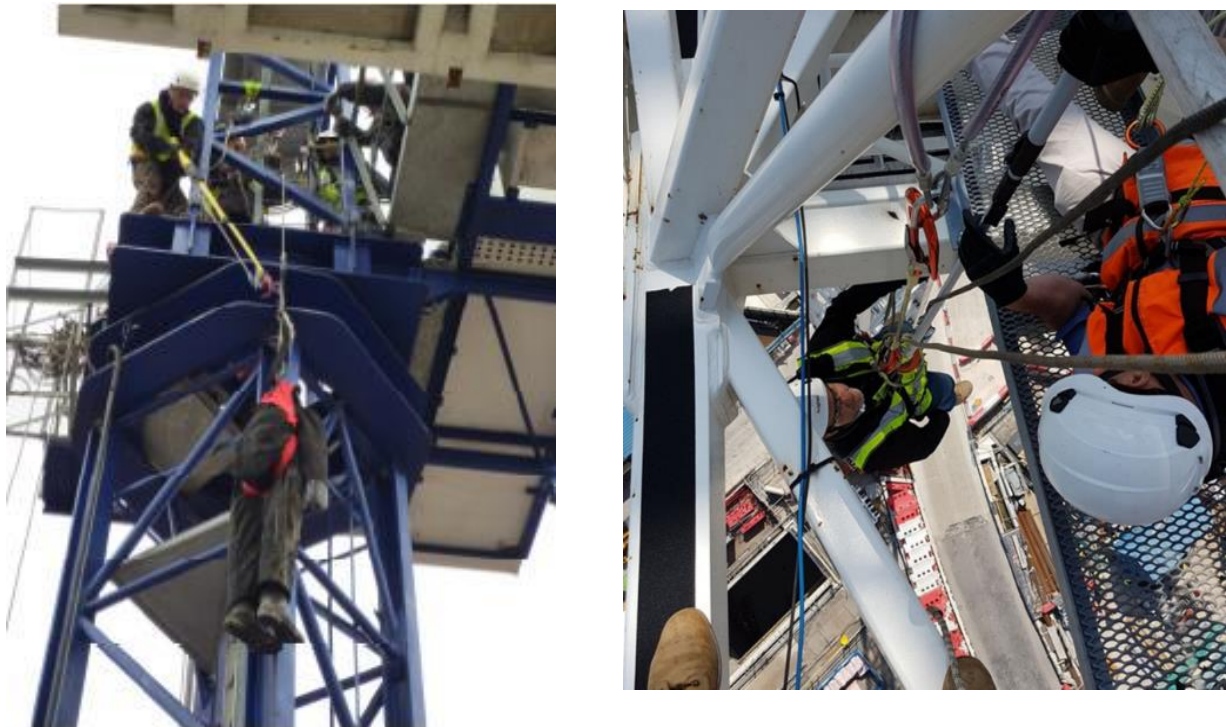


Figure 10: Rescuing a casualty suspended in a fall arrest harness may require working outside areas where there is collective fall protection

10.8 Rescue by taking a casualty down the crane's access ladders in a stretcher

Rescue by taking a casualty down the crane's access ladder system in a stretcher is not recommended and should only be undertaken after careful consideration of alternative methods, as rescue by this method will be impractical or impossible in most instances.

The disadvantages of taking a casualty in a stretcher down the tower crane's access ladders include:

- Repeated changes in orientation may cause significant deterioration of the casualty;
- The descent is likely to be bumpy and slow;

- The stretcher and casualty must be small enough to be manoeuvred through the slew ring section (see **Figure 11**), down the ladders and around the rest platforms by the rescue team members;

Note: Semi-rigid stretchers are available that are suitable for vertical use

- Each additional ladder and rest platform on the crane will increase the overall rescue time;
- The physical demands on the rescue team will be extremely high and they will need breaks or will regular substitution as the stretcher is lowered.

The advantages of using the tower crane's access ladders are:

- The route will be familiar to the rescue team;
- The route has collective fall protection throughout its length;
- There are safe places for rescuers to stand, above and below the casualty;
- The rescue personnel have can pause the descent at any time to administer further first aid or for any other reason.

