

Risk management

Safeguarding construction plant and equipment

A guide to loss prevention



Construction plant and equipment claims cost insurance companies millions of pounds every year

This document aims to provide a guide to the prevention of damage or theft of construction plant and equipment (CPE), raising awareness of some of the practical measures that can be implemented to ensure CPE is operated safely and stored securely.

Each year, insurance companies pay out millions in claims following significant damage and theft of construction plant and equipment; either owned, leased or hired in. Damage can also occur as a result of accidents due to fire, flood and overturning events, or deliberately through vandalism or arson. These incidents can also result in personal

injury, property damage and business interruption as well as potential delays and increased costs (including insurance excesses). Many loss events are preventable and occurrences can be reduced through appropriate risk management procedures and activities.

CPE is not only operated on civil engineering and construction sites but also in a diverse variety of environments and industries, including waste processing, metals recycling, docks, farming and quarries, etc. Consequently, it is important to properly risk assess the work activities and to ensure the selected plant is suitable for its operating environment.

This guide also aims to identify common loss prevention measures that can be applied to CPE working in various situations.

With such a diverse range of CPE available, the specific operating and maintenance instructions for any particular piece of CPE should be referred to. However, many of the loss prevention principles are common to all types of CPE and working locations.

Further industry best practice guidance, organisations and relevant legislation is included at the end of this document.



Types of CPE

- mpers and dump trucks
- Tracked and wheeled excavators
- Wheel loaders, bulldozers and face shovels
- Mini excavators and skid steer loaders
- Compressors and generators
- Fork lift trucks and telehandlers
- Mobile elevated working platforms
- Tower, gantry and mobile cranes
- Steel ropes, slings, chains, shackles
Hoists and winches
- Pumps
- Piling rigs, augers, tremie pipes and casings
- Power screens and trommels
- Tunnel boring machines, roadheaders and locomotives
- Directional drilling equipment
- Concrete and asphalt batching plants
- Asphalt and concrete pavers
- Compactors and rollers
- Handheld breakers, disc cutters, grinders, concrete vibrators

Key components in preventing loss or damage to CPE

Management and planning

Many loss or damage events can be traced back to poor management and planning, together with operator competence and insufficient maintenance. The following elements are key to ensuring CPE is operated safely and without incident.

Safe system of work

A safe system of work must be in place prior to deploying any CPE. This should consist of a suitable and sufficient risk assessment, describing minimum control measures to be applied when working with or near CPE. Any deviations from the safe system of work should be further risk-assessed before being actioned. For the more complex tasks (i.e deep excavations, demolitions, complex lifting operations, etc) a comprehensive method statement may be required in addition to a risk assessment.

This process should involve planning of the specific task/activities, selection of suitable CPE, checking adequate maintenance has been carried out, preparation of the working area (working platform, etc), provision of properly-trained and competent supervisory and operating personnel; ensuring all test certificates and inspection reports are available and provision for the safety of all those involved or affected by the operating CPE.

Operator competence

All CPE operators must be adequately trained and competent to operate the selected equipment. Competence should be demonstrated through achieving suitable qualifications recognised by the Construction Industry Training Board (CITB) and/or the Construction Plant Competence Scheme (CPCS) or equivalent. Checks should be made to ensure qualifications are genuine and up-to-date.

All operators should be able to undertake basic pre-start checks and shutdown procedures. It is recommended that the use of checklists are employed to ensure no aspect is left unaddressed.

Maintenance

All CPE needs to be part of a planned maintenance programme that strictly corresponds to the manufacturers' requirements. Proper maintenance will prevent problems arising and ensure the equipment operates efficiently. Inadequate maintenance can cause equipment failure, leading to breakdown and/or fire.

All CPE should be checked over by the operator every day to ensure oil and water levels are correct, and to check for signs of wear or damage.

It is important to keep detailed records of the maintenance and repair history of each piece of CPE, either in electronic or paper form. Copies of job sheets and receipts for all work undertaken should be retained in a dedicated file for each piece of CPE.

CPE hazards and control measures

Being aware of the typical hazards that can lead to CPE damage is key to ensuring losses are controlled and prevented. Damage can be either accidental or intentional (e.g. arson or vandalism). Access and security are key factors in protecting CPE from loss or damage from arson, theft or vandalism, wherever it may be in use.

