

Reducing Unintended Movement of Plant

and managing exposure to consequential risks



Reducing Unintended Movement of Plant and managing exposure to consequential risks

Strategic Forum for Construction Good Practice Guide



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27/28 Newbury St

London

EC1A 7HU

Telephone: 020 7796 3366

Email: enquiries@cpa.uk.net

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Foreword

Construction plant is a vital part of the construction process. The unintended movement of plant can cause it to overturn, collapse and/or strike those in the vicinity. In the past, such incidents have led to a significant number of serious accidents, some tragically fatal. Not only do these accidents have a terrible cost in terms of human suffering, they also have a significant financial cost for all concerned. There is therefore a very strong business case for improving safety performance.

Reducing unintended movement and mitigating the effects of any such movement, is essential for the safe installation, setting up and operation of construction plant. The safe operation of plant depends on a number of factors including the selection and maintenance of the plant, the planning and supervision of its use, and the competence of the operator. If any of these are deficient, the risk of a serious accident increases significantly and it is therefore essential that all of those involved ensure that all plant operations are planned, managed, supervised and carried out safely by competent people.

The purpose of this guidance is to help those involved with planning and carrying out plant operations to achieve a better awareness of the causes of unintended movement, and how plant selection and other measures can significantly reduce the consequences of such movement.

This guidance has been developed by a working group representing all parts of the industry. It provides clarity on the reduction of unintended movement and will help construction plant suppliers and users improve health and safety standards. The guidance addresses planning, plant selection, people and additional measures to reduce unintended movement. The advice in this document is straightforward, comprehensive and easy to adopt. This guidance may go further than the minimum you need to do to comply with the law.

I thank those who have been involved in its preparation and commend the guidance to anyone who owns, supplies or controls the operation of construction plant. Please read the publication and turn the advice into action.



Kevin Minton

Director Construction Plant-hire Association

Chair of the Strategic Forum Plant Safety Group

1.0 Introduction and Scope

Most plant operators know of unintended movement or have experienced it with their machine, but are often not aware of the potentially devastating consequences.

If an item of construction plant moves in an unintended way, there is always a risk that someone may be injured or killed. The person who is injured or killed in such circumstances is often not the operator, but a person near to the machine such as a slinger/signaller or ground worker, who may well be a friend or colleague of the operator.

For the purposes of this document unintended movement of plant may arise from the following situations:

- The inadvertent operation of controls where the operator does not intend to operate the control but, for example, catches their coat sleeve on a control when the machine's hydraulic system is live, resulting in movement;
- Operation of controls where the resulting movement is not as intended, for example meaning to travel forward in an excavator with the superstructure slewed through 180°, resulting in the machine travelling in the opposite direction;
- When safety systems are bypassed, removing the protection they provide against unintended movement;
- Malfunction due to inadequate inspection and maintenance.

Example of Inadvertent Operation of Controls	
Lorry Loader and Brick Clamp	
<p>1. <i>The driver of a builder's merchant's delivery truck was delivering landscaping materials to a house. He was operating the loader crane whilst standing on the truck bed, using a remote control unit attached to his body.</i></p>	<p>2. <i>Whilst attaching the loop of a bag of ballast to the legs of the clamp, he positioned himself between the legs and inadvertently operated the clamp which closed and fatally crushed his pelvis.</i></p>

Example of Operation of Controls where the Resulting Movement was not as Intended	
Excavator 360 (tracked)	
<p>1. <i>The operator of the excavator was on the edge of an embankment loading dump trucks. After loading, he went to track rearwards to move the machine away from the edge.</i></p>	<p>2. <i>He forgot that the track motors were at the front resulting in the machine tracking over the edge, down the embankment and overturning.</i></p>

Whilst the first aim of plant users should be to prevent the unintended movement of machines in the first place, it is also important that if such movement takes place the effects are adequately mitigated by, wherever possible, separating machines and people.

The contributory factors in preventing the causes and consequences of unintended movement of plant fall into three equally important and interdependent areas:

- Management of Plant Operations

Including:

- selection of equipment;
- task planning;
- supervision;
- maintenance;
- company culture.

- Machine Design

Including:

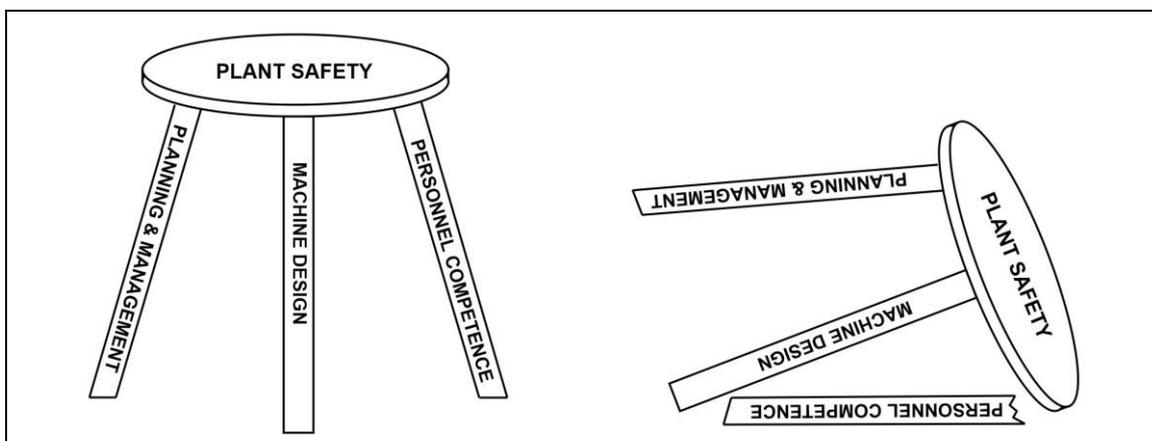
- design of a control isolator which cannot itself be inadvertently operated;
- design of controls to minimise the likelihood of inadvertent operation of controls;
- provision of adequate visibility aids to reduce likelihood of machine/person contact;
- design, selection and installation of OEM and third party 'add on's' e.g. secondary isolation devices and vision aids.

- Personnel Competence

Including:

- personal culture (attitudes and behaviour);
- basic training;
- gaining of experience;
- competence assessment;
- machine specific familiarisation.

These three areas are like a three leg stool where if one leg fails, the stool will fall over.



The purpose of this guidance document is to address both reducing the probability of unintended movement and mitigating the effects of that movement, if it takes place. The topics covered include:

- Taking account of unintended movement in task planning;
- Providing adequate supervision;
- Training and familiarisation of plant operators - ensuring that they know the circumstances when they should isolate their machine;
- Ensuring that those in the vicinity of plant are aware of the hazards arising from being in close proximity to the machine;
- Control of working zones - separation of machines and people;
- Use of plant controllers;
- Use of the 'thumbs up' procedure when people approach machines;
- Specification of operator's protective clothing to prevent clothing catching on a control;
- Selection of machines;
- Fitting of additional control interlock systems.

The scope of this document includes all plant and remote controls, with the exception of Mobile Elevating Work Platforms (MEWPs). Reducing unintended movement of MEWPs is addressed in the Strategic Forum Plant Safety Group publication; *Avoiding Trapping / Crushing Injuries to People in the Platform* which can be downloaded free-of-charge from www.cpa.uk.net

Whilst the document is aimed specifically at the construction industry, its guidance applies to other sectors of industry where plant is used. Where local rules are more onerous than those set out in this document, they take precedence.

2.0 Definitions, Roles and Responsibilities

Terms that are specific to this document

2.1 *inadvertent operation of controls*

The plant operator makes or causes an action without intending to operate a control, with the consequence that the control is operated.

2.2 *RUMP*

Reducing unintended movement of plant.

2.3 *unintended movement*

Movement of a machine which was not intended by the operator.

Industry standard terms

2.4 *appointed person for lifting operations*

A competent person appointed by the employing organisation carrying out a lifting operation, to have overall control of the lifting operation and ensure that it is planned and carried out safely.

2.5 *contractors (employers)*

Contractors carrying tasks on site are responsible for all aspects of planning, supervision and execution of those tasks.

2.6 *competent person*

Person with the necessary skills, knowledge, training and experience to carry out the tasks allocated to them in a manner that secures the health and safety of any person working on the construction site.

NOTE: See - *Competence to Operate Construction Plant - Good Practice Guide*. Strategic Forum for Construction - Plant Safety Group (free download from www.cpa.uk.net).

2.7 *The Construction (Design and Management) Regulations 2015 (CDM 2015)*

CDM 2015 is construction specific legislation that requires duty holders including clients, designers and contractors to plan, manage and monitor health, safety and welfare aspects of construction projects. This includes coordination of each stage of the process and sharing of information. Pre-construction information must be made available to assist contractors to tender.

Upon completion, project information must be passed to the client to assist with planning maintenance and further work at the site.

2.8 *client (non-domestic)*

Person or organisation who is having construction or building work carried out, unless they are a domestic client.

2.9 *client (domestic)*

Person who lives, or will live, in the premises where the work is carried out. The premises must not relate to any trade, business or other undertaking.

