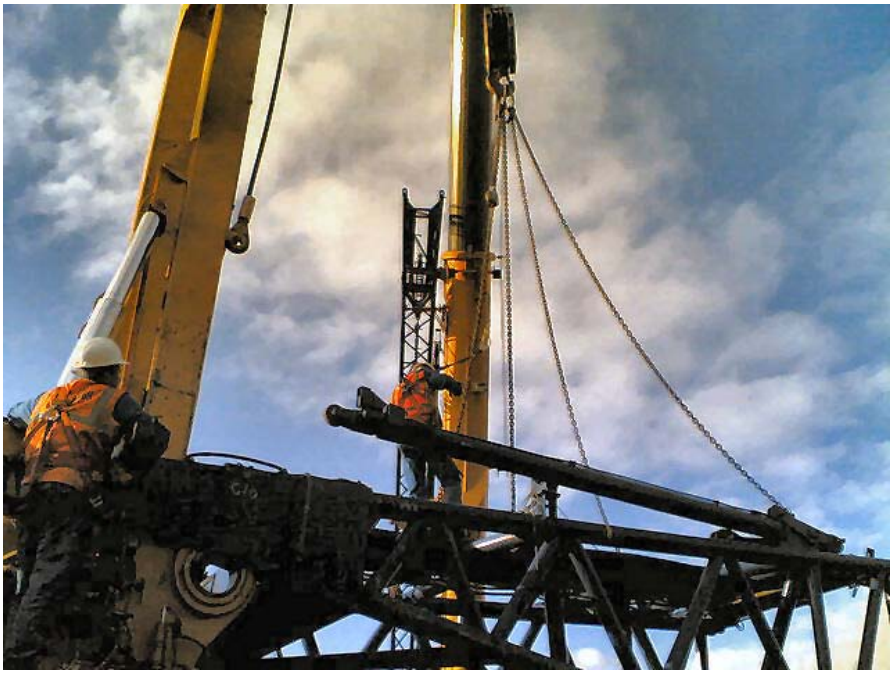
Work at Height on Mobile Cranes



CPA Best Practice Guide

Work at Height on Mobile Cranes

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Working in Partnership

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1.0 Introduction

On average there are five fatalities in the workplace each year due to falls from height from vehicles, including mobile cranes, with a yearly average of 775 non-fatal major injuries from the same cause. Where working at height is required as part of the rigging, use, maintenance and thorough examination of mobile cranes, it should be carried out by trained personnel, following careful planning, which includes adequate assessment of the risks involved. This document provides guidance on the issues involved.

Health and Safety legislation requires that safe systems of work are in place for all work activities. The particular references for the requirement to provide safe access, egress and a means of safe rescue are:-

- Health and Safety at Work etc. Act 1974. - Sections 2 & 3
- Work at Height Regulations 2005
- Provision and Use of Work Equipment Regulations (PUWER) 1998 – Regulation 17
- Lifting Operations and Lifting Equipment Regulations (LOLER) 1998 – Regulation 3
- Management of Health and Safety Regulations 1999 – Regulation 3
- Construction Design and Management Regulations 2007

2.0 Definitions

2.1 work at height (Work at Height Regulations)

"work at height" means -

(a) work in any place, including a place at or below ground level;

(b) obtaining access to or egress from such place while at work, except by a staircase in a permanent workplace,

where, if measures required by these Regulations were not taken, a person could fall a distance liable to cause personal injury

2.2 mobile crane

a jib crane capable of travelling, laden or unladen, by means of either road wheels or crawler tracks and which relies on gravity for stability

2.3 fall arrest system

a personal fall protection system which uses a body holding device (harness) connected to a reliable anchor to arrest and restrict a fall so as to prevent the collision of the user with the ground or structure whilst limiting the forces on the body

2.4 work restraint system

a personal protective system which uses a body holding device (harness) connected to a reliable anchor to prevent a person from reaching zones where the risk of a fall exists

2.5 work positioning system

a personal fall protection system which normally includes a body holding device (harness) connected to reliable anchor to support the user in tension or suspension in such a way that a fall is prevented or restricted

2.6 mobile elevating work platform (MEWP)

mobile machine which consists, as a minimum, of a work platform with controls, an extending structure and a chassis; that is intended for work at height

2.7 collective measures

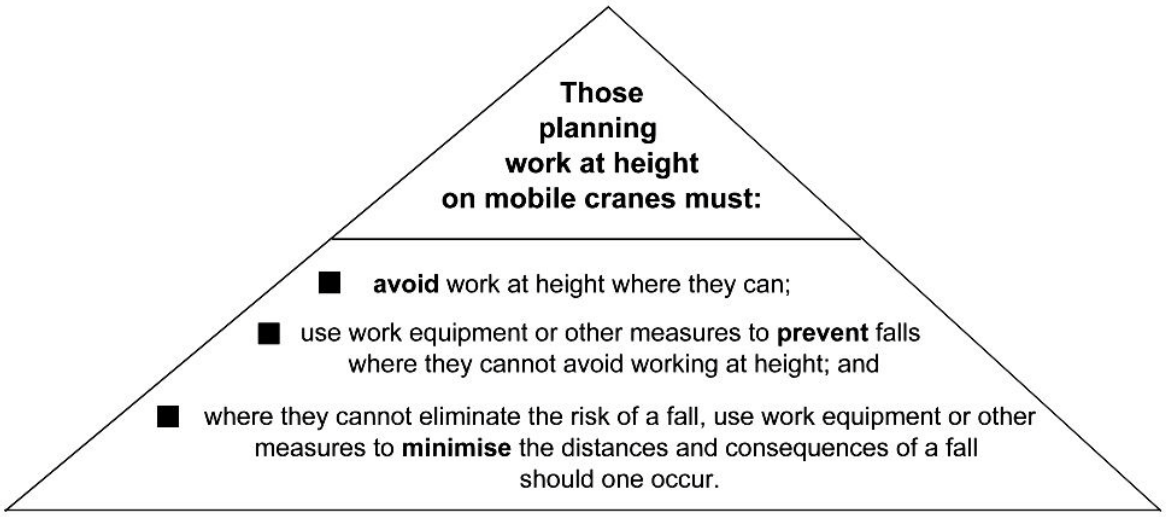
measures which collectively protect one or more people from falling (e.g. guardrails) or mitigate the effects of a fall (e.g. airbags or nets)

2.8 personal measures

measures which protect an individual from falling or mitigate the effects of a fall (e.g. personal work restraint or fall arrest systems)

3.0 Hierarchy For Work at Height

The *Work at Height Regulations 2005* set out a hierarchy of fall protection measures to be taken when planning work at height



- Avoid work at height wherever possible and actively seek solutions to facilitate this;
- If this is not possible, use “collective” means of prevention such as guardrails;
- If this is not possible, use “personal” means of prevention such as work restraint;
- If this is not possible, use “collective” means of protection such as air bags;
- If this is not possible, use a personal fall protection system such as a work positioning system or fall arrest system;
- Additionally provide training and instruction and take other measures to prevent any person falling a distance liable to cause personal injury.