Fire

Fire is a significant hazard and can lead to major damage or total loss of CPE. Fire can occur through poor maintenance (e.g. electrical faults, damaged fuel or oil lines), smoking, hot work and poor refuelling procedures.

Fire safety management

All working environments must be subject to a fire risk assessment, which must be undertaken by a 'Responsible Person'. The fire risk assessment must be kept up-to-date and the control measures reviewed regularly to minimise the risk to life and property.

Individuals need to be appointed as Fire Marshals or Fire Wardens, and their roles and responsibilities clearly defined. Adequate training in firefighting must be provided.

The following aspects are important in preventing and tackling fires involving CPE:

Fire prevention

- Ensure daily inspections and regular maintenance regimes review the condition of oil and fuel hoses to check for leaks and signs of wear.
- Repair any electrical faults at the earliest opportunity.
- Use fire resistant hydraulic oils where technically feasible.
- Carry out refuelling in a safe manner and in an area remote from the main operations.
- Hot work should not be carried out to fuel tanks or in the vicinity of fuel or oil lines. All hot work on CPE should be subject to a specific risk assessment and controlled with the use of a hot work permit. There should also be dedicated portable fire extinguisher and fire watch period. All hot work to CPE should be carried out in the open, away from any buildings or other CPE.

- Smoking should only be permitted in designated areas away from CPE.
- Burning of waste should not be allowed in the proximity of CPE.
- Provide overhead cable protection on vehicle routes.

Planning for the consequences of fire

- Consider installing automatic fire suppression systems to CPE.
- Ensure all ride-on mobile CPE is provided with a portable fire extinguisher and ensure operators are adequately trained to use them.
- Ensure there is sufficient firefighting facilities in the vicinity of operating CPE e.g. fire points, fire hoses, fire hydrants or mobile water bowsers.
- Provide an adequate means of raising the alarm and procedures to call the fire and rescue service.
- Consider notifying the fire and rescue service of the location and type of CPE in operation.

Case study 1

Hydraulic oil fire to a wheeled excavator - A wheeled excavator was operating within a steel-framed building when a fire started in the engine compartment. The driver tried to extinguish the fire with a portable fire extinguisher but the heat and smoke were too intense. The fire and rescue services were called and the

fire took 40 minutes to extinguish. The excavator was considered a write-off. Further fire and smoke damage also occurred to the building, causing further interruption to the business.

The cause of the fire was traced to a worn hydraulic hose, which had split

due to an over-tightened jubilee clip. The oil sprayed onto the hot engine and ignited.

The fire could have been prevented with proper maintenance procedures and checks, together with the use of fire resistant hydraulic oils.



Flood

Flood is a significant hazard to CPE and can lead to major overhauls and replacement of parts. CPE operating adjacent to rivers, in coastal locations or in deep excavations and tunnels is vulnerable to fluvial, seawater and stormwater flooding; potentially totally submerging the CPE. Recovery costs can be expensive and can, in some cases, render the CPE a write-off.

All CPE operating in flood-susceptible locations should be subjected to a flood risk assessment. Depending on the nature and exposure of the working environment to flooding, consideration should be given to

drawing up a formal Flood Preparedness Plan for all vulnerable working areas.

The plan should capture all flood mitigation measures and emergency procedures and include:

- Roles and responsibilities
- Lines of communication
- Flood hazards, including water sources, topography and any vulnerable work undertaken during the winter
- Flood risk assessments and flood risk registers
- Design principles including return periods for temporary protection measures

- Daily weather watches and forecasts
- Practical mitigation measures and arrangements (e.g. pumps and sumps, bunding, cut-off trenches, sandbags, use of elevated platforms to store materials and equipment, and cleaning of existing drainage systems, etc.)

A key mitigation measure is to move all CPE working in potentially vulnerable flood zones, to higher ground prior to the onset of any major storm.

Case study 2

Submersion of a piling rig -

A crawler-mounted piling rig was installing piles adjacent to the waters edge in a river mouth location. A major storm hit the site overnight and a storm-surge fully submerged

the piling rig. The rig suffered contamination of the engine and electrical system and required stripping down and rebuilding with new parts. The repair costs were considerable.