2.10 *combination of roles*

In certain circumstances it may be possible to combine some of the roles listed in this document. Role combination should only take place following risk assessment of the tasks to be undertaken. The combination of roles requires that the person undertaking the combined role has achieved the necessary competence for each role.

2.11 *construction plant*

Machinery used in the construction process, including lifting equipment, referred to in this document as 'plant' or 'machine'.

2.12 *exclusion zone*

A designated area of the worksite from which people are excluded to protect them from harm.

2.13 *ground workers and other trades*

Ground workers and other trades are responsible for carrying out tasks as briefed by the Supervisor. They should have the authority to stop the work if they believe it is not being carried out safely, and report any issues to the Supervisor.

2.14 *lift supervisor*

Person who controls the lifting operation, and ensures that it is carried out in accordance with the appointed person's safe system of work.

2.15 *maintenance personnel*

Maintenance personnel are responsible for ensuring that plant is serviced, inspected and repaired in a timely manner so that it is safe to use. If they have any concerns about the safety of an item of plant, they must report this immediately to the user of the plant.

2.16 *method statement*

Document describing a safe system of work using text, images, drawings etc.

2.17 *party in control of a site*

The party in control of a site who has overall responsibility for the safety of all personnel on site. They should ensure that where plant is being used to carry out a task, adequate steps have been taken to ensure that unintentional movement of plant does not occur through adequate briefings and supervision of other contractors and sub-contractors on site. The party in control of the site is often the Principal Contractor.

2.18 *planners*

Planners are responsible to the Contractor for planning tasks to ensure that they can be carried out safely and efficiently. Reducing unintentional movement of plant and/or measures to mitigate the effects of unintended movement are part of task planning. They must ensure that all task planning is effectively communicated to those who will supervise and carry out the task.

2.19 *plant*

See construction plant.

2.20 *plant controller*

Competent person authorised to control the work activities of the machine.

2.21 *plant marshaller*

Competent person authorised to guide and direct machinery movements on or around site.

2.22 *plant operator*

The principal operator of an item of plant who is responsible for carrying out tasks as briefed by the Supervisor and operating their machine in a safe manner. They should have the authority to stop the work if they believe it is not being carried out safely and report any issues to the Supervisor.

2.23 *plant owners, manufacturers and suppliers*

Plant owners, manufacturers and suppliers are responsible for ensuring that at the time of supply, the item of plant is in a safe condition, and provide sufficient information to enable it to be used safely.

2.24 *pre-use check*

A check of the item of plant carried out by a competent person, who may be the operator, to ensure that it is free from obvious defects before being operated.

2.25 *principle designer*

A person or organisation appointed by the client, required by CDM 2015, to plan, manage and monitor the pre-construction phase and co-ordinate health and safety.

2.26 *risk assessment*

A systematic process of identifying the hazards, evaluating the potential risks arising and identifying the necessary measures required to eliminate or reduce those risks to an acceptable level.

2.27 *safe system of work*

A method of working designed to eliminate, if possible, or otherwise reduce risks to health and safety.

2.28 *signaller*

Person responsible for directing the lifting equipment operator to ensure safe movement of the lifting equipment and load.

2.29 *slinger*

Person responsible for attaching and detaching the load to and from the lifting equipment; for correct selection and use of lifting accessories in accordance with the specifications of the appointed person and for initiating the movement of the load.

2.30 *supervisors*

Supervisors are responsible for ensuring that those carrying out a task are competent and understand how to carry out the task. They are also responsible for supervising those people and monitoring their performance. They should have the authority to stop the work if it is not being carried out safely and report any issues to contractors and planners.

3.0 Legal Duties

3.1 General

The Health and Safety at Work, etc. Act 1974 (HSWA) and associated regulations, require employers and self-employed persons to ensure the safety of employees and others not in their employ (including members of the public). Part of that duty is ensuring the safety of construction plant on site and in particular reducing unintended movement and the protection of people who might be at risk from such movement. Those with duties include:

- Clients;
- Principal Designers;
- Designers;
- Management Contractors;
- Principal Contractors;
- Main Contractors;
- Sub-contractors;
- Other Employers;
- Self-employed;
- Employees;
- Maintenance Personnel;
- Plant Manufacturers;
- Dealers;
- Rental Companies (Plant Owners).

In addition, plant manufacturers, plant dealers and rental companies have a duty under both HSWA (Section 6) and the Supply of Machinery (Safety) Regulations (SMSR) to provide adequate information to enable a piece of construction plant to be used safely.

Annex A lists the main sets of regulations made under HSWA which apply to the management of plant operations, including reducing unintended movement of plant. These regulations only apply in Great Britain and the guidance contained in this document is not necessarily applicable in other jurisdictions.

***NOTE:** Northern Ireland has its own set of regulations which tend to mirror those in Great Britain, but may have minor differences. Employers should ensure that they are aware of the regulations in the jurisdiction in which they are working.*

3.2 Corporate Manslaughter and Gross Negligence Manslaughter

The Corporate Manslaughter and Corporate Homicide Act 2007 enables companies and organisations to be prosecuted for serious management failures resulting in a gross breach of a duty of care. Individuals can be prosecuted under Common Law for gross negligence manslaughter where their gross negligence of a duty of care to a person has resulted in that person's death.

3.3 Prosecutions

Employers and individuals can be prosecuted for infringements of HSWA, regulations made under the act and SMSR, which can result in punitive fines and custodial sentences. Some examples are given in **Annex H**.

A new sentencing guideline on Health and Safety, and Corporate Manslaughter offences came into force on 1st February 2016. Convictions since that date have shown a very significant increase in both fines and custodial sentences.

4.0 Case Studies

4.1 General

Table 2 shows a number of examples of real life incidents involving the unintended movement of construction plant. Each example has been mapped against the causal factors in **4.2**. Twenty case studies have been analysed, the primary causal factors determined and the rate of occurrence established as follows:

Causal Factor	Number of Occurrences
Operator competence	17
Pre-use checks	2
Operator work station and poor housekeeping	5
Lack of supervision	16
Poor planning	16
Loose clothing	4
Persons in the machine's arc	14
Non isolation of controls	14
Machine design	4
Bypassing of Safety Devices	3
Table 1 - Causal Factors and Frequency	

This indicates that the most frequently occurring causal factors are:

- Operator competence and driver error;
- Lack of supervision;
- Poor planning;
- Persons in the machine's working area;
- Non isolation of controls.

This document concentrates on providing guidance on the elimination or mitigation of these factors.

4.2 Primary Causal Factors

4.2.1 Operator competence

If an operator does not possess the necessary competence to operate the machine, unintended movement may occur. It may be a lack of skills, a lack of familiarity, or being complacent about the operation of the individual machine.

4.2.2 Pre-use checks

Pre-use checks are a basic requirement of safe plant operation. If not carried out before use, the operator may well find out that a control is malfunctioning when it is too late to get the problem rectified.

4.2.3 Operator work station and poor housekeeping

Cabs on small machines may have restricted space which can lead to operators with a large body frame or heavier build, and/or wearing bulky clothing, inadvertently moving controls.

Untidy cabs with un-stowed cups, papers, documents and cans have caused several instances of unintended movement, either because the operator has bent down to retrieve an item from the floor and inadvertently operated a control, or where a can has rolled under the travel pedals, preventing full movement.

Only essential items should be stored around the operator's workstation.

4.2.4 Lack of supervision

A lack of supervision of the work site can result in ground workers and bystanders straying into the reach or working zone of plant, which in turn may lead to injury or death in the event of unintended movement of the plant. Incidents of 'helping-hands' – nearby and unauthorised workers assisting with a particular activity - have resulted in trapped and crushing limbs and are a result of poor supervision.

4.2.5 Poor planning

Poor task planning, including the selection of inappropriate equipment, can result in ground workers or slinger/signallers being in the danger area in the event of unintended movement.

4.2.6 Loose clothing

Loose clothing catching on controls has led to a number of instances of unintended movement. Some employers now specify short 'bomber-style' jackets with elasticated cuffs and coat skirts to reduce this risk.

4.2.7 Persons in machine working area

People who are in the working area of the machine are by definition at risk of being struck by the machine if an unintended movement occurs. This risk can be eliminated by ensuring that people are excluded from the working area unless the machine's controls are isolated. It is also important to ensure that all people near the working area are aware of the dangers, and that an effective signalling system is used by the operator and those people nearby, to ensure that they only approach the machine when it is safe to do so.

4.2.8 Non isolation of controls

Most items of plant have a means of isolating the controls. This may be an emergency stop, an isolating key switch, a foot pedal switch, an enabling button, or contact sensitive joy sticks. In the case of 360° excavators, a safety lever is fitted which is raised or lowered to allow the operator to leave the cab.

4.2.9 Machine design

All machines supplied into the European Union must meet the requirements of the Machinery Directive 2006/42/EC (see **Annex E**). Manufacturers must assess their machines against either one of the many harmonised European Product Standards or the essential health and safety requirements of the Directive. Having ensured that their machines are compliant, they will apply a CE mark to each machine supplied and issue an EC Declaration of Conformity for the machine.