As a primary aim, all tasks associated with work at height on mobile cranes should be reviewed to see if they can be fully or partially completed at ground level.

If, when working on mobile crane rigging and maintenance, it is not possible to avoid all work at height, collective or personal fall protection measures may need to be implemented. See **Section 7.**

4.0 Circumstances Requiring Work at Height

The following table summarises the main activities and locations requiring both access and work at height. .

Activity	Person Working at Height	Location
Rigging and de-rigging	Rigger + Operator	Access to parts of the crane above ground level without edge protection to guide lifted components, attach and remove lifting accessories, and to assemble components.
Loading and unloading of crane components on and off vehicles	Rigger + Operator	Access to vehicle body and load to attach and remove lifting accessories, and fit and remove load securing devices.
Access to cab	Operator	Access to the superstructure cab to carry out crane operating duties
Daily checks	Operator	Access to all parts of the crane necessary for carrying out daily/weekly checks
Fitting and removal of cab security guards	Operator	Access to exterior of superstructure cab to fit and remove security guards
Maintenance	Maintenance personnel	Access to all parts of the crane to carry out maintenance tasks
Thorough Examination	Competent person	Access to all parts of the crane to carry out thorough examinations

Further identification of fall hazards associated with mobile cranes is given in **Annex 2.**

5.0 Responsibility for Planning of Work at Height and Provision of Rescue Resources

The primary duty for ensuring that work at height on a mobile crane is effectively planned and that there are adequate resources for carrying out rescue of persons from height, rests with the organization in control of the premises on which any mobile crane is sited. In the case of a construction site this will be the Principal Contactor, as defined by the *Construction (Design and Management) Regulations 2007*. The Principal Contractor has a responsibility to assess, approve the method of work and monitor that work is carried out in accordance with the method statement.

Location	**Responsibility for Planning Work at Height**
Construction Sites	Principal Contractor
Industrial Premises	Person in control of the site
Retail Premises	Person in control of the site
Airports, Docks and Railways	Person in control of the site
Petrochemical Plants	Person in control of the site
Domestic Premises	Sole responsibility of the crane supplier if hiring directly to a consumer.

In practice it is likely that:-

- Arrangements for work at height during rigging and de-rigging will be made by the mobile crane supplier;
- Arrangements for rescue during rigging and de-rigging, maintenance and thorough examination on site, or other activities associated with the mobile crane will be made by the person in control of the site. The mobile crane supplier should, however, also ensure that adequate arrangements are in place;
- Arrangements for work at height during use and the carrying out of daily checks by the operator will be made by the mobile crane supplier;
- Arrangements for work at height during maintenance and thorough examination will be made by the crane supplier in cooperation with the employer of an external competent person (e.g. An Insurance Company);
- Arrangements for rescue during maintenance and thorough examination will be made by the crane supplier in cooperation with the employer of an external competent person (e.g. An Insurance Company).

Note: It is vital that there is effective communication between all parties involved.

6.0 Planning

In carrying out both work at height and rescue from height, as with all activities in the workplace, employers must ensure that a safe system of work is in place. Planning is a vital part of establishing the safe system of work and will involve the following stages relating directly to work at height (See **Sections 3 and 4**):-

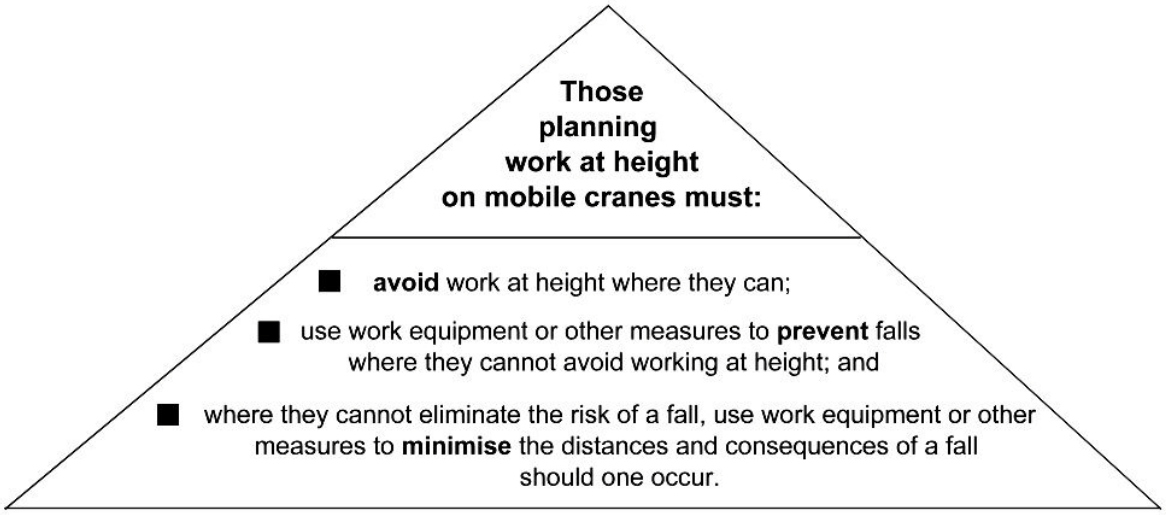
- Identify the task to be undertaken and by whom;
- Identify the hazards associated with the task;
- Carry out a risk assessment;
- Identify control measures;
- Select appropriate equipment;
- Develop the method to be used;
- Record the outcome of the planning in a Method Statement. See Annex **10**;
- Communicate the plan to all persons likely to be involved and affected by the work;
- Review the plan whenever circumstances change and at appropriate intervals;
- This safe system of work should form part of the overall planning for mobile crane rigging, alteration, maintenance, de-rigging, thorough examination and operation;
- Arrangements should be put in place to monitor the tasks.

The control measures identified should include arrangements for training of personnel and the provision, inspection and maintenance of both PPE and rescue equipment.

It is essential that the crane manufacturer's instructions are followed and incorporated into the planning process.

7.0 Guidance for Work at Height

The *Work at Height Regulations 2005* set out a hierarchy of fall protection measures to be taken when planning work at height



- Avoid work at height wherever possible and actively seek solutions to facilitate this;
- If this is not possible, use “collective” means of prevention such as guardrails;
- If this is not possible, use “personal” means of prevention such as work restraint;
- If this is not possible, use “collective” means of protection such as air bags;
- If this is not possible, use a personal fall protection system such as a work positioning system or fall arrest system;
- Additionally provide training and instruction (See **Section 11**.) and take other measures to prevent any person falling a distance liable to cause personal injury.

7.1 Elimination of Work at Height

As a primary aim, all tasks associated with work at height on mobile cranes should be reviewed to see if they can be fully or partially completed at ground level. Manufacturers should be encouraged to ensure that new designs of mobile crane are developed to reduce the need for work at height to a minimum. Where work at height cannot be eliminated the following hierarchy should be employed.

7.2 Collective Fall Prevention Measures

Permanent collective fall prevention measures such as guard rails currently have a limited application on mobile crane structures. They are sometimes used on roofs of crawler crane machinery housings and on the working platforms of some wheeled mobile cranes.