The loss could have been prevented by monitoring the weather and moving the piling rig to higher ground out of the potential storm-surge flood-zone.



Overturning

Overturning is a further risk to CPE, particularly where machinery is operating on temporary working surfaces, at dock sides, lakes and reservoirs, at the head of steep slopes or near the 'danger area' at the edge of open trenches and excavations. These areas are more likely to collapse without warning. Overturning CPE can be significantly damaging and cause injury to operators, site personnel and the general public.

Any CPE operating in dangerous or constricted working environments should be assisted by competent banksmen and signallers. Wheel stops should be provided at the edge of shear faces.

The mechanism of overturning is often as a result of a failure of the ground or supporting structure beneath the operating CPE. This is particularly important in connection with tall or load-carrying CPE such as mobile cranes, piling rigs, mobile elevated working platforms, etc.

The following aspects are key to ensuring an adequate working surface is provided:

Site categories and underground hazards

Sites can be split into a number of categories to highlight the most likely hazards that need to be considered and risk-assessed. More attention is required to establish the strength of the ground where ground conditions are poor or where there is a lack of data on the nature of the subsoil. Typical categories include:

- Greenfield sites: particular problem areas are adjacent to rivers, estuaries and floodplains where soft alluvial deposits and high groundwater tables can be expected.
- Beaches: low sand density and a variable groundwater level can create difficult conditions.
- Brownfield sites: unknown previous use including basements, storage tanks, poorly-filled open pits and badly compacted fill, etc.

Case study 3

Overturning of a mobile crane -

A 35-tonne truck-mounted telescopic crane overturned on a construction site. The incident occurred after one of the outriggers, which supported the crane, sank into the ground. The crane driver was forced to leap to safety and the 5.7 tonne beam that was being lifted into place narrowly missed two employees as it fell.

The area of the site and ground on which the crane was working, had not been adequately prepared for crane activities.

The incident could have been avoided if the contractor had simply considered all lifting requirements for the site and prepared the ground to ensure adequate working platforms were installed to accommodate such activities.



- Paved areas: tarmacked or paved areas can appear deceptively strong but lead to CPE punching through weak surfacing. Lightly trafficked car parks, estate roads and footpaths should be scrutinised. The edge of paved areas are usually weak.
- Town centre sites: expect underground hazards beneath paved areas, including services, drainage pipes, buried cables, basements and tunnels, etc. This can lead to CPE punching through to the void below.

Ground investigation

Before CPE arrives on site, existing information on the nature of the soils should have been studied. Reference should be made to any existing site investigation reports and particular attention paid to the character of the ground at shallow depths, where CPE will be operating.

Ground-bearing capacity

An assessment of the ground bearing capacity may be required to determine the size and type of support required for CPE. This can be calculated with reference to the ground investigation reports and should be carried out by a competent geotechnical engineer. It should be noted that the presence of water tends to reduce the strength of soils and can lead to a reduced capacity since the initial bearing capacity assessment.

Settlement

Settlement must be kept to a minimum to avoid eccentricities and additional loading. Level indicators and inclinometers should be employed where feasible. If settlement occurs, then the foundation needs to be reassessed.

Working platforms and design

A working platform may be required, for example, to provide a designated area over which CPE can travel during its delivery, operation and movement around the construction site. The design, installation, maintenance and repair of the working platform should be the responsibility of the main contractor, and a temporary works engineer should be consulted on the detailed requirements. The platform should be free-draining to prevent the build-up of water and, in certain cases, separation/filter membranes may be required underneath. Appropriate safety factors should be employed in the design and regular checks undertaken to ensure the platform is not disturbed by other construction activity. Excavations, trenches, or other holes dug to facilitate other construction activities must be properly backfilled and repaired to avoid creating soft spots. The edge of the platform needs to be clearly defined and ground preparation should extend beyond the working area required for the CPE.

Working Platform Certificate

Consideration should be given to using a 'Working Platform Certificate' to ensure that the correct procedures have been followed, the ground is adequate to support CPE activity and that there are no irregularities that could result in local subsidence and toppling. Further detailed guidance on working platforms for tracked plant and a sample 'Working Platform Certificate' is available from the Federation of Piling Specialists (see 'References and guidance' section in this document).