Some modern machines have computer based control systems incorporating diagnostic systems which will recognise sensor faults or bypassing of safety devices.

4.2.10 Bypassing of safety devices

The control systems of machines include safety devices, such as interlocks, which prevent the machine from operating at all or outside predetermined limits if it is not safe to do so. Deliberately bypassing these devices removes the protection of the safety device and increases the risk of harm to the operator and people in the machine's immediate area.

Item	Description	Primary Causal Factors								Machine Design	Bypassing of Safety Devices
		Operator competence	Pre-use checks & Maintenance	Confined cab/ Housekeeping	Supervision	Planning	Loose clothing	Persons in the machine arc	Non isolation of controls		
1.	A 360° excavator was being manoeuvred out of a spray booth. When the engine was started the upper structure of the machine slewed immediately, causing serious injury to a bystander. The safety lever had been in the lowered position so all controls were operational. The joystick control had been taped down during painting which resulted in the rapid movement of the machine.	✓	✓		✓	✓		✓	✓		✓
2.	A slinger/signaller was removing a chain sling from a concrete beam. The excavator operator leaned forward to pick up a drawing which had fallen on the cab floor. He knocked the right hand lever which caused the chain to tighten, trapping the slinger/signaller's finger. The safety lever was not used as the operator stated "it only takes 5 seconds to unsling". The site safety officer did not expect the safety lever to be used as the job only took seconds.	✓		✓	✓	✓		✓	✓		
3.	The operator of a ride-on roller was killed when his seat became detached from the machine. The operator fell with the seat beneath the rollers and was run over by the machine. The subsequent investigation found that the seat cut out switch had been defeated and the emergency stop button was missing. The operator was also untrained.	✓	✓		✓	✓					✓
4.	An unsupported excavation (3.6 m deep) had a ground worker working in bottom clearing around a pipe by hand. A 360° excavator bucket had been lowered into the excavation as a means of emergency escape in the event of collapse. The excavator operator made accidental contact with control levers, causing the bucket to lift and swing towards the ground worker, causing life threatening injuries to his face, upper torso and spine.	✓			✓	✓		✓	✓		
5.	A farmer was using a telehandler to move silage bales from the farmyard to a shed in order to feed her cattle. She asked her neighbour to remove the plastic wrapping from the last bale which was still in the bale grab. As the neighbour was removing the wrapping, the farmer moved the machine trapping the neighbour between the machine and a feed barrier. The farmer was not trained to operate the telehandler, which would normally have been operated by a trained farm worker who was unavailable that day.	✓			✓	✓		✓			
6.	A ground worker was struck by manhole concrete ring while it was being lowered into position by a 180° excavator. The operator was distracted while lowering the ring, resulting in uncontrolled movement of the ring which caught the ground worker at knee level. The operator had moved in his seat to talk to someone behind him and as he turned, his body caught the controls.	✓			✓	✓		✓	✓		
7.	The operator of a vacuum excavator was trapped and crushed between the vacuum excavator suction pipe and the wall of a trench when the excavator boom moved unintentionally. The machine was being operated by a remote control station which was just out of reach of the operator in the trench.	✓			✓	✓		✓		✓	
Table 2 - Case Studies											
8.	A competent and trained excavator operator with many years of experience was lifting a container to reposition it on site. As the container was being lowered, the operator turned to his right to check on the location of the other workers on site, two of whom were working nearby. In turning, the operator's fleece jacket caught the left hand lever of the machine. This caused an inadvertent slew to the right of around 90 degrees, resulting in the container pivoting on the rear corner and striking a worker in the back.						✓	✓			

Item	Description	Primary Causal Factors								Machine Design	Bypassing of Safety Devices
		Operator competence	Pre-use checks & Maintenance	Confined cab/ Housekeeping	Supervision	Planning	Loose clothing	Persons in the machine arc	Non isolation of controls		
9.	The driver of a builder's merchant's delivery truck was delivering landscaping materials to a house. He was operating a loader crane fitted with a grab, using the remote controls attached to his body. Whilst standing on the truck bed and attaching the loop of a bag of ballast to the grab, he inadvertently operated the grab which crushed his pelvis. The operator was released from the grab, but died at the scene.	✓			✓	✓		✓	✓		
10.	A site was being cleared using an excavator. The operator and a ground worker were discussing which items were to be moved. The operator then entered the cab, whilst the ground worker walked to the other side of the machine. Having sat down, the operator stood up to open the front window and as he sat back down, his jacket got caught on a control lever, resulting in inadvertent movement of the bucket, trapping the ground worker's legs between the bucket and the tracks. The ground worker was taken to hospital and later had both his legs amputated just above the knee.	✓			✓	✓	✓	✓	✓		
11.	Having been instructed to stop the movement of a load, the operator of a tower crane reached across the control console in the cab to open the window. As he did so, his sleeve caught the hoist control lever and caused the load suspended on the hook to drop to the ground in an uncontrolled fashion. Fortunately, no one was injured.	✓		✓			✓	✓	✓	✓	
12.	The operator of a 5 tonne excavator caught the arm of his jacket on the safety lever and at the same time knocked the slew control lever. The machine slewed and the bucket hit a colleague standing at ground level.				✓	✓	✓	✓			
13.	The driver of a vehicle delivering landscaping materials to a racecourse was unloading the materials using a loader crane fitted with a brick clamp and operated by a remote control station slung around his neck. The driver was attaching the loops of a one tonne bag of pebbles to hooks on the brick clamp when he inadvertently operated the loader crane's second boom, crushing himself between the brick clamp and the bag of pebbles. He was working by himself and when discovered by race course staff, was found to have died. The Fatal Accident Enquiry found that the operator had failed to isolate the remote control station, had adopted unsafe working practices and has not received any formal training or assessment.	✓			✓	✓		✓	✓		
14.	Two experienced workers were working with an excavator. The ground worker was in front of the machine. It was a hot day and the operator stood up to open the cab window and inadvertently touched the controls, which moved the bucket towards the machine trapping the legs of the ground worker between the bucket and the track frame, causing him to lose both legs.	✓		✓	✓	✓		✓	✓		
Table 2 - Case Studies (continued)											
15.	A tower crane operator was transferring control of the crane to a colleague before taking a break. A large shutter was suspended from the hook and during the process of changing over, one of the operators caught the hoist control lever and the load dropped a short distance. Fortunately, the personnel positioning the load managed to get their hands out of the way and no one was injured.	✓		✓					✓	✓	

Item	Description	Primary Causal Factors									
		Operator competence	Pre-use checks & Maintenance	Confined cab/ Housekeeping	Supervision	Planning	Loose clothing	Persons in the machine arc	Non isolation of controls	Machine Design	
16.	A ground worker was changing a bucket on an excavator which was not fitted with a quick hitch. The operator got out of the cab to help with the pins and as he left the cab, caught the control pod and inadvertently operated the boom with his jacket. The ground worker suffered a broken jaw.	✓			✓	✓			✓		
17.	The operator of a top cutter (trencher) had completed his work and parked his machine. He was inspecting the cutting wheel before loading the machine onto transport and the isolating switch on the control station seat had been bypassed to allow the wheel to slowly rotate whilst he inspected the teeth. He became caught in the teeth of the rotating wheel, was drawn into the machine and unfortunately died. He was working alone and was not discovered until sometime later.	✓			✓				✓		✓
18.	An excavator operator and his machine were called to another part of site to carry out an ad-hoc job without being briefed. The operator was required to hold sheet piles in place whilst the piles were being welded together. A ground worker, acting as a slinger/signaller, dropped a shackle and bent over to pick it up. As he did so, the operator lent forward to pick up a paper cup from the cab floor, inadvertently moving the boom and crushing the ground worker against the sheet pile.	✓		✓	✓	✓		✓	✓		
19.	A tower crane operator was sitting in the cab of his crane whilst maintenance was being carried out. The control circuits were live and the operator dozed off, slipping forward in his seat and pushing the hoist lever with his knee. This caused the hook block to slowly descend to the ground. Fortunately, no one was in the area at the time and no injuries resulted.	✓				✓			✓	✓	
20.	An excavator operator, who was proud of his machine and took very good care of it, found that he was unable to control the travel function when a can of dashboard cleaner rolled under the travel pedals.				✓	✓		✓			
Total number of occurrences		17	2	5	16	16	4	14	14	4	3

Table 2 - Case Studies (continued)

5.0 Task Planning and Selection of Plant

Poor planning is one of the major causes of accidents arising from the use of construction plant. All operations on construction sites should be planned to ensure that they are carried out safely and that all foreseeable risks have been taken into account.

5.1 Task Planning

Planning a task to ensure it can be carried out safely and efficiently involves the following actions:

- Identify the task or outcome to be achieved;
- Identify the hazards associated with the task;
- Identify options that could completely avoid (eliminate) hazards;
- Identify measures to control any remaining hazards and record them (measures could include information gathering, physical protection, special procedures);
- Review the situation and consider whether the identified control measure(s) create any new hazards;
- If the risk of an incident is still too high, the task cannot be undertaken until additional control measures are put in place which have reduced the risk to low as is reasonably practicable;

***NOTE:** If additional control measures cannot be put in place the task or outcome will need to be reviewed and amended so that it can be achieved safely.*

- Record the planning in a risk assessment and method statement;
- Arrange for the work to be carried out. This includes fully briefing the team who will undertake the task.