When purchasing new mobile cranes, consideration should be given to the collective measures provided by the manufacturers as part of the purchase evaluation process. Manufacturers should be strongly encouraged to incorporate collective measures into new designs of mobile crane to enable rigging, use and maintenance to be carried out safely, with a minimal need for the use of personal fall protection systems.

Other collective measures that can be employed include the use of other equipment such as access gantries, tower scaffolds and MEWPs. Care needs to be taken, particularly in the case of MEWPs where the operation should be adequately planned and operators must be adequately trained and familiarised with the specific model of MEWP to be used.

Detailed guidance on the safe use of MEWPs is given in *BS8460:2005 – Safe use of MEWPs – Code of practice*

7.3 Personal Fall Prevention

Collective fall prevention is often difficult to provide when accessing mobile crane structures. Therefore some of the work will be carried out using personal fall prevention equipment. This will normally fall into one of two types:-

- Work restraint systems
- Work positioning systems

7.3.1 Work restraint systems

Figure 1 - Work Restraint System

Work restraint systems are designed to prevent personnel from reaching an unprotected edge and falling. By definition they restrain the wearer by restricting movement and may be of limited value when working on the crane structure.

7.3.2 Work positioning systems

Work positioning systems can provide full or partial support to personnel and prevent them from falling whilst carrying out tasks in one location. They allow the wearer to work safely with both hands. Work positioning systems used on mobile cranes should always be combined with a fall arrest system to provide protection at the location where the work positioning system will be used. The fall arrest system will provide protection whilst the wearer is moving to and from, the location where the work positioning system will be used.

Figure 2 - Work Positioning System

7.4 Collective Fall Protection

There are a number of proprietary collective fall protection systems, such as nets or airbags on the market. These should be carefully evaluated to ensure that they are appropriate and effective solutions for the particular issues associated with working at height on mobile cranes.

7.5 Personal Fall Protection

If it is not possible or appropriate to use collective or personal fall prevention or collective fall protection systems, personal fall protection should be used to mitigate the effects of any fall. This will generally be the use of personal fall arrest systems

Figure 3 - Fall Arrest System

Fall arrest systems will reduce the consequences of a fall where the wearer is working outside a protected edge, such as the confines of any guardrails. A two lanyard system will allow movement around a structure. When fall arrest systems are used, a vital part of the planning process is consideration of arrangements for the rescue of persons suspended in the fall arrest system after a fall.

Suspension trauma can occur even if a person has only been suspended at height for a short period of time, particularly if they are motionless (See Section **9.1**).

When using fall arrest systems it is important that the anchor point is as high as possible to ensure that the “fall factor” which provides an indication of the length and severity of a fall, is kept as low as possible. The “fall factor” can also be reduced by the use of a proprietary shortening device (See Figure **4**).

Reducing fall factors is vital where personnel using fall arrest systems are working at low heights above the ground, as is often the case with mobile cranes. If an anchor point is level with the feet of the wearer the minimum free space required above the ground with a 1.5m energy absorbing lanyard is 5.75m, according to Table F1 of BS 8437.

Further information on “fall factors” is given in Clause 9.1.3.1 of BS 8437:2005 - *Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace.*

Figure 4 - Lanyard Shortening Device

7.6 Anchor Points

All personal fall protection systems require connection to an anchor point. It is essential that all anchor points have an adequate margin of strength and stability to withstand the dynamic and static forces that could be applied to them in service. Anchor points for fall arrest systems will require a greater capacity than those for work restraint or work positioning systems. Manufacturers should be consulted on the designation of suitable & sufficient anchor points.

Single person anchor points for fall arrest systems should be designed to resist a minimum static force of 12kN. This includes a safety factor of 2 to allow for the dynamic and static forces that could be applied to them in service. If two or more users are to be connected to the same anchor the minimum static strength of the anchor should be increased to 14kN for two persons and 16kN for three person use.

Specifications for the installation and testing of anchors are given in:-
BS 7883:1997 - *Code of practice for application and use of anchor devices conforming to BS EN 795.*

Where personal fall protection systems are required, manufacturers should be encouraged to provide and designate suitable & sufficient anchor points to which lanyards etc. can be fastened. On new machine purchases the provision of anchor

points should be made a condition of order and manufacturer's advice should be sought on the availability of anchor point kits for retrofitting on existing cranes.

With all types of personal fall protection equipment it is essential that the following points are considered during planning for work at height:-

- Correct equipment for the application is selected;
- Personnel are trained and assessed as competent in the correct adjustment, use, care and recorded checking of fall protection equipment;
- Suitable anchor points on the structure are identified*;*
- Arrangements are made for the inspection and maintenance of the equipment.

Some basic advice on the selection of personal fall protection systems is given in **Annex 4.**

Additional detailed guidance is given in BS 8437:2005 - *Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace.*

7.7 Ladders

The basic configuration of mobile cranes means that it may not be possible to provide means of access to parts of the crane with collective fall protection, particularly when a crane is on site, rather than in a depot. Consequently fixed ladders (attached to the crane structure) and portable ladders are often used.

Where portable ladders are used they should be of sound construction, with a broad base and fixed to provide effective restraint against slipping. Research has shown that "footing" of ladders by a second person is of limited value. Where personnel are transferring from a ladder to the crane structure there must be sufficient projection of the ladder (at least 1m or three rungs) beyond the landing level to provide adequate handholds during transfer.

Suitable Ladder

Automatic Ladder Latch with Anchor Point

Personnel using ladders must be adequately trained in the selection, use and pre-use checking of ladders. See **Sections 11 and 13.**

Additional guidance is given in the following HSE publications:-

- INDG402 - *Safe use of ladders and stepladders: An employers' guide*
- INDG403 - *A toolbox talk on leaning ladder and stepladder safety*
- INDG405 - *Top tips for ladder safety(Pocket Card)*

8.0 Circumstances Requiring Rescue From Height on Mobile Cranes

The following table summarises the activities during which persons may require rescue from height, the persons who may require rescue and the types of emergency that may necessitate rescue.

Activity	Person Requiring Rescue	Type of Emergency
Erection Alteration Dismantle Out of Service	Erector	Suspension from fall protection system
		Injury
		Medical crisis
Maintenance Thorough Examination Out of Service	Maintenance personnel Competent Person	Suspension from fall protection system
		Injury
		Medical crisis
Use of Man Baskets and Boatswain's Chairs In Service	Persons being lifted	Suspension from fall protection system
		Injury
		Medical crisis

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9.0 Guidance for Rescue From Height on Mobile Cranes

Section 8.0 identifies three distinct activities where rescue from height may be required. Typical methods and items for consideration in the planning for each of these situations are as follows:-

9.1 Recovery from Suspension During Rigging or De-rigging

If the work at height during rigging or de-rigging only involves low level working it may be adequate to utilise other members of the rigging team to support the suspended person. This must however be carefully evaluated at the planning stage, taking into account the potential height of the suspended person above the rescuers and the number and physique of the rescuers.