NOTE: It is recommended that site specific onsite training in the use of a stretcher is as realistic as possible



Figure 11: Restricted access through the opening at slew ring section

11.0 Rope Rescue Equipment Selection and Provision

Rope rescue systems and equipment are available from a range of suppliers. When selecting equipment consideration should be given to:

- Portability of the equipment by the rescue team to the position where it will be required on the crane;
- How easy it is to configure and use the equipment;
- The potential for miss-use;
- Durability and vulnerability when in use. (Hazards such as sharp edges);
- How the equipment will be securely stored and protected when not in use so that it does not deteriorate;
- The availability of manufacturer's approved training and technical assistance;
- Compatibility and limitations of equipment.

Note: *It is essential that the instructions provided by the manufacturer are obtained and the rescue team members are made aware of any compatibility or limitations in use of the equipment*

The rescue equipment should include:

- A suitable number of rescuer harnesses;
- A suitable number of casualty harnesses;
- A suitable number of work at height helmets;
- A suitable casualty harness;
- A suitable casualty stretcher;
- Ropes, anchor stops, karabiners, and deviation pulleys;
- Equipment for recovery of a person held in suspension that includes a reach and recovery mechanism (pole) that will allow an individual to access and recover a fallen worker;
- A controlled descent device lowering device.

11.1 Rescuer harnesses

A rescuer harness should:

- Be quick and easy to put on;
- Have attachment points to allow quick connection to a system for lowering, raising and/or suspension;
- Have accessory loops to allow attachment of ancillary equipment such as a torch, radio, etc.

A selection of rescue harnesses is shown in **Figure 12**.



Figure 12: Rescuer harnesses

11.2 Casualty harnesses

Harnesses that are intended to be used by casualties should be quick and easy to fit without any assistance of the casualty. Harnesses are available that hold the casualty in different positions. As the casualty could be in a harness for long periods as they are lowered down the crane, the harness must be comfortable, provide sufficient support and not cause further injury or undue suffering to the casualty.

11.3 Rescue stretcher

A rescue stretcher should:

- Meet appropriate standards;
- Be simple to use;
- Be lightweight;
- Be compact and transportable;
- Be suitable for both horizontal and vertical lowering ;
- Provide protection to the casualty;
- Provide security to the casualty;
- Be sufficiently stiff to support the casualty;
- Be compatible with spinal immobilisation equipment;
- Be easy to lift whether manually or by crane;
- Be easy to wash and disinfect;
- Be easily stored and transportable.

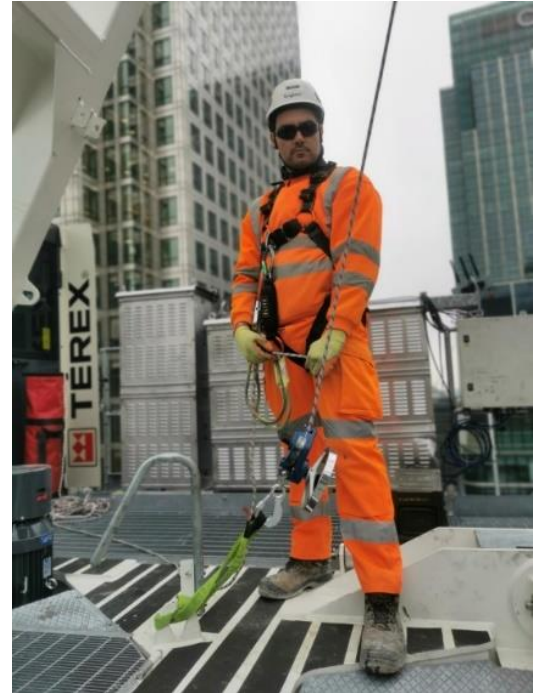
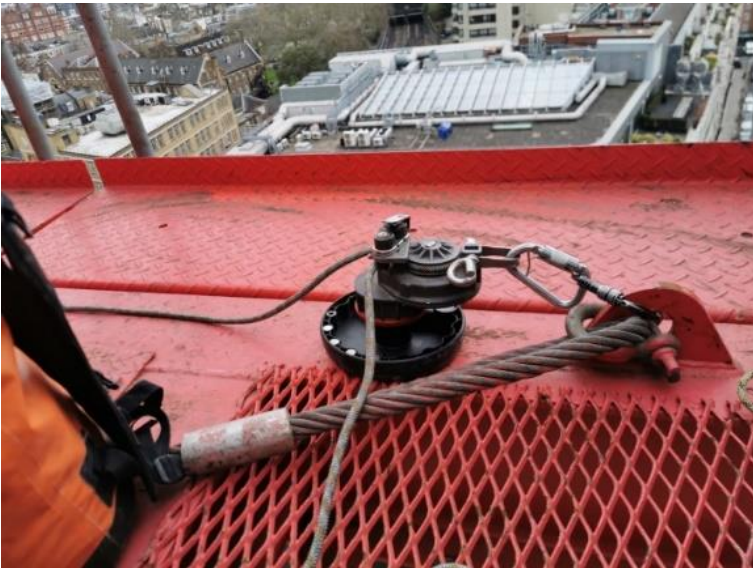
Examples of rescue stretchers are shown in **Figure 13**.