It is essential that task planning is carried out by those who have the necessary skills, knowledge and experience of both the task and the plant or equipment to be used.

5.2 Selection of Plant

The selection of the plant and any attachments should be part of the planning process. The selection process should at least take into account the following points:

- Is the site of adequate size for the use of the type of plant?
- Is the machine appropriate for this application?
- What are the weight, dimensions and characteristics of both the machine and the material to be excavated, handled, carried, lifted, pumped etc.?
- What are the radii and height of lift required?
- How far will the loads have to be carried and over what sort of terrain?
- What are the number, frequency and types of operation?
- What space is available for machine access, deployment, operation, maintenance and stowage, including the space required for correct deployment of stabilizers (if any)?
- Is there a need for attachments such as buckets, work platforms or lifting hooks?
- What is the effect of the operating and surrounding environment on the machine, and vice versa?
- Is there a need for the machine to travel on the public highway?

- Is operator selection a criterion for machine selection?
- What is the source of the machine - user's own fleet, hired in or purchased?
- Will the operator have adequate visibility for the location in which it will be used?
- Is the chosen machine **still** appropriate for this application?

5.3 **Selection of Attachments**

Attachments for use with plant should be chosen with care to ensure that the combination of machine and attachment is both safe and productive. The selection process should at least take into account the following points:

- Which make and model of machine is the attachment going to be fitted to?
- What task is the attachment required for?
- Which type of attachment is best suited to the application?
- Is the attachment approved for use on that machine?
- Is the attachment compatible with the machine?
- Are user instructions (including load charts if appropriate) available for the use of the attachment on the specific make and model of machine?
- Is the plant operator both familiar with, and competent to operate, the attachment?
- Will the operator require additional training and/or familiarisation?
- Who will be carrying out fitting and removal of the attachment and are they competent to do so?
- Are there particular hazards associated with the location and/or the task to be carried out?
- Will the attachment be sourced from the machine manufacturer, from an attachment manufacturer or from a third party?
- Will the attachment be sourced from the plant owner's own stock?
- Will the attachment be used for the lifting of suspended loads?

Attachments should be designed for use with a specific machine and supplied with instructions to enable them to be assembled and used safely with the specific machine. The instructions should specify which make and model of machine the attachment can be safely assembled and used with, either by reference to the technical characteristics of the machine or, where necessary, by reference to specific models of plant.

Certain types of attachment are known as *interchangeable equipment* and require CE marking. Further details in **Annex E**.

6.0 Planning, Supervisory and Operating Personnel

6.1 General Work Related Competence for Plant Operations

An often used definition of a competent person is “a person who has such practical and theoretical knowledge, experience and capacity as is necessary to safely carry out the task to which the term relates in each particular context”. A person who is competent to carry out one task will not necessarily be competent to carry out another with the same equipment. For example, a telescopic handler operator who is competent to lift and place unit loads may not be competent to work with suspended loads.

Employers must ensure that their personnel are competent to work safely with plant operations. Employers must therefore assess the competence of their staff and, where necessary, provide training to achieve the level of competence required. The training needs to reflect the ability and level of responsibility of the individual, degree of complexity of the task and the risks involved.

Employers have a duty to both ensure the health of their employees and to ensure that any employee is fit to undertake the tasks they are required to carry out by ongoing assessment. Further guidance on assessing the medical fitness of construction plant operators is given in the Strategic Forum for Construction - Plant Safety Group publication *Medical Fitness to Operate Construction Plant - Good Practice Guide* (free download from www.cpa.uk.net).

6.2 Attributes and Selection

It is essential that planning, supervisory and operating personnel involved with the selection, and use of plant have the necessary attributes to ensure that they will be able to carry out their duties both effectively and safely. The necessary attributes for planning, supervisory and operating personnel are set out below.

6.2.1 Competent Persons (planning) Attributes

Competent Persons carrying out planning of the use of plant should know and understand:

- The principles of plant operation;
- What the plant can and cannot be used for;
- The hazards associated with plant operations including;
 - overturning;
 - electrocution – contacting overhead and underground power lines;
 - colliding with pedestrians;
 - crushes and trapping;
 - falling loads;
 - load swing and drift;
 - falling from height (when lifting people);
 - loss of control;
 - insecure attachments;
 - inadequate ground conditions;
 - inclement weather.
- The checks and inspections that are required on a daily and weekly basis;
- What can happen if the machine is poorly maintained;

- The need for thorough examination of lifting equipment;
- How to attach and detach an attachment in the prescribed manner;
- How to carry out checks to ensure the attachment has been correctly engaged;
- That all work must be carried out to a Method Statement and that the Method Statement is a description of the safe system of work developed from a risk assessment of the task to be undertaken;
- That accidents and incidents are mainly caused by incorrect planning and use;
- The increased risks when plant is being operated in the vicinity of other people and ensure/maintain an exclusion zone wherever possible;
- Their responsibilities under the Health and Safety at Work Act.

Competent Persons should be able to:

- Carry out a risk assessment of the work to be carried out;
- Develop a safe system of work based on the outcomes of the risk assessment;
- Record the safe system of work in a Method Statement;
- Carry out an effective observation and know what to look for;
- Communicate effectively with supervisors, operators and line managers;
- Recognise bad practice and unsafe behaviour;
- Develop good working relationships;
- Raise health and safety standards;
- Display consistency and be persistent;
- Raise and address issues confidently and not be afraid of conflict.

6.2.2 Supervisor Attributes

Supervisors should know and understand:

- The principles of plant operations;
- People's behaviour and their unpredictability;
- What plant can and cannot be used for;
- The hazards associated with plant operations including;
 - overturning;
 - electrocution – contacting overhead and underground power lines;
 - colliding with pedestrians;
 - crushes and trapping;
 - falling loads;
 - load swing and drift;
 - falling from height (when lifting people);
 - loss of control;
 - insecure attachments;
 - inadequate ground conditions;
 - inclement weather.
- The checks and inspections that are required on a daily and weekly basis;

- What can happen if the machine is poorly maintained;
- The need for thorough examination of lifting equipment;
- How to attach and detach an attachment in the prescribed manner;
- How to carry out checks to ensure the attachment has been correctly engaged;
- That work must be carried out to the Method Statement unless it is unsafe to do so in which case work must stop;
- That accidents and incidents are mainly caused by incorrect planning and use;
- The increased risks when plant is being operated in the vicinity of other people and ensure/maintain an exclusion zone wherever possible;
- Their responsibilities under the Health and Safety at Work Act.

Supervisors should be able to:

- Carry out an effective observation and know what to look for;
- Communicate effectively with operators and line managers;
- Recognise bad practice and unsafe behaviour;
- Develop good working relationships;
- Raise health and safety standards;
- Display consistency and be persistent;
- Raise and address issues confidently and not be afraid of conflict.

6.2.3 Operator Attributes

Operators should know and understand:

- The principles of plant operations;
- What the plant can and cannot be used for;
- The hazards associated with the plant operations including:
 - overturning;
 - electrocution – contacting overhead power lines;
 - colliding with pedestrians;
 - crushes and trapping;
 - falling loads;
 - load swing and drift;
 - falling from height (when lifting people);
 - loss of control;
 - insecure attachments.
- What can happen if the machine is poorly maintained;
- The need for thorough examination of lifting equipment;
- That they must check any attachment or quick-hitch in accordance with the manufacturer's instructions, before work commences or recommences following fitment;
- That they must organise their work in accordance with the Method Statement (generic or task specific), including coordination with others who may be affected, and follow the Method Statement unless it is unsafe to do so, in which case work must stop;

- That they must report all unsafe working practices and faults with their machine to their supervisor;
- That poor planning, operation, training, maintenance, supervision or working environment, (or a combination thereof), are major contributory factors to accidents/incidents;
- The increased risks when plant is being operated in the vicinity of other people and ensure/maintain an exclusion zone wherever possible;
- The organisational procedures and requirements that they need to follow;
- The need for familiarisation training before operating new or unfamiliar types of machine and/or attachment;
- Their responsibilities under the Health and Safety at Work Act;
- Their limitations in organising their work or operating the machine in any given environment.

Operators should be able to:

- Communicate effectively with other workers and line managers;
- Interpret relevant information and follow given instructions;
- Organise the work activity or part of the work activity with others;
- Select and/or request resources and additional equipment required;
- Carry out the checks and pre-use inspections that are required on a daily and/or weekly basis as required;
- Attach and detach an attachment in the prescribed manner;
- Carry out checks to ensure the attachment has been correctly engaged;
- Operate the machine according to manufacturer's requirements and safe working practices;
- Raise and address issues confidently and not be afraid of conflict or of stopping work when necessary to ensure safety.

6.3 *Groundworkers and Other Personnel*

Groundworkers and other personnel who are in the vicinity of plant should be made aware of the potential dangers of plant movement, including those arising from the unintended movement of plant.