Where rescue by other members of the rigging team is not practicable other means must be employed. This could include:-

- A system provided by the Principal Contractor;
- A MEWP;
- A telehandler with a non-integrated platform;
- A crane with a man riding cage;
- A proprietary rescue system.

In planning for rescue from height, reliance should not be placed on the use of the Emergency services without first consulting those services

Suspension in a harness for a period of time (often as little a ten minutes) without moving may give rise to "suspension trauma" which leads to pooling of blood in the veins of the lower limbs. This can cause disturbance to the circulatory system leading to damage of the vital organs. When rescuing a suspended person care must be taken to avoid moving them into a horizontal position as this can cause a massive flow of venous blood to the heart, which cannot cope, and this can cause potentially fatal cardiac abnormalities.

Additional information on suspension trauma is given in Annex D of *BS 8437:2005 - Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace.*

9.2 During Maintenance and Thorough Examination of the Mobile Crane

In this situation the method described in **9.1** can also be used, it does however rely on having a trained person on site at all times whilst fall arrest systems are being used.

9.3 Injury or Medical Crisis

In this situation the injured person should be lowered to a suitable position where first aid can be administered in accordance with the site emergency plan.

9.4 During Use of the Crane Where Persons are in Man Baskets and Boatswain's Chairs

There are a number of proprietary systems available which allow stranded personnel to be lowered safely to ground level (**See Annex 1**).

10.0 Method Statements

The outcome of the planning process for both work at height and rescue from height, on mobile cranes should be recorded in a method statement, which should be specific for the type and model of crane. Generic risk assessments and method statements may not be sufficient for all situations as risks and measures to control those risks will vary from location to location.

10.1 Work at Height on Mobile Cranes

Details of the planning for work at height recorded in a method statement should include:-

- Details of working procedures;
- Configuration of the equipment for different types of access;
- Details of any personal fall protection equipment to be used;
- Identification of anchor points on the crane structure;
- Limitation of the plan for adverse weather such as high winds.

10.2 Rescue From Height

Details of the rescue plan should be recorded in a method statement which should be specific for each type and model of mobile crane. The plan should include:-

- Details of the rescue equipment to be used;
- Configuration of the equipment for different types of rescue;
- Identification of anchor points on the crane for each type of planned rescue;
- Limitation of the plan for adverse weather such as high winds;
- The need for trained rescue personnel.

The method statement should be used to brief persons who will be working at height and involved in the rescue plan.

11.0 Training of Personnel

All personnel working at height on mobile cranes and carrying out the following tasks:-

- Rigging;
- Use;
- Daily checks;
- Alteration;
- Maintenance;
- Thorough examination;
- De-rigging;

will require training in safe working techniques and the correct use of personal fall protection systems. This training should include assessment of competence.

Additional training is required for personnel carrying out the rescue of persons.

11.1 Safe working at height training

It is essential that all personnel required to work at height on mobile cranes are trained and assessed as competent to work safely at height. This training will cover:-

- Safe working practices, including those set out in the manufacturer's manual;
- Selection and use of personal fall protection equipment;
- Pre-use inspection of personal fall protection equipment.

Initial training should be carried out by the supplier of the fall protection system to be used or by in-house trainers who have been trained and assessed by the system supplier. Trainees should be assessed for competence by carrying out erection and maintenance tasks on a mobile crane.

Refresher training should be carried out at appropriate intervals (normally three yearly) followed by assessment of competence by carrying out typical tasks at height on a mobile crane.

It is important that trainees are not exposed to additional risk whilst carrying out tasks during training. Before beginning training the training organisation should carry out a thorough risk assessment and put in place any necessary control measures such as a back up secondary safety rope.

11.2 Rescue from height training

It is essential that all rescue from height on mobile cranes is carried out by adequately trained personnel who should be available on site at all times when rescue may be required.

Initial training should be carried out by the supplier of the system to be used or by in-house trainers who have been trained and assessed by the system supplier. Trainees should be assessed for competence by carrying out a simulated rescue on site.

Refresher training should be carried out at 6 monthly intervals, followed by assessment of competence by carrying out a simulated rescue.

It is important that trainees are not exposed to additional risk during any simulated rescue carried out during training. Before beginning training the training organisation

should carry out a thorough risk assessment and put in place any necessary control measures such as a back-up secondary safety rope.

Additional guidance on training is given in:-

- BS 8454:2006 - *Code of practice for delivery of training and education for work at height and rescue.*
- OC 282/31 – *Rope evacuation from mechanical handling equipment.*
  (HSE Operational Circular available on http://www.hse.gov.uk/lau/lacs/20-3.htm)

12.0 Inspection and Maintenance of Personal Fall Protection and Rescue Equipment

All equipment used for personal fall protection and the rescue of persons from height on mobile cranes must have a pre-use check (visual and tactile inspection) before each use. The check should be carried out in accordance with the manufacturer's instructions. Damaged equipment should be taken out of service immediately. The checks should include any tensioned horizontal safety lines.

In addition to pre-use checks, equipment should be subjected to detailed inspections (thorough examination) by a competent person before first use and at intervals not exceeding six months (or three months where the equipment is used in arduous conditions), and after circumstances liable to jeopardize safety have occurred. Damaged equipment should be taken out of service immediately.

BS 8437 also recommends that interim inspections of personal fall protection equipment are carried out, in addition to the pre-use checks and the detailed inspections, at intervals determined by the risk assessment carried out at the beginning of the job. In determining what is a suitable interval, factors such as whether items are subject to high levels of wear and tear or contamination should be considered. Certain items of personal fall protection equipment for rescue purposes may be supplied by the manufacturer in sealed transparent packaging. Provided that the seal is not broken, these items do not require interim inspections, however after a specified period (often three years) they must be returned to the manufacturer for inspection and resealing.

Both the detailed inspections and the interim inspections should be recorded.

Equipment should be kept clean and dry and should be properly stored. Wet equipment should be thoroughly dried before storage. Equipment should not be altered or repaired, unless this has been authorized 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.

Employers should make adequate provision to ensure that employees are following the above requirements.

Inspection Type	Maximum Interval
Pre-use	Before each use
Interim	By risk assessment
Detailed	Before first use Three months (arduous conditions) Six months (normal use)

Additional guidance is given in:-

- BS 8437:2005 - *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.*
  (HSE free leaflet available on http://www.hse.gov.uk/pubns/indg367.pdf)

13.0 Inspection and Maintenance of Access, Egress and Other Equipment

All areas used for access and egress on mobile cranes should be checked by the user before use to ensure that they are secure, undamaged and well maintained, as mud and other agents may cause slips and trips. Any defects found must be immediately reported to the user's supervisor. These areas should also be included in maintenance inspections and thorough examinations.

Equipment used for access, egress or work at height on mobile crane must have a pre-use check (visual inspection) before each use. The check should be carried out in accordance with the manufacturer's instructions. Damaged equipment should be taken out of service immediately and the defects reported to the user's supervisor.