Figure 13: Rescue stretchers

11.4 Ropes, anchor strops, karabiners and deviation pulleys

The rescue kit should include a range of ropes, anchor strops, karabiners and deviation pulleys. The ropes should be of sufficient length to reach the ground easily from the highest point on the crane where rescue may be affected. Anchor strops should be of sufficient length and suitability to be secured to a range of potential anchor points. Deviation pulleys should be sized for the diameters of rope included in the rescue kit (see **Figures 14 & 15**).



Figures 14: Anchor compatibility – sling and Karabiner attachments



Figure 15: An anchored deviation pulley and karabiner

11.5 Recovery kit for recovery of a person in suspension

A recovery kit should be compact and simple to use, easily carried and should consist of all or some the following:

- A locking, extendable rescue pole allowing easy connection to a person hanging suspended after a fall;
- A controlled rate lowering device with lifting capability and maximum speed limiter, designed to rescue casualties by lifting or lowering;
- An easy to fit casualty harness;
- A pulley, providing mechanical advantage to raise a load or deviate a rope;
- Sufficient slings suitable for the application;
- Include sufficient length of rope to raise or lower the casualty to a safe location.

Examples of recovery kits are shown in **Figure 16**.



Figure 16: Recovery kits for persons in suspension

11.6 Controlled descent device

The rescue equipment selected should incorporate a descender winch that is:

- Compliant with EN341 (lowering and lifting function);
- Capable of limiting the descent speed to less than 0.8m/s;
- Rated to lower the full height of the tower crane.

NOTE: Descenders are rated with a maximum descent distance for a given payload



Figure 17: Controlled descent device

11.7 Anchor points

Anchor points for ropes used for lowering should be identified in advance of any rescue and their location be familiar to members of the rescue team. The anchor points should be immediately above the position where the casualty is to be lowered. It is recommended that the rescue kit provided to the rescue team incorporates a range of different anchor stops, pulleys and karabiners to allow for the different anchor points that have been on the crane (see **Figure 18**).



Figures 18: Anchor Points, deviation pulley and karabiner

11.8 Permanent horizontal lines on jibs

Where a permanent horizontal line is fitted and used on a jib, account should be taken of the number of people who can attach to the system safely at any one time. This information should be provided by the manufacturer of the tower crane and/or the manufacturer of the line system.

Advice on horizontal lines can be found in EN795, EN365 and BS7883.

12.0 Rescue Considerations

12.1 Rescue from cabs

Different makes and models of tower cranes have different means of access to the cab. Some have rear doors which will assist in the rescue of the operator, whilst others are accessed through a hatch in the floor or a hatch in the roof which may cause difficulties (see **Figures 19 - 22**). These factors should be considered when selecting a tower crane.



Figure 19: A narrow cab door makes access to the casualty difficult as they must be lifted over the seat



Figure 20: Small walkways also restrict access



Figure 21: Casualty may require rope assistance to lift them out of the cab



Figures 22: Restricted access can limit the number of rescuers around the casualty

12.2 Rescue from mast sections

Rescue of a casualty within a mast section can be difficult (see **Figure 23**). The casualty may have to be raised, lowered and reorientated to avoid entanglement with ladders and hoops. It is often easier to raise the casualty to the next landing and then after medical assessment, complete the recovery by lowering the casualty in a rescue harness outside of the mast structure.