Those potentially at risk include:

- Groundworkers;
- Slinger/signallers;
- Steel fixers
- Maintenance personnel;
- Supervisors;
- Managers;
- Visitors.

The following is an example of the risks associated with those in the vicinity of plant:

Two experienced workers were working with an excavator. The ground worker was in front of the machine. It was a hot day and the operator stood up to open the cab window and inadvertently touched the controls, which moved the bucket towards the machine trapping the legs of the ground worker between the bucket and the track frame, causing him to lose both legs.

6.4 Assessment of Training Needs

As part of personnel selection an assessment should be made of the extent of training which is needed by an individual, bearing in mind that this could be influenced by any previous training and experience. When supervisors or operators are recruited, it is essential that employers check that their qualifications and experience relate to the job they are to do. Where the type of machine to be used is outside the employee's previous experience, additional training must be provided. In any event, some further job specific training is likely to be necessary.

An example of guidance on the assessment of training needs for forklift trucks is given in HSE (L117) *Rider-operator lift trucks. Operator training and safe use. Approved Code of Practice and Guidance*, Third Edition 2013 and can be used as a template for most types of mobile plant.

Guidance on assessment of training needs for personnel carrying out maintenance and thorough examination is given in the *CPA Best Practice Guide on the Maintenance, Inspection and Thorough Examination of Mobile Cranes* (free download from www.cpa.uk.net).

6.5 Training

Any gaps in the knowledge, skills and understanding of competent persons (planning), supervisors and operators must be remedied by suitable and sufficient training. This may be carried out in-house or by an external training provider with appropriate expertise. At the end of the training period the trainee must be impartially assessed to ensure that the training/learning objectives have been met.

6.6 Assessment

Employers should ensure that personnel are assessed against occupational standards to establish that they are competent to carry out the tasks they are required to undertake. This applies equally to personnel completing training and experienced workers who have been recently recruited.

Assessment should contain both practical elements to demonstrate the skills and standards achieved and the answering of questions or discussions to demonstrate relevant underpinning knowledge and understanding. The assessment should be carried out by occupationally competent and authorised assessors with relevant industry experience.

6.7 Applying Learnt Skills in the Workplace

On the majority of plant training programmes, for safety reasons, candidates do not operate machines at their full potential. Consequently, employers should ensure that newly trained operators are limited to activities and/or working areas encountered within the training programme until they become confident in operating to the parameters experienced within training. When required to operate outside these parameters appropriate supervision must be applied to ensure the operator can safely carry out the task.

Plant training courses for the construction sector generally concentrate on core activities in a predominately segregated training environment, which does not reflect actual site conditions. Employers and supervisors should be aware of skills attained during the

training course and provide further specific training as required within the typical working environment.

Manufacturers and importers of plant and equipment, as well as external training providers having the appropriate expertise who offer plant training, can be approached for advice on relevant training requirements.

For newly qualified operators, employers and supervisors should:

- Specify any particular work requirements to nominated training providers prior to the commencement of training;
- Establish the type and the content of training and/or assessment programmes undertaken by the operator;
- Identify differences in learnt skills and the work site utilising training body learning outcomes and/or training material;
- Initially limit the operator to activities and/or working areas encountered within the training programme;
- Provide time for the operator to study the machine's operating notes/handbook and other related data;
- Provide time and facilities for the operator to practice with the new machine type;
- Monitor work undertaken to gauge operator confidence and ability;
- Introduce new activities and/or working areas under supervision, especially if lifting loads to heights higher than previously encountered, or working within hazardous or busy areas;
- Carry out periodic assessments and ascertain when new or high risk activities can be undertaken safely;
- Provide specific additional training for such activities as lifting operations.

6.8 Further guidance

Further guidance on training is given in:

- *Competence to Operate Construction Plant - Good Practice Guide*. Strategic Forum for Construction - Plant Safety Group (free download from www.cpa.uk.net).

7.0 Control of Working Zones

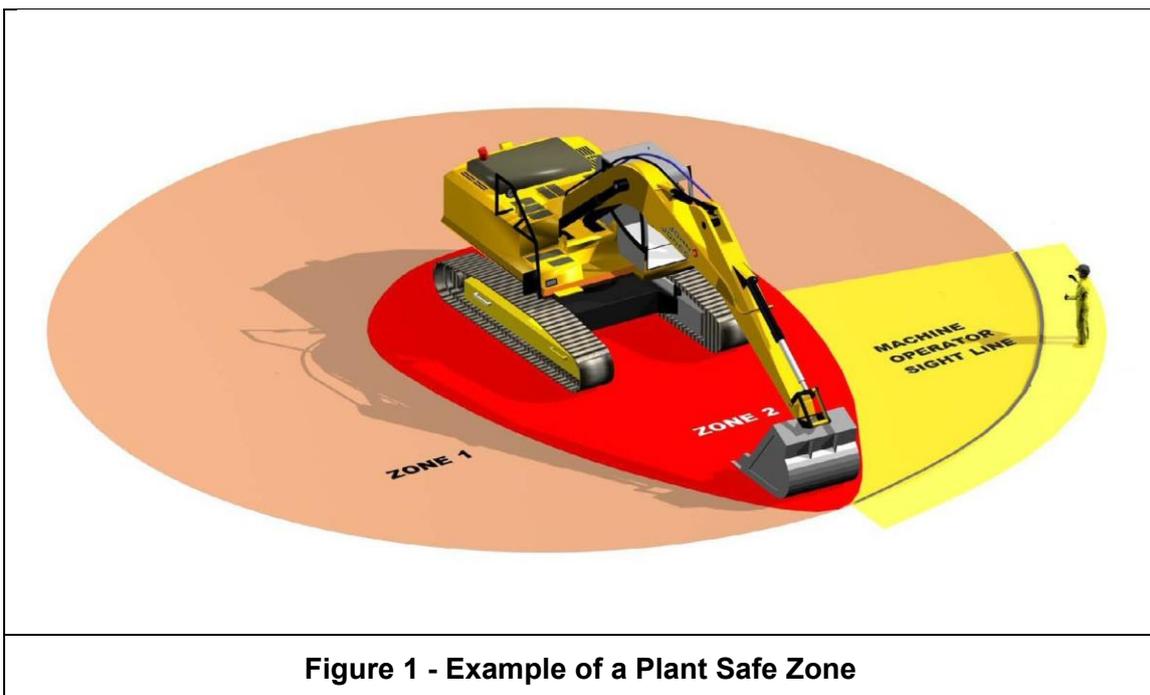
The consequences of unintended movement can be eliminated or reduced by ensuring that people are not in the working zones of construction plant. It is essential that all persons in the general vicinity of plant wear high visibility clothing to maximise their visibility to plant operators. The risks associated with working zones should be assessed and appropriate control measures put in place, such as total exclusion, the use of plant controllers and aids such as cameras and proximity sensors (see 7.2 and Annex F).

7.1 Plant Operating Areas

As a general rule there should be no one in the operating area unless they are authorised to be there.

The planning process should ensure that each item of plant has a designated 'Plant Safe Zone' as shown in **Figure 1** below, courtesy of Highways England. The aim of a safe zone is to ensure that persons in the vicinity of plant can identify the zones which should not be entered unless the machine's power source is isolated (**Zone 2**) and those which may be entered once the plant operator has indicated that it is safe to do so (**Zone 1**).

The dimensions and positions of the zones will be decided by individual risk assessment and will vary with the type, size, reach and number of machines operating within a given area. Account should be taken of attachments and long loads.



7.2 Plant Controllers

Some organisations are using plant controllers to control the access of persons to the working area of plant. Details of the duties of a plant controller are given in **Annex I**.

7.3 Plant Awareness Training

An important part of ensuring that people are not in the working zones of construction plant is the training in safe working practices when in the vicinity of construction plant. Information on this is given in **Annex G**.

7.4 **Signals and Communication**

It is essential that there is effective communication between plant operators, their supervisors and other personnel involved in the operation to ensure that working zones are controlled to exclude all personnel not directly involved in the operation, thereby eliminating or reducing the risk of injury. All communication must be clear and unambiguous taking account of any language issues. The main methods of communication, which should be agreed and understood by all parties are as follows:

7.4.1 Verbal Communication

Where the people communicating with each other are in close proximity, it may be possible to use verbal communication. Care should be taken to ensure that ambient noise levels are low enough to ensure that communications can be clearly understood.

7.4.2 Hand Signals

An agreed set of hand signals for communication between crane operators and slingers and signallers has been established for many years in lifting operations (see BS 7121-1:2016). There are also sets of hand signals for other plant such as excavators and backhoes (see **Annex J**).

7.4.3 'Thumbs-up'

An approach used by the British Army and currently being adopted on UK construction sites is the 'thumbs-up' method where operators give ground workers and other people in the vicinity of the machine a 'thumbs-up' sign which indicates that they are aware of their presence.