In addition to pre-use checks, equipment should be subjected to detailed inspections by a competent person before first use and at intervals not exceeding six months (or three months where the equipment is used in arduous conditions), and after circumstances liable to jeopardize safety have occurred. Damaged equipment should be taken out of service immediately and the removal from service recorded.

Additional guidance is given in:-

- HSE Research Report 437 - *The underlying causes of falls from vehicles associated with slip and trip hazards on steps and floors*

14.0 Lone Working

Lone working should be avoided by suitable liaison with the person in control of the site to ensure that site personnel are always in attendance.

The planning process for work at height on mobile cranes should take into account the particular hazards of lone working. If lone working is unavoidable, suitable measures should be put in place to minimise risks to the lone worker. This might include:-

- Call in arrangements
- Notification to a remote supervisor of entry and exit to premises
- Provision of alarm and tracking systems

Additional advice on lone working is given in:-

- INDG 73 - *Working alone in safety*

Annex 1 - Personal Fall Protection and Rescue System Manufacturers

Company	Address	Website	Telephone
Capital Safety	Capital Safety Group (Northern Europe) Ltd Unit 7 Christleton Court, Manor Park Runcorn Cheshire WA7 1ST	www.csgne.co.uk	01928 571324
Heightec	Heightec Ltd LDBP Mintbridge Road Kendal Cumbria LA9 6NH	www.heightec.com	01539 728866
Heightworks	Heightworks Ltd 11 Rydal Close Hednesford Staffordshire WS12 4RP	www.heightworks.com	07812 206265
Spanset	SpanSet (UK) Limited Telford Way MIDDLEWICH Cheshire CW10 0HX	www.spanset.co.uk	01606 737494
Total Access	Total Access (UK) Ltd Unit 5 Raleigh Hall Industrial Estate Eccleshall Staffordshire ST21 6JL	www.totalaccess.co.uk	01785 850333
Tag Height Safety	TAG Ltd Waterside Mill Greenfield OL3 7NH	www.tagsafety.com	01457 878640

Personal fall protection and rescue equipment should be CE Marked and comply with:-

BS EN 353-1, *Personal protective equipment against falls from a height: guided type fall arresters including a rigid anchor line.*

BS EN 353-2, *Personal protective equipment against falls from a height: guided type fall arresters including a flexible anchor line.*

BS EN 354, *Personal protective equipment against falls from a height — Lanyards.*

BS EN 355, *Personal protective equipment against falls from a height — Energy absorbers.*

BS EN 358:2000, *Personal protective equipment for work positioning and prevention of falls from a height — Belts for work positioning and restraint and work positioning lanyards.*

BS EN 360, *Personal protective equipment against falls from a height — Retractable type fall arresters.*

BS EN 361, *Personal protective equipment against falls from a height — Full body harnesses.*

BS EN 362, *Personal protective equipment against falls from a height — Connectors.*

BS EN 363, *Personal protective equipment against falls from a height — Fall arrest systems.*

BS EN 795:1997, *Protection against falls from a height — Anchor devices — Requirements and testing.*

BS EN 1496:1996 - *Rescue equipment — Rescue lifting devices*

BS EN 1497, *Personal fall protection equipment — Rescue harnesses.*

Annex 2 – Typical Fall Hazards Associated With Wheeled and Crawler Mobile Cranes

Rough Terrain, All Terrain & Hydraulic Truck Cranes	
OPERATIONAL FALL HAZARDS	
1.	Climb into operating cab (regular cab & tower crane attachment)
2.	Check, oil, coolant, and pumps
3.	Wipe, scrape, and clear snow and ice from windows
4.	Visuals on winches
5.	Visuals on counterweights
6.	Cycle boom support float valves
7.	Grease or inspect jib
8.	Grease or inspect boom
9.	Inspect sheaves and grease bearings
10.	Sweep off snow or ice
11.	Operating training & assessment
12.	Dolly Inspection & Installation
RIGGING FALL HAZARDS	
1.	Remove and install swingaway jib assembly
2.	Remove and install hoist lines
3.	Raise and lower idler sheave
1.	Remove and install rigging
2.	Remove and install counterweights
3.	Remove and install boom, fixed jib, and luffing jib assembly
4.	Remove and install superlift mast and bridle assembly
5.	Remove and install hoist lines
6.	Remove and install pennant lines and rods
MAINTANENCE & INSPECTION FALL HAZARDS	
1.	Repairs on hydraulic systems
2.	Check batteries
3.	Engine and transmission servicing
4.	Repairing heaters
5.	Repairing windows, wipers and lights
6.	Inspection, servicing, and replacing winches and ropes
7.	Inspection and servicing of computer and electronics
8.	Mechanical and structural inspection of upper structure/carriers
9.	Equipment cleaning (washing)
10.	Greasing and checking oil levels
11.	Inspection, repairs, adjustments and welding repairs on booms
12.	Inspection, repairs to air system
13.	Boom disassembly and removal
14.	Repairs on dolly
15.	Inspection of stored components / boom inserts
16.	Welding repairs

Crawler Cranes	
OPERATIONAL FALL HAZARDS	
1.	Climb into operating cab
2.	Check, oil, coolant, and pumps
3.	Wipe, scrape, and sweep windows
4.	Visuals on winches
5.	Visuals on counterweights
6.	Visuals on mast/gantry sheaves
7.	Visuals on backstops
8.	Grease or inspect jib
9.	Grease or inspect boom
10.	Inspect sheaves and grease bearings
11.	Sweep off snow or ice
RIGGING FALL HAZARDS	
1.	Remove and install rigging
2.	Remove and install counterweights
3.	Remove and install boom, fixed jib, and luffing jib assembly
4.	Remove and install mast assemblies, bridles and bails
5.	Remove and install tracks
6.	Remove and install superstructure on carbody
7.	Remove and install backstops
8.	Remove and install superlift trays/buggies and tackle
9.	Remove and install hoist lines
10.	Remove and install block, head, and luffing mast reeving
11.	Remove and install pennant lines and rods
12.	Cycling hydraulic function valves
MAINTANENCE & INSPECTION FALL HAZARDS	
1.	Repairs on hydraulic systems
2.	Check batteries
3.	Engine and pump servicing
4.	Repairing heaters
5.	Repairing windows, wipers and lights
6.	Servicing, replacing winches and cables
7.	Servicing computer and electronics
8.	Servicing/replacing sheaves
9.	Servicing/repairing backstops
10.	Inspection, repairs, adjustments and welding repairs on booms/gantry
11.	Inspection, repairs to air system
12.	Boom removal
13.	Inspection of stored components / boom inserts
14.	Repairs to super lift