Figure 23: Rescue from within the mast sections

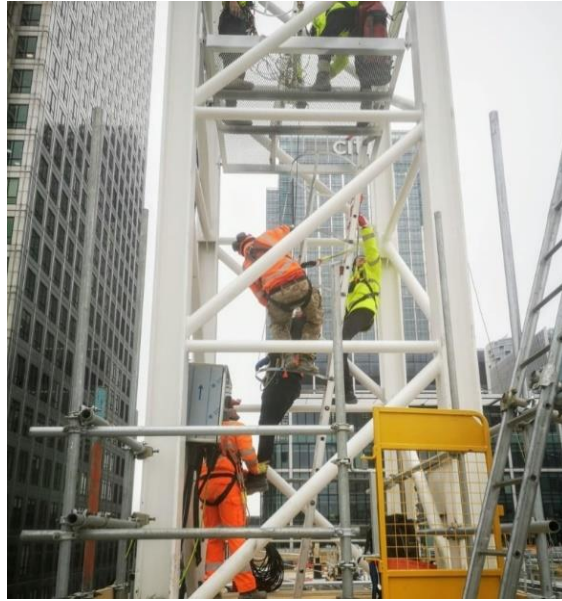


Figure 23 (cont'd):
Rescue from within the
mast sections

12.3 Rescue from the front jib, rear jib and machine deck

The front jib, rear jib and machine deck have limited and restricted space for rescue team members to operate (see **Figures 24 and 25**). To avoid congestion responders should be kept to a minimum.

Deployment of rescue systems on exposed areas such as the jibs will usually require specific training in the use of the height safety and rescue equipment in that location.

The rescuer must be particularly alert to hazards, including but not limited to:

- Exposed and unprotected fall hazards;
- Gaps in guard rails;
- Thin deck flooring that only offers minimal structural protection;
- Unguarded machinery;
- Electrical hazards;
- Grease.



Figure 24: Rescue from front jib

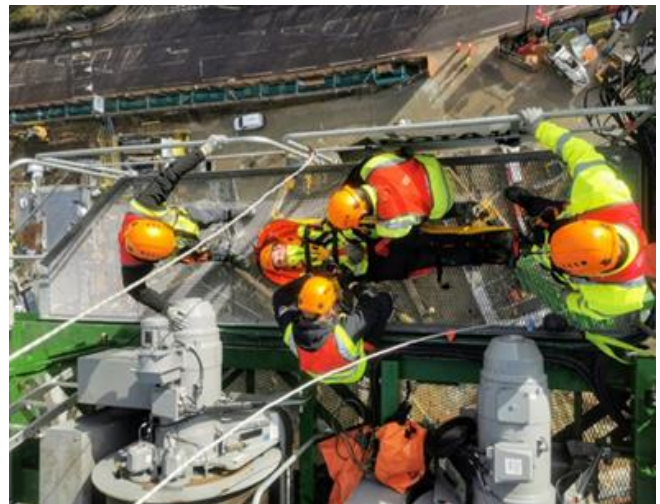


Figure 25: Rescue from front jib

13.0 Site Rescue Teams

When selecting and training site rescue team members, it is essential that:

- team members are prepared and willing to undertake rescue training and are confident to undertake an actual rescue after training has been completed;
- all the members of the team are available when required (sickness, holidays, transfer to another site day/night /weekends, etc.);
- the person being rescued will have confidence in the rescue team;
- the team members will be available to undertake the site practice rescue scenarios and attend ongoing training sessions.

The setting up and maintenance of a rescue team on a small construction site can be problematic due to the small numbers of persons available on site. Not all persons will be confident and willing to work at height. As the project progresses, persons willing and confident to work at height may move to other projects. It is essential that the availability of team members is continuously monitored.

In inner city locations, it may be possible for the site to work together with other sites or crane owners to establish a shared rescue provision. This will require training and confirmation of competence of the alternative/additional rescue team members to carry out rescue from all the makes and models of tower cranes involved, as well as coordination to ensure that the rescue provision will be available swiftly, whenever required.

If the site chooses to provide a site rescue team, then members of the team should have the following attributes:

- 1) Fit and able to assist manoeuvring a person;
- 2) Comfortable working at height;
- 3) Trained in the use of appropriate personal fall protection equipment;
- 4) Available whenever the crane(s) is(are) in operation, being maintained or thoroughly examined;
- 5) Trained and capable of taking rescue equipment, including personal fall protection equipment, up the crane;
- 6) Aware of suitable points to which the rescue equipment can be attached;
- 7) Up to date with the site emergency action and rescue plan.