Outrigger foundations

Where CPE is provided with outriggers, these should always be fully extended and all the tyres lifted clear of the ground. The area of the pad attached to the outrigger is small and, therefore, generates high pressures on the ground. The pressure can be reduced by the provision of suitable spreader mats which, depending on the allowable bearing pressure of the subsoil, could consist of timber mats, timber and ply plates, proprietary mats, steel grillages, concrete pads or piles (for high loads in weak soil conditions). Calculations will be required and the temporary works design engineer should be consulted. Outriggers should always be positioned central to the spreader mats, which should be in contact with the ground over its entire surface area.

Theft

Millions of pounds worth of CPE is stolen in the UK every month and less than 10% of it is ever recovered. In many cases, it will be taken overseas in a shipping container within 24 hours. Even with many advanced security systems available, it is still common to find expensive CPE left unprotected on construction sites overnight.

Theft of CPE from any working environment should be the subject of a risk assessment. This should identify the CPE exposed, history of theft in the area, roles and responsibilities and mitigation measures, including physical and electronic security systems. There should be a particular focus on weekends, night time and holiday periods when sites are most vulnerable.

There should be a clear company security policy and plant security strategy implemented by all supervisors and CPE operators. The security strategy should include both prevention and recovery measures.

Key CPE hazard and control measures to consider are as follows.

Prevention measures

- Provide security guards or gate personnel at all access points wherever feasible
- During out of hours periods, return CPE to secure, well-lit compounds or out of sight within buildings
- Provide remotely monitored PIR/PA CCTV coverage to CPE storage areas and/or SIA-approved security guards
- Ensure storage areas are protected by minimum 2.5m high metal fencing with gates secured with high-quality chains and closed shackle padlocks
- Use larger items of CPE to block in other smaller equipment, for example, by extending hydraulic arms
- Use physical security devices such as breaker locks, leg locks, ram locks, track locks, wheel clamps and tow hitch locks to trailers
- Provide retractable anti-ram bollards behind gates
- Remove ignition keys from site if possible or store in a concealed key safe
- Activate ignition immobilisers (Thatcham-approved)
- Secure smaller items of CPE and tools in steel containers and steel tool chests

Recovery measures

Types of measures that can be employed include:

- Maintaining accurate records and a photographic database of all CPE
- Register CPE with the CESAR scheme, which provides a unique registration, hidden transponder, DNA solution and security datadots identifying key elements of the CPE
- Marking CPE with a unique VIN
- Marking all CPE with 'smart water'
- Painting all CPE in corporate colours with distinctive livery markings
- Installing Thatcham-approved GPS tracking devices
- Providing security etching to all cab glass

Case Study 4

Theft of a loading shovel -

A loading shovel was stolen from a housing development site out of hours. Access onto the site was gained by breaking a padlock and chain to a fence gate. It is believed the equipment was transported off site using a low loader. The loading shovel was never recovered.

The loading shovel was provided with an isolator but no GPS tracker, alarm or cab-guard. There was no CCTV or security guards on site.

The theft could have been prevented through enhanced security provisions.



Arson and vandalism

All CPE is a potential target for deliberate fire-raising or malicious damage. Fires can spread to other CPE, property or business assets. Businesses that suffer a major fire may never recover. It is therefore crucial that an effective arson prevention strategy is in place. Arson and vandalism can be caused by external parties but also by disgruntled employees.

Key elements of an arson prevention strategy are as follows:

- Undertake an arson/vandalism risk assessment taking into account the location, history of problems in the area and nature of the business, particularly the type of work carried out (i.e. if it is of a sensitive or emotive nature)
- Designate a person responsible for arson risk assessment and management
- Ensure combustible materials are not stored adjacent to CPE
- Minimise the amount of fuel and LPG stored on the site/premises
- Lock all fuel caps to CPE and fuel tanks
- Provide suitable firefighting facilities (see 'Fire' section on page 3)
- Where possible, store CPE inside buildings with fire protection systems providing buildings/any stored materials are of a non-combustible nature
- Ensure robust, physical security measures are in place to prevent access to CPE (see 'Theft' section on page 8)
- Provide window shutters and screens to glass cabs

Collisions

All mobile CPE has the potential to be involved in collisions with other CPE, property or pedestrians. As well as the impact damage caused, this can also result in injury, overturning, fires, etc.