Annex 3 - Typical Mobile Crane Fall Hazards Risk Assessments

RISK ASSESSMENT – All Terrain & Truck Mounted Cranes

ACTIVITY/ DANGER	HAZARD	RISK ((Low, Med, High)	PERSONNEL AFFECTED	CONTROLS	RESIDUAL RISK (Low, Med, High)
Climbing into and out of superstructure cab, using ladder to access crane deck	• Falling when letting one hand go to open cab. • Lower step can change height while on outriggers or uneven ground causing overbalancing. • Slipping off ladder rungs • Slips on slippery and contaminated deck surfaces • Tripping over trip hazards • Slipping out of shallow toeholds	High	Crane Operators Maintenance Personnel Personnel carrying out thorough examinations	• Hand rails and grab rails - Ensure handholds are in suitable positions to open doors and enter & leave cab safely. • Maintain three point contact whilst entering and exiting crane. • Procedure for doors to be opened before getting up (where practical). • Lower door handle position. • Personnel must not carry anything while entering and exiting crane. • Provide non-skid surfaces on decks and ladder rungs. • Ensure suitable footwear is provided and kept clean. • Keep decks clear of materials by good housekeeping and provision of storage. • Inspect and maintain all ladders, attachment points and surfaces. • Ensure adequate toe clearance depth. • Training and toolbox talks on safe access and egress. • Monitoring compliance. • When specifying new cranes, manufacturers should be encouraged to improve cab access enabling three point contact to be maintained at all times and provide non slip surfaces and walkways.	Low

RISK ASSESSMENT – Crawler Cranes

ACTIVITY/ DANGER	HAZARD	RISK ((Low, Med, High)	PERSONNEL AFFECTED	CONTROLS	RESIDUAL RISK (Low, Med, High)
Climbing into and out of superstructure cab, using crawler tracks and steps/ladders	• Falling when letting one hand go to open cab. • Slipping off ladder rungs • Slips on slippery and contaminated crawler, step and rung surfaces • Tripping over trip hazards • Slipping out of shallow toeholds	High	Crane Operators Maintenance Personnel Personnel carrying out thorough examinations	• Hand rails and grab rails - Ensure handholds are in suitable positions to open doors and enter & leave cab safely. • Maintain three point contact whilst entering and exiting crane. • Procedure for doors to be opened before getting up (where practical). • Lower door handle position. • Personnel must not carry anything while entering and exiting crane. • Provide non-skid surfaces on decks and ladder rungs. • Ensure suitable footwear is provided and kept clean. • Keep decks clear of materials by good housekeeping and provision of storage. • Inspect and maintain all ladders, attachment points and surfaces. • Ensure adequate toe clearance depth. • Training and toolbox talks on safe access and egress. • Monitoring compliance. • When specifying new cranes, manufacturers should be encouraged to improve cab access enabling three point contact to be maintained at all times and provide non slip surfaces and walkways.	Low

Annex 4 – Selection of Personal Fall Protection Equipment

1. Harnesses

Harnesses should be of the full body type with both front and rear lanyard attachment points. There are a large number of basic harnesses on the market which meet the requirements of the European Standard but are neither durable nor comfortable for extended wear. Harnesses must always be worn and adjusted correctly to minimise injury to the wearer in the event of a fall.

2. Fall Arrest Lanyards

Fall arrest lanyards are normally 2m long with a karabiner to attach to the harness and either a karabiner or scaffold hook at the other end to connect to the anchor point. All fall arrest lanyards must incorporate - an energy absorber to reduce deceleration and hence impact force on the wearer.

3. Double Lanyards

Double Lanyards enable the wearer to move around a structure ensuring that one leg of the lanyard is attached to a suitable anchor point at all times. It is essential that double lanyards only have ONE shock absorber. If two single lanyards are used and are both attached at the time of a fall the body of the falling person will be subjected to a magnitude of deceleration that is likely to cause very significant injury. Some personal fall protection equipment suppliers provide “parking points” on the harness webbing to keep the unattached lanyard out of the way.

4. Retractable Type Fall Arrester (Inertia Reels)

Retractable type fall arresters are effective at preventing falls and minimising falling distance. They must however be anchored overhead and must not be used at angles greater than that specified by the manufacturer, (typically 30° to the vertical). Care should be taken to ensure that the retractable webbing/rope does not pass over sharp edges that may cause tears and failure.

Retractable type fall arresters are increasingly being used to provide fall protection by attaching to the hook of a mobile crane positioned vertically above the wearer. In this case the inertia reel should be attached to the crane hook by use of a soft sling to keep the inertia reel well below the hook and clear of lifting slings etc. **The line connecting the inertia reel to the harness should be kept vertical at all times to minimise the pendulum effect in the event of a fall.**

Some retractable type fall arresters incorporate an integral means of rescue, which can be used by a rescuer to raise or lower an incapacitated person to a position of safety.

5. Work Positioning

Work positioning equipment can be useful to allow the wearer to work in a fixed position with both hands free. To carry this out safely a two point full body harness with integral work positioning belt is required. A fall arrest lanyard must always be connected to a suitable anchor point and the harness whilst the wearer is using the work positioning belt or moving to or from the position at which work is to be carried out. The work positioning belt is used with an adjustable lanyard or grillon connected to or around a suitable support structure.

6. Horizontal Safety Lines

A number of temporary horizontal safety line systems are available. These consist of a line which can be temporarily installed between suitable anchor points and tensioned using a tensioning device. Certain proprietary systems incorporate an integral tension indicator. Common systems available can have line lengths up to 20m and can be used as an anchor point for work restraint for up to two persons or as a fall arrest anchor for one person. Following installation the line should be labelled with information as to the maximum number of people that may be anchored to it in fall arrest or work restraint modes. Horizontal safety lines should always be installed following an engineering assessment of the location and the structure to which they will be attached.

7. Work Restraint

For work restraint a full body two point harness should be used with fixed or an adjustable lanyard which must always be adjusted so that the wearer cannot reach a position where they can fall. Various designs of adjustable work restraint lanyards are available including one which is colour coded to encourage the wearer to keep it as short as possible.

An energy absorbing lanyard of the correct length may be used for restraint

Additional guidance on selection of personal fall protection systems is given in:-

- *BS 8437:2005 - Code of practice for selection, use and maintenance of personal fall protection systems and equipment for use in the workplace*

Annex 5 – Example of Typical Risk Assessment Form

Client:		
Project / Site:		

RISK ASSESSMENT - MANAGEMENT OF HEALTH AND SAFETY AT WORK REGULATION 1999

Assessment Ref:-		**Activity:**	**Using leaning ladders for access or as a work place.**	**Date:-**	**07.03.06**