13.1 Site rescue team members

The planning for site rescue teams should consider:

- How many site rescue team members will be required to affect a safe rescue allowing for holidays and absence of team members;
- How the team is to be supervised and managed;
- The number of First Aiders will be required if they are not members of the rescue team.

13.2 Mobilising the rescue team and summoning emergency services

The rescue plan should:

- consider how the rescue team are to be summonsed and mobilised to undertake a rescue;
- how the emergency services (ambulance and paramedics) are to be summonsed;
- who will coordinate and oversee rescue activities.

13.3 PPE for rescue teams

The rescue plan should consider personal protective equipment (PPE) that is to be provided to the rescue team. The equipment should include:

- Climbing safety helmet and head torch;
- Eye protection;
- Waterproof breathable clothing;
- Safety harness;
- Twin fall arrest lanyards and integral energy absorber;
- Work restraint lanyard;
- Safety boots;
- Gloves.

The equipment should be stored when not in use and in a clean, dry, secure area away from potential contaminants in an easy-to-access location, close to the crane.

13.4 Communication between rescue team members

The rescue plan should consider how rescue team members will communicate during a rescue. Any communications equipment that is provided must be of light weight and easily carried or worn. Handheld radios should be secured with a lanyard. Arrangements should be in place to ensure that any communications equipment is charged and immediately available if a rescue is required.

13.5 Training of rescue personnel

It is essential that all rescue from height on tower cranes is carried out by trained (competent) persons who should be always available on site and in sufficient numbers when rescue may be required.

Initial training, which should include checks of equipment, should be carried out by a professional training provider or by in-house trainers, who have been trained and assessed by the system supplier. Trainees should be assessed using practical exercise(s) as well as theory session(s). Whilst the training may initially be undertaken off site, it is essential that the training includes simulated rescues from different positions on the actual crane to confirm that the training has been assimilated.

Refresher training should be carried out at an interval not exceeding six months, followed by an assessment of competence by carrying out a simulated rescue. This should include a review of the rescue plan, as well as the equipment being used and its location.

Equipment should be inspected at the end of any exercise and the findings recorded.

It is recommended that time is allocated after each simulated rescue exercise for group discussion and reflection. This may identify the need for additional training, familiarisation or changes to the methods or techniques used.

It is important that trainees are not exposed to additional risk during any simulated rescue carried out during training. Where necessary, a mannequin of representative height and weight should be used during a rescue exercise, although it can sometimes be beneficial to use a 'live' casualty (person) for maximum authenticity. If a 'live' casualty is being used, competent supervision and a lifeline must be used to provide back-up fall protection.

Additional guidance is given in: BS 8454: 2006 *Code of practice for delivery of training and education for work at height and rescue* and OC 282/31.

It is also important that persons operating or carrying out work on erected tower cranes have an appreciation of the rescue process. This will ensure that if they are rescued, they will know what to expect and, if conscious, may be able to cooperate with the rescue team.

Whichever method of rescue is chosen, the personnel involved will require adequate initial and refresher training to ensure that they are competent to carry out the rescue procedure safely, minimising the risk to the casualty and themselves. Before carrying out training, a robust risk assessment should be undertaken to identify the risks involved and the control measures required to reduce those risks to a minimum.

Rescue methods, such as rope access rescue kits, will have a much higher risk profile than others, such as the use of a MEWP or a rescue man-riding cage.

14.0 Inspection and Maintenance of Rescue Equipment

All equipment used for the rescue of persons from height on tower cranes must have a pre-use check before each use. Damaged equipment should be taken out of service immediately.

It is recommended that the equipment is kept in secure tamperproof storage in-between checks, so it is ready for immediate deployment.

In addition to pre-use checks, equipment should be subjected to periodic detailed inspection (and/or thorough examination) by a competent person in accordance with a pre-determined regime specified by the equipment manufacturer (or LOLER).

NOTE: *The inspection regime may specify the need for 'interim inspection'. LOLER requires lifting equipment to undergo a six-monthly thorough examination. It may be desirable to extend the six-monthly period, e.g. where rescue kit has been hermetically sealed (which will also prevent mis-use)*

Furthermore, equipment should be inspected after use and, if damaged, taken out of service immediately.