7.4.4 Radio Communications

As an alternative to hand signals, hand held VHF/UHF radios are often used with the benefit that it allows a supervisor or other personnel to stand further away from the machine, increasing their field of vision and allowing communication without entering the plant operating area. The use of radios can however lead to a number of problems which may interfere with the clear communication, vital for safe operations and include:

- Loss of signal and thus communication, leading to loss of control of the operation;
- Interference from radios on adjacent sites, which can lead to loss of communication or directions being given to the wrong operator;
- Misunderstanding between the operator and supporting personnel, leading to problems such as parts of the machine or loads colliding with people or a structure.

Further information on dealing with these issues is given in **Annex K**.

7.4.5 Written Instructions

Where personnel are provided with written instructions such as a Method Statement, these must be clear and concise and in a language(s) understood by all readers. Steps should be taken to ensure that the information has been understood.

8.0 Plant Operating Controls and Means of Isolation

8.1 Function

A control is a device which sends a signal to an actuator which, through mechanical or electrical means, initiates, controls and stops a function on a machine. On plant, controls are divided into two groups; those which control the movement of a whole machine or a component of the machine and those which control auxiliary functions such as windscreen wipers, heaters or beacons.

Controls controlling movement generally are of the 'hold to run' type which ensures that when the control is released, the motion ceases.

8.2 Control Types and Positioning

The control station of an item of plant will have a number of switches, pedals and/or levers that require the partial or full co-ordination of an operator. In some cases, levers can be operated in two planes allowing combined control of several services. Operating pedals usually have one plane of motion but allow operation of one service – neutral to active, or two with the active position either side of a centralised neutral position.

Frequently-used controls should be ergonomically designed and positioned to allow full unhindered use over long operating periods. However, the design is based by manufacturers, in most cases, on a notional body-type and build, with limited adjustment facilities to allow comfort to all users.

In essence, the ergonomic design of an operating station will not suit all operators and fatigue may build up quickly in particular situations, depending on the nature of work being carried out.

The layout and positioning of controls can differ markedly amongst machines of a similar type and manufacturers, and can even differ between the same machine model of differing years of manufacture.

8.3 Remote Controls

Remote control stations use either direct-cable connection or radio-signals to send control signals to the machine. These control stations use switches and/or joystick levers to control the machine's functions electronically. In most cases, remote operation involves the operator wearing or carrying the control station which allows greater flexibility of movement, but introduces additional hazards.

For example, free operator movement and the ability to view the machine from different angles may result in dis-orientation between the operator and machine. The consequent selection of a wrong service or motion may result in a serious incident.

8.4 Operator Duties

The key competence for the plant operator is to select or deselect the correct control in the correct direction, in the correct order or sequence, at the correct rate (in the case of proportional controls) and at the correct moment.

Where different types of actuation are required at the same time to operate a number of services in order to carry out the work, e.g. pressing a switch whilst moving a lever and/or pedal, this can increase the risk of an incorrect operation.

The multiple use of a varied range of controls at the same time highlights the need for adequate experience and familiarity to ensure all movements are correctly undertaken and timed, and demonstrates how easily inadvertent selection can be easily undertaken.

9.0 Control Aspects of Plant Selection

9.1 General

There are various design elements of construction machinery which can either enhance or reduce the risk of unintended movement. This section is intended to provide those making machine purchase decisions with some ideas for consideration.

9.2 Wheeled Plant – Neutral Start

It is a requirement of the Machinery Directive that unintentional movement of the machine is impossible while the engine is being started. For machines intended for Europe this is often interpreted as meaning that, as a minimum, the engine will only start when the machine is in neutral. It may also be that the engine will only start with either the foot brake applied or the parking brake on.

9.3 All Plant – Positioning of Controls.

Check the layout of the controls. If it is necessary to reach past one control to operate another, check whether this brings a risk of unintended movement.

9.4 Excavators – Control Lock-out Lever

All excavators have a lever in the access route intended to ensure that the operator cannot leave the cabin without disabling the controls. There are several features of this barrier which can vary between designs.

- Does it adequately close off the exit route or is it easy to get past without disabling the controls?
- Does the lever work in such a way that there is a risk of it being accidentally knocked/pulled to the 'live' position when the operator leaves the cab?
- If the left hand control pod slides with the seat, is the gap suitably closed off when the seat is fully back?
- If the lock-out lever is the control pod itself (very common in mini-excavators), is there a risk of catching the pod in clothing on leaving the machine, such that the controls become live?
- If the lock-out lever is the control pod; is a suitable handle provided for pushing the pod down without accidentally operating the control lever at the same time? Is it intuitive to use the handle, rather than the control lever?

In addition, some machines include extra safety features which can be considered as additional risk reduction elements. Examples include:

- The safety lever acting like the 'neutral start' system in a wheeled machine, meaning that the engine will only start when the controls are disabled.
- Having an additional control, like a "dead man's switch", requiring the operator to perform an additional operation before the controls become live.

9.5 Quick Hitches – Protected Release Controls

All quick hitch control systems should be well protected from unintentional release of the attachment. There are many variations allowed in the standard and many variations on the market so there is no single 'right' solution. However, all systems must be such that it is impossible for the operator to release the attachment without clearly intending to do so. Check that the attachment cannot be released by the operation of a single switch, and that any combination of switch operations, or any sequence of operations, would be impossible to carry out by accident.

10.0 Selection and Fitting of Additional Control Measures

One of the possible actions to reduce the likelihood of RUMP or mitigate the consequences, is the fitting of additional control measures. These may include selecting appropriate clothing, and fitting secondary control isolation devices and proximity sensing systems. The fitting of additional devices should be undertaken with some caution to ensure that the additional systems do not introduce additional hazards.

When choosing such measures, the hierarchy of risk removal should be the first course of action and where this is not possible, risk mitigation should always be followed. The selection of additional measures should take account of reliability, robustness and the need for re-calibration and maintenance to ensure that they will not fail at the critical moment. The residual risks remaining after additional measures have been adopted should be evaluated and where these are unacceptably high, further steps should be taken to reduce risks to as low as is reasonably practicable.

The fitting of additional systems should, wherever possible, be undertaken in consultation with the plant manufacturer or distributor to ensure that interfacing with the machine's control system does not compromise the integrity of that system. In addition, modifications to the machine from the manufacturer's standard specification may affect the validity of the machine's EC Declaration of Conformity (see **Annex E**).

When an additional safety system has been fitted, it is essential that the machine operator, supervisors and maintenance staff are fully familiarised with the system, and that those carrying out task planning are also briefed on the function and limitations of the system.

Many additional safety systems are available (see **Annex F**).

11.0 Checks, Inspections and Maintenance

11.1 General

The effective maintenance of plant is an essential part of safe operation. All machines wear and deteriorate, and can suffer damage over time. The maintenance process - including checks and inspections - monitors, prevents and rectifies this deterioration. It is important that the personnel asked to carry out these tasks have the necessary machine-specific training, experience and competence in both periodic and breakdown maintenance.

The user of the plant and any attachments has a responsibility to ensure that they are maintained in a safe working condition. In practice, the maintenance - other than pre-use checks - is normally undertaken by the plant owner on the user's behalf.

Basic checks and inspections should be carried out in accordance with the manufacturer's recommendations and will comprise of:

- Pre-use Checks - these are carried out at the start of every shift and whenever there is a change of operator. They should include checks for damage and correct functioning of the machine including cameras and additional equipment fitted to reduce unintended movement;
- Weekly Inspections - these are additional inspections to the pre-use checks.

All checks and inspections should be recorded.

If there is a defect that affects the safe operation of the machine, it must be reported and the machine taken out of service immediately. If the defect does not affect the immediate safe operation of the machine, the defect should be reported to the supervisor so that repairs may be carried out in a timely manner.

11.2 Scheduled Lubrication

Operators may be required to carry out lubrication of certain items, such as the greasing of sliding parts, at specified intervals. They should only undertake such tasks if they are competent to do so and should be provided with the necessary equipment and instructions to carry this out safely.

11.3 Scheduled Maintenance

It is the responsibility of the site management to ensure that all plant is adequately maintained in efficient working order and in a state of good repair.

A scheduled preventative maintenance programme helps to meet these requirements. The frequency at which maintenance activities are carried out must take into account the machine usage and the working environment. A record of maintenance should be kept for each machine.

Where an item of plant is hired out on the basis that the owner is responsible for carrying out maintenance, the owner should inform the hirer - at the start of the hire - that their maintenance staff will require access to the machine at specified intervals. The hirer should be advised of the frequency and length of time required for maintenance operations.

Maintenance personnel should never stand under a suspended load or raised equipment as the load or equipment could fall or tip. If work has to be carried out under, for example, a raised boom, suitable scotches or supports must be put in place before access is gained.

Care should be taken when working on the hydraulic system to ensure that the system, lines, components etc. are depressurised before work starts. Even with the machine's engine switched off, the hydraulic system may still be pressurised. An example of this is if a machine is on a slope, the slew and travel circuits will be pressurised by the mass of

the boom and chassis. Consequently, the replacement or repair of hydraulic hoses or fittings should be approached with extreme caution.

Replacement components should comply with the machine manufacturer's specifications.

11.4 *Maintenance Records*

Comprehensive maintenance records are essential to the safe, efficient and economical operation of construction plant. Maintenance records can be kept in either paper or electronic format.