Training Records	Hazards	Risks	Persons at risk	Required Control Measures	Severity 1 – 10 (10 high)	Likelihood 1 – 10 (10 high)	Rate	Risk Rating
All personnel will be issued with a working at height kit bag & have received external training in the safe use & inspection of the contents of the kit bag. Training consisted of the working at height Regulations • Fall Arrest • Work Positioning • Restraint • Suspension • Rescue	Working from ladder to enable crane operator to insert swingground fly jib pins luffing fly jib pins luffing root pins. Access & egress to and from mobile crane also other areas relating to the mobile crane. Ballast operators accessing & egress trailers	.**Overreaching** • Ladder may become unstable • Hand tools could fall • Hand tools could strike persons working below **Sideways loading** • User pushing themselves & ladder off balance & falls **Losing Balance** • User loses balance • User grabs ladder and ladder becomes unstable.	Crane operators Ballast operators Appointed person Crane supervisor Maintenance engineers	Ensure the leaning ladder is capable of reaching the working height. Ensure the ladder is erected and secured at the correct angle. Check the all ladders prior to use for wear, tear and any damage that affects safety (e.g rungs, stiles & dents. If in doubt do not use the ladder.) Aluminium and other metal ladders conduct electricity - do not use. Select a non-conducting ladder. No LIVE electrical conductors within dangerous proximity. When carrying ladders to & from the place of workplace & positioning it safely be aware of your route with regard to slips, trips & falls. Always check condition of safety footwear e.g tread, grease & mud. One person working on ladder at all times Ground conditions must be firm, level & stable ladder must be secured at the top or footed at all times. Always monitor weather conditions (e.g lightning, wind, rain, snow, ice, temperature and sun.) When working from ladder avoid overreaching & sideways loading) Segregate the working area around the ladder to protect it & other personnel. Reconsider level of risk if tasks change or if there is a change on the site.				

Prepared By:		Ref No:	

Annex 6 – Case Studies

Case Study 1 – Mobile Crane Access

The Incident

Two mobile cranes, a truck crane and an all-terrain owned by the same crane hire company, were working nearby in a petrochemical plant. The operator of the truck crane needed an additional lifting sling and asked the operator of the all-terrain if he could borrow one of his. The all-terrain operator agreed and invited the first operator to climb onto the all-terrain to collect the sling. The truck crane operator climbed up using the single fixed access ladder, collected the sling and started to climb down from the superstructure using one of the outrigger beams as a step. In the process he slipped on the outrigger beam and fell to the ground sustaining a head injury. He was taken to hospital where he fortunately made a full recovery.

Investigation Conclusions

During the subsequent investigation it was found that:

- Crane operators regularly used the outrigger beams as a means of access and egress from the bed of their cranes;
- The outrigger beams were painted with gloss paint making them slippery;
- There were insufficient fixed ladders on the crane allowing access onto the crane bed when the crane was slewed over the side of the crane;
- There were no decals warning the operator not to use the outrigger beam as a means of access or egress onto the crane;
- The operator was not familiar with the all-terrain crane he had climbed onto.

Fig. 1 - Additional Access Ladders

Fig. 2 - Additional Access Ladders

Fig. 3 - Additional Decals

Fig. 4 - Decal Location

Resulting Actions

- All cranes going into the petrochemical plant were fitted with ladders at the front and rear on both sides of the crane bed (See Figs. 1 & 2);
- All outriggers now display a 'no step' decal on the outrigger beams (See Figs 3 & 4);
- A new safe system of work was introduced at both the petrochemical plant and crane hire company preventing the use of outrigger beams as a means of access or egress from a crane;
- Additional training was given to all crane operators on the dangers of using outriggers as steps;
- Additional training was given to all crane operators on the dangers of allowing access by unfamiliar personnel, onto the crane bed of a crane;
- The crane hire company informed the manufactures of all their cranes about the incident. As a result modification kits were supplied and retrofitted to their fleet;
- The crane hire company now specifies additional access and egress ladders on all new cranes and all larger cranes are required to have additional walkways and grab handles around the superstructure cabs.

Case Study 2 – Crawler Crane Hoist Rope Installation

The Issue

During the rigging of a strut jib crawler crane the installation of hoist ropes has typically been carried out by a fitter walking along the top of the lowered jib pulling the rope behind him as it is paid out from the hoist winch drum (See Fig. 1).

Work at Height Assessment

An assessment of the risks of falls from height found that:

- Personnel walking along the top of the jib were at significant risk of falling at least two metres;
- Installation of temporary collective means of preventing the fall such as handrails would be time consuming and present significant risk of falling during installation;
- The use of personal fall protection systems was not practicable as personnel need to move freely down the full length of the jib;
- The best approach was to redesign the work method to eliminate the need to work at height.

Fig. 1 – Previous Method

Fig. 2 – Extending Rope At Ground Level

Fig. 3 – Extending Rope At Ground Level

Fig. 4 – Bigger Team For Longer Ropes

Fig. 5 – Rope Through Head Sheaves

Fig. 6 – Lifting Rope Onto Jib

New Work Method

- Hoist ropes are now pulled along the ground by a team of two (See Fig. 2);
- On long jibs the number in the team is increased (See Fig. 3);
- Once the hoist rope has been fully extended it is fed through the jib head sheaves (See Fig. 4);
- The hoist rope is then lifted from the ground to the top face of the jib (See Fig. 5);
- The operation is completed without involving work at height.

Case Study 3 – Mobile Crane Access

The Incident

A crane operator was leaving the deck of his mobile crane, using the swing round ladder fitted by the crane manufacturer. Once the operator had positioned himself on the upper part of the ladder it swung outwards resulting in the operator's leg slipping in between the rungs. This caused him to fall backwards, ending upside down with one leg caught in the ladder rungs. Fortunately there were other personnel in the vicinity who came to his aid and he was released, having suffered only minor injuries.

Investigation Conclusions

During the subsequent investigation it was found that:

- The lack of restraint preventing the ladder pivoting with changes in weight distribution was a major cause of the operator slipping;
- The nominally vertical ladder position prevented the operators feet from fully engaging on the ladder rungs;
- The handholds for the operator when positioning his feet on the first rung of the ladder were inadequate;
- There had been a history of ladder top hinge failure which was found to be due to excessive loads from the unrestrained ladder;
- Other manufacturers had addressed this issue by providing a fold out stay which rested on a tyre, holding the ladder at an appropriate angle and providing a good footing (See Fig. 5).

Fig. 1 - Original Freely Suspended Access Ladder

Fig. 2 - Insufficient Foot Penetration

Fig. 3 - Original Ladder Swung Round From Stowage Position

Fig. 4 - Original Ladder Hanging Freely

Fig. 5 - Another Manufacturer's Solution

Fig. 6 - New Latch

Fig. 7 - New Standoff

Fig. 8 - New Grab Handle

Resulting Actions

- The crane manufacturer designed a modification kit which comprised:-
  - Improved hinges (See Fig. 6);
  - A grab handle fitted to the carrier decking for additional support during access and egress from the top of the ladder (See Fig. 8);
  - A latch fitted to the ladder top to prevent the ladder swinging out if the operator leans forward when on top of the ladder (See Fig. 8);
  - A standoff to ensure that the ladder is held at an appropriate angle to provide a good footing by allowing sufficient foot penetration (See Fig. 7).

Annex 7 – Example Toolbox Talks

Safe Access/Egress from Chassis & Superstructure

Tool Box Talk - Safe Access/Egress from Chassis & Superstructure

Date Held:	Location:	Time Held:

Introduction:

Falling from height is the major cause of fatalities in the construction, petrochemical, rail & nuclear industry. Over 50% of major injuries are due to falls from below 2 metres and falls from any height may result in death or serious injury. All such deaths and serious injuries are preventable.