Equipment should be kept clean and dry and should be safely stored in a secure place, close to the base of the crane. The location should be well sign posted and kept clear of obstructions. On multiple crane sites, consideration should be given to locating rescue equipment at the base of each crane. Wet equipment should be thoroughly dried before storage. Equipment should not be altered or repaired unless this has been authorised by the manufacturer.

The frequency of detailed inspection should be reviewed by a competent person, to take account of storage conditions and any damage found at pre-use and detailed inspections. All of the PPE and lifting equipment must be uniquely traceable to the inspection reports and suppliers' certificate of conformance.

It should also be noted that some of the rescue equipment will be subject an obsolescence date.

Where a permanent horizontal line is fitted, it should be inspected regularly (and tested, if required by the manufacturer).

Additional guidance is given in:

- BS 8437:2005 + A2:2012 - Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace;
- INDG 367 – Inspecting fall arrest equipment made from webbing or rope.

15.0 Bibliography

15.1 Legislation

The Health and Safety at Work etc Act 1974 (HSWA);

The Work at Height Regulations 2005 (WAHR);

Lifting Operations and Lifting Equipment Regulations 1998 (LOLER), *Safe use of lifting equipment*, Approved code of practice and Guidance (HSE, L113);

The Management of Health and Safety at Work Regulations 1999 as amended (MHSW);

The Construction (Design and Management) Regulations 2007 (CDM);

Personal Protective Equipment at Work Regulations 1992 (as amended), Personal protective equipment at work, Guidance (HSE, L25);

The Health and Safety (First-Aid) Regulations 1981.

15.2 Standards

BS 7121-1:2016, Code of practice for the safe use of cranes - Part 1: General;

BS 7883:2019, Personal fall protection equipment. Anchor systems. System design, installation and inspection. Code of practice;

BS 8437:2005+A1:2012, Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace;

BS 8454:2006, Code of practice for delivery of training and education for work at height and rescue;

BS EN 361:2002, Personal protective equipment against falls from a height. Full body harnesses;

BS EN 362:2004, Personal protective equipment against falls from a height. Connectors;

BS EN 363:2018, Personal protective equipment against falls from a height. Personal fall protection systems;

BS EN 365:2004, Personal protective equipment against falls from a height. General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging;

BS EN 795:2012, Protection against falls from a height — Anchor devices — Requirements and testing;

BS EN 1496:2017, Personal fall protection equipment. Rescue lifting devices;

BS EN 1497:2007, Personal fall protection equipment. Rescue harnesses;

BS EN 1498:2006, Personal fall protection equipment. Rescue loops.

15.3 Other Publications

INDG 367, *Inspecting fall arrest equipment made from webbing or rope* (HSE, www.hse.gov.uk/pubns/indg367.pdf)

OC 282/31, Rope evacuation from mechanical handling equipment (HSE, HSE Operational Circular, http://www.hse.gov.uk/foi/internalops/ocs/200-299/282_31.htm)

Topic Inspection Pack – Falls from Height (HSE, www.hse.gov.uk/foi/internalops/fod/inspect/falls.pdf)

Guidance on rescue during work at height (Work at Height Safety Association, Technical Guidance PGN03 <http://www.wahsa.org.uk/wp-content/uploads/2017/11/PGN03-GUIDANCE-ON-RESCUE-DURING-WORK-AT-HEIGHT.pdf>)

CPA Best Practice Guide on the Safe Use of Top Slew Tower Cranes (CPA)

Strategic Forum Plant Safety Group (SFPSG) Best Practice Guide on Medical Fitness to Operate Construction Plant (CPA)

CPA TCIG TIN 034 - Ensuring the Safe Access of Tower Crane Operators on Site.

All CPA and SFPSG publications are free downloads at www.cpa.uk.net

15.4 Useful Websites

Chief Fire Officer's Association	www.nationalfirechiefs.org.uk
Construction Plant-hire Association	www.cpa.uk.net
CITB	www.citb.co.uk
Health and Safety Executive	www.hse.gov.uk
Industrial Rope Access Trade Association	www.irata.org/
Safety Assessment Federation	www.safed.co.uk
Work at Height Safety Association	www.wahsa.co.uk

NOTE: *The Work at Height Safety Association can provide a list of manufacturers and providers of rescue equipment*

16.0 Acknowledgements

16.1 Working Team Members

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16.2 Photographs

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