12.0 Thorough Examination

12.1 General

Plant used for lifting falls under the thorough examination requirements of the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER), whilst plant not used for lifting fall under the inspection requirements of the Provision and Use of Work Equipment Regulations 1998 (PUWER).

The periodic examination and/or inspection of plant forms a vital addition to planned preventive maintenance. It provides evidence of the adequacy of a maintenance regime and highlights any deficiencies, leading to improved reliability and safety of the machine. The requirements for examination and/or inspection varies with the type of machine. Consequently, the type of examination/inspection and the frequency at which it occurs is a decision for the competent person carrying out the examination/inspection.

The nature and extent of both LOLER thorough examinations and PUWER inspections are risk based. Since the risks associated with failures are similar for lifting and non-lifting duties, good practice requires that machines which are not used for lifting are inspected according to Regulation 6 of PUWER at the same intervals as the thorough examination of machines used for lifting required by Regulation 9 of LOLER i.e. at intervals of not more than 12 months.

NOTE: Regulation 9 of LOLER requires that machines which lift people are thoroughly examined at intervals not exceeding 6 months.

All machines subject to thorough examination must be permanently marked with a unique identification number. If a machine does not have such a number, the owner/user must ensure that one is applied.

Reports of thorough examination should contain the details required by Schedule 1 of LOLER.

Thorough examinations should be carried out by competent persons who have the genuine authority and independence to ensure that examinations are properly carried out and that the necessary recommendations arising from them are made without fear or favour.

12.2 Thorough Examination/Inspection following Major Alteration, Damage or Incident

If plant has been subjected to major alteration, repair, damage or has been involved in an incident, it should be thoroughly examined/inspected before it is put back into service.

12.3 Thorough Examination of Lifting Accessories

LOLER requires that lifting accessories are thoroughly examined at intervals not exceeding six months.

12.4 Further guidance

Further detailed guidance on the thorough examination/inspection of plant is given in:

- BS 7121-1:2012, *Code of practice for the safe use of cranes Part 2-1: Inspection, maintenance and thorough examination – General*
- *Guidance on Lifting Operations in Construction When Using Excavators.* Construction Plant-hire Association (free download from www.cpa.uk.net).
- L113 *Safe use of lifting equipment - Lifting Operations and Lifting Equipment Regulations 1998, Approved Code of Practice and guidance.*
- L22 *Safe use of work equipment - Provision and Use of Work Equipment Regulations 1998, Approved Code of Practice and guidance.*

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Annex A - Legal Framework

A.1 Introduction

The law places duties on persons concerned with the setting up and use of construction plant on construction sites. This Section outlines those legal duties and points the reader towards further relevant guidance material.

NOTE: Northern Ireland has its own set of regulations which tend to mirror those in Great Britain, but may have minor differences. Employers should ensure that they are aware of the regulations in the jurisdiction in which they are working.

A.2 The Law Outlined

Legislation relating to the use of construction plant at work includes:

- The Health & Safety at Work etc. Act 1974;
- The Construction (Design and Management) Regulations 2015/SI50;
- The Management of Health & Safety at Work Regulations 1999/SI3242;
- The Provision & Use of Work Equipment Regulations 1998/SI2306;
- The Lifting Operations & Lifting Equipment Regulations 1998/SI2307;
- The Supply of Machinery (Safety) Regulations 2008/SI1597;
- The Corporate Manslaughter and Corporate Homicide Act 2007.

A.3 Health & Safety at Work etc. Act 1974 (HSWA)

HSWA places a duty on employers to ensure the health and safety of employees and others who may be affected by their work activities. Similar duties are placed on the self-employed and persons in control of premises. Employees, managers and directors also have responsibilities. The HSWA also places a duty on construction plant owners and users, where their work activity involves plant being used where it could affect the general public.

A.4 The Construction (Design and Management) Regulations 2015 (CDM 2015)

CDM 2015 is divided into five parts:

- Part 1 deals with the application of CDM 2015 and definitions;
- Part 2 covers the duties of clients for all construction projects. These duties apply in full for commercial clients. However, the duties for domestic clients normally pass to other duty holders;
- Part 3 covers the health and safety duties and roles of other duty holders, including:
 - Designers;
 - Principal designers;
 - Principal contractors;
 - Contractors.
- Part 4 contains general requirements for all construction sites;
- Part 5 contains transitional arrangements and revocations.

HSE has published Legal Series guidance L153 which supports CDM 2015 and provides further explanation.

A.5 Management of Health & Safety at Work Regulations 1999 (MHSWR)

Under MHSWR, employers and self-employed people are required to assess risks to health and safety from their undertaking. This includes risks from the setting up and use of construction plant on their premises. The risk assessment should identify what measures are needed to comply with health and safety requirements to control risk. The duty holder should then put in place the organisation and arrangements to ensure that those measures are properly implemented. MHSWR

also requires employers on multi-occupancy sites to co-operate with each other to ensure that all statutory provisions are complied with.

A.6 The Provision & Use of Work Equipment Regulations 1998 (PUWER)

PUWER is concerned with such matters as selection of suitable work equipment, safeguarding of dangerous parts of machinery, provision of appropriate controls and emergency stops, and maintenance of work equipment including construction plant.

PUWER places duties on any person who has control to any extent of:

- work equipment;
- a person at work who uses, supervises or manages the use of work equipment; or
- the way in which work equipment is used at work (including maintenance).

PUWER applies to employers in respect of work equipment provided for, or used by, their employees, self-employed persons in respect of work equipment they use and other persons, e.g. visitors.

A.7 The Lifting Operations & Lifting Equipment Regulations 1998 (LOLER)

LOLER deals with the specific risks arising from the use of work equipment (including lifting accessories) to lift loads. It builds upon PUWER and applies to the same groups of people. LOLER also introduces particular requirements for lifting equipment which is used to lift people, and a requirement for the thorough examination and reporting of thorough examination of lifting equipment.

A.8 Supply of Machinery (Safety) Regulations 2008 (SMSR)

The Supply of Machinery (Safety) Regulations are the UK's implementation of European Union Directive 2006/42/EC - the '*Machinery Directive*' - which requires that all machinery (including lifting accessories) supplied into the European Union meets the Essential Health and Safety Requirements detailed in Schedule 2 Part 1 of the Regulations. This include the provision of information for use, including loads imposed on the ground. Each machine must be accompanied at time of supply by an '*EC Declaration of Conformity*' declaring that the machinery fulfils all the relevant provisions of the Regulations.

A.9 Corporate Manslaughter and Gross Negligence Manslaughter

The Corporate Manslaughter and Corporate Homicide Act 2007 enables companies and organisations to be prosecuted for serious management failures resulting in a gross breach of a duty of care. Individuals can be prosecuted under Common Law for gross negligence manslaughter where their gross negligence of a duty of care to a person has resulted in that person's death.

A.10 British, European and ISO Standards

Standards do not generally have the force of law; the application of a standard is almost always voluntary, although standards are very often used in support of legislation. Compliance with a standard is sometimes quoted in legislation as offering a route to discharging legal obligations. Typical examples are references to the BS 7121 series in the Guidance to LOLER.

British Standards are generally restricted to Codes of Practice for safe use of equipment e.g. BS 7121-3:2000 *Safe use of mobile cranes*, whilst European (EN) standards cover requirements for:

- basic principles (Type A);
- common product requirements (Type B);
- specific product requirements (Type C) e.g. EN 474-5:2006+A2:2012, *Earth-moving machinery – Safety – Part 5: Requirements for hydraulic excavators*.

International Standards (ISO) cover both the safe use and specification of mobile cranes and components. They do not have any legal status by themselves but are often taken as good practice and when cited as normative references in some EN product standards, they have the same force as EN standards.

Annex B - Guidance for the Plant Operator

- You have personal and legal responsibility to use all plant safely. Serious misuse of plant may well be treated as gross misconduct which could well lead to dismissal or individual prosecution;
- If it is not safe to start work - **Inform your supervisor**;
- If it is not safe to carry on working - **Stop and inform your supervisor**;
- Always follow the plant or attachment manufacturer's instructions.

Before Starting

- Ensure that you are trained and authorised to operate the machine and have been familiarised with the specific make and model of machine you are to operate, including driving on the public highway (if applicable);
- Ensure you have been briefed by your supervisor on the task, hazards, control measures (including designated exclusion zones) and site conditions that may affect the safe operation of the plant. You should be authorised to carry out the task and given a copy of the risk assessment and method statement;
- Verify with your supervisor that the plant, attachments and accessories have been inspected and suitably maintained and where required have a current report of thorough examination;
- Always carry out pre-use checks, including safety devices, attachments and accessories, before starting work;
- Ensure that safety devices are working correctly and also not bypassed or tampered with;
- Ensure that the operator control station or cab is free from loose items which could activate or jam controls;
- Record all defects and report them to your supervisor;
- Ensure that you are comfortable with carrying out the task;
- If you have someone assisting you, inform them that they must stay clear of the moving path of your machine, maintain regular eye contact with you and work to the agreed communication method;
- If it is not safe to start work – **Stop and inform your supervisor**.