Main Points:

- Lower crane on suspension whenever possible.
- Use ladders fixed to the crane chassis, or manufactured recess steps.
- Before using crane carried ladders, always ensure they are in good condition before use.
- Never use a damaged ladder.
- Ensure that access steps are free from contamination and defect.
- Use crane grab handles, and handrails whenever possible.
- Always check safety footwear for mud grease etc. and remove all surplus debris.

Discussion points:

- Do not use mobile crane out-riggers or “No Step” areas to gain access or egress to and from the crane.
- Always be aware when checking water and oil levels that you are alongside open edge.

IT’S NOT THE FALLING THAT HURTS – IT’S THE LANDING!

Working at Heights

Tool Box Talk - Working at Heights

Date Held:	Location:	Time Held:

Introduction:

Falling from height is the major cause of fatalities in the construction, petrochemical, rail & nuclear industry. Falls from any height may result in death or serious Injury. All such deaths and serious injuries are preventable.

Main points:

- Can work at height be avoided and the risk eliminated?
- Plan work at height to include safe access/egress, edge protection (for people and materials), PPE and suitable training as applicable.
- Work at height requires guardrails, intermediate guardrails and toeboards to be fitted where possible. Alternative collective means of protection include MEWPs, podium steps and tower scaffolds.
- Where impracticable to fit guard-rails, intermediate guard-rails and toe-boards (short duration work such as the installation of the swing round fly jib or inserting securing pins to main boom head section) then personal fall protection equipment must be utilised as required. Operators must use their working at height PPE kit bag when carrying out work at height.

Discussion points:

- If roof work is involved, identify any fragile areas and/or openings and implement suitable protective precautions.
- Access ladders must be secured and extend at least 1 metre beyond working platforms to allow for safe access/egress.
- Where access ladders run for more than 9m then suitable intermediate platforms must be provided.
- Consider weather conditions – wet, windy and/or icy conditions can have a serious impact on safety at height.
- Ensure operatives are suitably trained and physically capable for tasks being undertaken.
- If guard-rails, fragile surface covers, void protections, etc, are removed for any reason they must be replaced as soon as possible, and in the interim should be physically guarded.
- Use crawling boards/roof ladders where applicable.

IT'S NOT THE FALLING THAT HURTS – IT'S THE LANDING!

Tool Box Talk - Mobile Tower Scaffolds

Date Held:	Location:	Time Held:

Introduction:

Mobile tower scaffolds provide a very useful and efficient working platform for numerous tasks when used properly. When misused, there is a significant risk of serious injury to both users and other employees.

Main points:

- Plan the use of mobile tower scaffolds. Ensure that they are of sufficient capacity, that manufacturer's guidelines are complied with and that a competent person is available to erect, adjust and dismantle.
- Check all mobile tower scaffolds prior to use. Check: general condition, brakes/locking devices, free rotation of wheels, all bracings are in place, suitable access/egress is available and that the platform is suitable.
- All guard-rails, intermediate guard-rails and toe-boards must be fitted (note this is a minimum requirement – recommended that they be fitted regardless of height).
- Use one of the two safe methods of work for the erection of towers recommended by PASMA:-
    - The advanced guardrail system which makes use of specially designed temporary guard rail systems which are locked in place from the level below and moved up to the platform level.
    - The 'through the trap' (3T) method which allows the person erecting the tower to position themselves at minimum risk during the installation of the guard rail components to the next level.

Discussion points:

- Check manufacturers guide for base to height ratio. The general rule is that the height should not exceed 3 times the narrowest base width, i.e. where narrowest base width equals 1.5m, height should not exceed 4.5m. (Note: this can be extended by use of outriggers.)
- Mobile tower scaffolds should only be used on firm, level surfaces. If the surface is soft or not level adequate support **must** be provided.
- Wheels should be locked whenever the tower is in use.
- Only integral ladders should be used – on no account rest ladders against outside, or use ladders off of mobile tower platforms.
- Ensure that all persons and materials are removed from mobile tower scaffolds prior to moving. Move by pushing at the base, avoid potholes/uneven surfaces, and beware of overhead obstructions – especially power lines!
- Mobile tower platforms should be fully boarded out where practicable. The platform must be a minimum of 600mm wide.

MOBILE TOWER SCAFFOLDS ARE AN ASSET – NOT A SHORTCUT.
NO JOB IS SO URGENT THAT IT CAN'T BE DONE SAFELY!

Tool Box Talk - Use of Ladders

Date Held:	Location:	Time Held:

Introduction:

Ladders are one of the most used, and abused, pieces of equipment on a Construction site. When abused and misused, they have enormous potential to cause accidents and injuries.

Main points:

- Ladders are essentially a means of access/egress and should only be used as working platforms for very short duration tasks, where alternative platforms would be impracticable and where such tasks can be carried out safely using a ladder.
- Only industrial class ladders should be used. These must be in good condition (no missing/broken rungs, split stiles, etc).
- Ladders must be suitably angled (1 unit out for every 4 units up) and suitably secured (Preferably tied off at the top using both stiles to prevent both sideways slip and rotation).
- Metal ladders should not be used for the fitting/removal of fly jibs.

Discussion points:

- Ladders must extend at least 1 metre beyond working platforms to allow for safe access/egress.
- Beware of overhead obstructions, especially overhead power lines (metal ladders/metal reinforcements).
- Ladders must not be painted (this hides defects), should be stored correctly and be subject to regular inspection.
- Never take serviceability for granted, always carry out a visual check prior to use. Report any defects immediately.
- Never carry out home made repairs on a ladder, and never use a ladder with existing home made repairs, and never use a home made ladder!
- Always stand ladders on a firm base. Never use milk crates, oil drums, etc., to gain extra height, and if ground is soft use suitable support. Consider staking at bottom.
- Never use rungs as a support for planks, or rest rungs on planks.
- Remove excessive mud, grease, etc. from footwear prior to climbing/descending a ladder.
- Always use both hands to climb/descend, and always face the ladder.
- Do not carry loads up ladders – use hoists or alternatives.
- Never over reach from ladders – get down and move them.
- Avoid using metal ladders against metal surfaces – the reduced friction makes them more liable to slipping.

SILLY PEOPLE TAKE CHANCES – SENSIBLE PEOPLE TAKE PRECAUTIONS

Attendance Record

Toolbox Talk Attendance Record			
Toolbox Talk Subject:			
Toolbox Talk Deliverer	**Name:**		
	Signature:		
Attendees			
Name	**Trade**	**Company**	**Signature**

Annex 8 – Bibliography

Legislation

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The Management of Health and Safety at Work Regulations 1999.

Standards

BS 7883:1997 - *Code of practice for application and use of anchor devices conforming to* BS EN 795*.*

BS 8437:2005 - *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.*

BS8460:2005 – Safe use of MEWPs – Code of practice

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OC 282/31 – *Rope evacuation from mechanical handling equipment.*

HSE Research Report 437 - *The underlying causes of falls from vehicles associated with slip and trip hazards on steps and floors*

Annex 9 – Drafting Group Membership

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