All mobile CPE should be subjected to a Traffic Management Plan to control the movement of CPE both on and off construction sites and working premises.

Key aspects to consider to avoid collisions include:

- Establishment of a one-way system wherever feasible
- Clear segregation of traffic and pedestrian routes
- Deployment of adequate signage to give warning of hazards
- Enforcement of appropriate speed limits
- Positioning of solid, impact protection barriers around static CPE and property
- Provision of grills and protective barriers to CPE cabs to deflect falling rocks (in quarries or tunnels) or masonry (on demolition sites)
- Properly planned and managed lifting operations, where these involve lifting and moving CPE (e.g. lowering mini excavators into excavations or tunnel boring machines into shafts, etc)
- Provision of banksmen and signallers to assist with the movement of CPE
- Established procedures for poor conditions, e.g. fog, heavy rain and ice

Guidance

References

HSB guides to loss prevention

- To view our full suite of loss prevention guides, visit our website:	www.munichre.com/HSBEIL/services/loss-control-engineering/guides-to-loss-prevention/index.html
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Mobile crane and CPE stability

- BS 7121-1:2006 – Code of practice for safe use of cranes	www.bsigroup.com
- BS 7121-3:2000 – Mobile cranes	
- CIRIA Publication C703:2003 – Crane stability on site	www.ciria.org
- BRE Report 470 – Working platforms for tracked plant	www.brebookshop.com
- CPA/Crane Interest Group – Best Practice Guide for Risk Assessment and Method Statement for a Contract Lift: 2012	www.cpa.uk.net
- Working Platform Certificate	www.fps.org.uk
- Health and Safety in Construction (HSG 150)	www.hse.gov.uk
- Safe Use of Vehicles on Construction Sites (HSG 144)	www.hse.gov.uk
- The selection, management and use of mobile elevating work platforms (HSE GEIS6)	www.hse.gov.uk
- Construction Industry Training Board (CITB)	www.citb.co.uk
- Construction Plant Competency Scheme (CPCS)	www.citb.co.uk
- Building Research Establishment (BRE 470) Guide to good practice for working platforms for tracked plant	www.bre.co.uk
- The Royal Society for Prevention of Accidents RoSPA	www.rospa.com
- Health and Safety Advice the Plant Operators	www.citbni.org.uk

Construction site security and fire safety

- Fire Prevention on Construction Sites - The Joint Code of Practice on the Protection from Fire of Construction Sites and Buildings Undergoing Renovation – 9th edition - October 2015	www.thefpa.co.uk
- Fire Safety in Construction (HSG 168)	www.hse.gov.uk

Flood

- Environment Agency Flood Mapping	www.gov.uk
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CPE security

- CESAR Registration scheme	www.cesarscheme.org
- The National Plant & Equipment Register	www.ter-europe.org
- Combined Industries Theft Solutions	www.theftsolutions.org
- The Construction Equipment Association	www.thecea.org.uk
- The Construction Plant-hire Association	www.cpa.uk.net
- Thatcham	www.thatcham.org
- Covert marking system	www.datatag.co.uk

Arson

- Arson Prevention Forum	www.stoparsonuk.org
- Arson Prevention - protection of premises from deliberate fire raising – RISC Authority/FPA RC48	www.thefpa.co.uk
- Criminal activity and statistics for an area	www.police.uk

Legislation

There are many statutory requirements which apply to the safe use and operation of CPE. The main requirements are as follows:

- The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER)
- The Provision and Use of Work Equipment Regulations 1998 (PUWER)
- The Supply of Machinery (Safety) Regulations 2008 (as amended)
- The Working at Height Regulations 2005
- The Health and Safety at Work Act 1974
- The Construction (Design and Management) Regulations 2015
- The Management of Health and Safety at Work Regulations 1999
- The Regulatory Reform (Fire Safety) Order 2005

Disclaimer: The guidance in this document refers to industry best practice loss control advice. Adoption of the advice contained within this document does not imply compliance with industry, statutory or HSBEI guidelines, nor does it guarantee that related losses will not occur.

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