During Use

- Ensure that you understand the plant's limitations and that you keep within them;
- Know your site – be aware of slopes, ground conditions, visibility, pedestrians and other potential hazards that may affect the safe operation of the plant;
- When entering or leaving the operator control station under any circumstances, ensure that any isolating controls are in the correct position and that only designated hand holds are used for support, not control levers or steering wheels;
- Ensure that loose clothing does not catch on controls, especially when entering or leaving the operator control station;
- Do not operate any operator station controls from outside the operator control station;
- Where remote controls are used, they must be isolated at all times when the controls are not in use i.e. when carrying out any task other than operating the plant;
- Where the control station is provided with a seat, this must be used at all times during operation of the plant. The seat belt should be worn at all times to reduce the risk of injury should the plant overturn. **It could save your life!**
- Ensure controls are isolated before retrieving objects within the cab, repositioning yourself in the seat or talking to anyone outside the operator's station;
- Ensure you are familiar with using and changing any attachments you use;
- Maintain regular vision with any assistant and stop your machine immediately if you lose sight of them or they enter the danger zone;
- Take account of changes in weather conditions which may affect your ability to operate safely - such as bright sunlight, fog, rain and mud;
- Before leaving the machine at any time – even for short periods, ensure that equipment is lowered to the ground, the power source (engine) is switched off and the keys removed;
- If it is not safe to carry on working - **Stop and inform your supervisor**.

After Use

- When leaving the plant control station, where relevant - park on firm, dry and level ground in a safe place, lower any equipment to the ground, apply the parking brake and leave the transmission in neutral;
- Switch off the power source (engine) or other supply, apply any additional measures to prevent movement (except where a free-movement type situation is required, and take the ignition or isolating keys out);
- Exit the plant control station safely using correct procedures.

Annex C - Guidance for People in the Vicinity of Plant

Working or being near to operational plant is hazardous, meaning that you are at risk of serious injury or even death. It is up to you to ensure that you are clear of the machine when it is working so that you will not be struck by any part of the machine (see 7.1). Working near to or involved with machine operation need to comply with or be aware at least of the following:

Before Starting

- If you are to work near to the machine, you need to be familiarised with how the machine functions, which parts of the machine move and how, and whether the machine stays in one position, or travels within a given area;
- Persons appointed to work directly with the machine must be formally trained for the activities being undertaken (see Annex I);
- Danger areas around the machine should have physical barriers so that it creates a firm exclusion zone. You cannot enter those zones unless authorised by the operator or their controller;
- Before the machine commences work, you need to inform the operator, or the machine's controller, where you are working and what work you are doing;
- High visibility clothing that is suitably visible and conspicuous e.g. is clean and bright must be worn;
- You should be informed by the operator, supervisor or machine's controller on which tasks and activities the machine is undertaking, and where the hazardous parts of the machine are;
- If a machine controller has been allocated to a particular machine, they are the first point of contact for queries or requests relating to the operations;
- A communication method for instructions – whether talking directly to the operator, via a radio, or via hand signals - should be decided between you and others involved in the activity before work starts;
- Where you need to carry out a temporary construction activity within an area of moving plant, no lone working should be allowed. A person to act as a look out should assist you during the activity;
- Inadvertent operation of controls, such as the operator turning in their seat and pressing on a control lever, has caused fatalities. If you are working close to the machine, you need to identify or be advised on potential trapping points for the machine's configuration and the safe distances that need to be maintained in cases of inadvertent operation.

During Use

- Where no controller is at hand and you need to enter the machine's exclusion zone, you should make eye contact with the operator from a safe distance. Only once the operator has communicated (usually by a 'thumbs-up') can you approach the machine;
- The operator should maintain regular vision of all persons in the vicinity and must stop the machine immediately if they lose sight of you, any other assistants or if unauthorised persons enters any danger zones – stay in eye contact with the operator if you are in the danger zones;
- Do not assume the operator can always see you, even if they have full view of you. If a situation looks unsafe, clear the area immediately;
- In the case of travelling plant, you need to be clear of the machine's path of travel;
- In cases of plant such as forward tipping dumpers and forklifts. the load or material being carried can partially obscure the operator's all round vision;
- Be aware that the view from the operator's seat around the machine can be limited, despite the use of mirrors, cameras, proximity sensors etc. Dust, mud, excessive rain, fog, a low-rising or setting sun, unclean glass etc. can severely hamper the operator's all-round vision;
- Although more plant is fitted with warning aids such as reversing cameras, 360-degree vision cameras etc. these plus the other amount of equipment and controls within the cab that the operator needs to observe means they may fail to register that someone has entered the hazardous area;
- Never walk behind a reversing machine as the operator's vision can be either partially restricted, or that they haven't fully checked that the reversing area is clear. Being struck by a reversing machine is a common incident on site;
- During your working activities with a machine, others working nearby may be tempted to assist designated personnel with a view that they are helping out. This action can place both parties in danger and non-authorised workers but be informed to keep well clear of any activity. Accident data indicates that unauthorised individuals helping who are untrained have suffered injuries.

Annex G provides a sample training syllabus for those working around or near to construction plant. **Annex I** outlines the duties, responsibilities and attributes for those who provide a direct supporting role to a machine such as plant controller and plant marshalls.

Annex D - Guidance for Site Managers

- You have personal and legal responsibility to ensure that all plant is used safely. Serious misuse of plant may well be treated as gross misconduct which could well lead to dismissal or individual prosecution;
- Ensure that the operator knows that if it is not safe to start work - **They must inform you;**
- Ensure that the operator knows that if it is not safe to carry on working - **They must stop and inform you;**
- Ensure that the plant or attachment manufacturer's instructions are always followed.

Before Starting

The manager or supervisor should confirm that the operator:

- Is trained and authorised to operate the machine and has been familiarised with the specific make and model of machine they are to operate, including driving on the public highway (if applicable);
- Has been briefed by their supervisor on the task, hazards, control measures (including designated exclusion zones) and site conditions that may affect the safe operation of the plant. They should be authorised to carry out the task and given a copy of the risk assessment and method statement;
- Has carried out all manufacturer's pre-use checks, including safety devices, attachments and accessories, before starting work;
- Has ensured that safety devices are working correctly and have not been bypassed or tampered with;
- Has ensured that the operator control station or cab is free from loose items which could activate or jam controls;
- Has recorded all defects and reported them to their supervisor;
- Is comfortable with carrying out the tasks;
- Is aware that if they have someone assisting them, they should inform the assistant that they must stay clear of the moving path of the machine, maintain regular eye contact with the operator and work to the agreed communication method;
- Knows that if it is not safe to start work they should **stop and inform their supervisor.**

The manager or supervisor should confirm that the plant, attachments and accessories have been inspected and suitably maintained and where required have a current report of thorough examination;

During Use

The manager or supervisor should confirm that that the operator:

- Understands the machine's limitations and keeps within them;
- Knows the site and is aware of slopes, ground conditions, visibility, pedestrians and other potential hazards that may affect the safe operation of the machine;
- When entering or leaving the operator control station under any circumstances, has ensured that any isolating controls are in the correct position and that only designated hand holds are used for support, not control levers or steering wheels;
- Ensures that loose clothing will not catch on any control, especially when entering or leaving the operator control station;
- Does not operate any controls from outside the operator control station;
- Where remote controls are used, isolates them at all times when not in use i.e. when carrying out any task other than operating the plant;
- Where the control station is provided with a seat, uses it at all times during operation of the plant. The seat belt must be worn at all times to reduce the risk of injury should the plant overturn. It could save the operator's life!
- Isolates the controls before they retrieve objects from within the cab, reposition themselves in the seat or talks to anyone outside the operator's station;
- Is familiar with using and changing any attachments they use;
- Maintains regular vision with any assistant and will stop their machine immediately if they lose sight of the assistant or they enter the danger zone;
- Takes into account changes in weather conditions which may affect their ability to operate safely - such as bright sunlight, fog, rain and mud;
- Before leaving the machine at any time, ensures that equipment is lowered to the ground, the power source (engine) is switched off and the keys removed;
- Knows that if it is not safe to carry on working, they must stop and inform their supervisor.

After Use

The manager or supervisor should confirm that that the operator:

- When leaving the plant control station, has (where relevant) parked on firm level ground in a safe place, lowered any equipment to the ground, applied the parking brake and left the transmission in neutral;
- Has switched off the power source (engine) or other supply, applied any additional measures to prevent movement (except where a free-movement situation applies), and isolated the machine by removed the ignition or isolating keys.

Annex E - Machine Modifications and CE Marking

The EU Machinery Directive 2006/42/EC, which came into force on 29th December 2009, contains requirements for all machines put into service in the European Union. It covers:

- Machinery;
- Interchangeable Equipment;
- Lifting Accessories;
- Safety Components;
- Partly Completed Machinery.

The Machinery Directive is enacted in the UK as the Supply of Machinery (Safety) Regulations.

E.1 Machinery

Machinery is defined by the Directive as an assembly which:

- Is fitted with, or intended to be fitted with, a drive system other than directly applied human or animal effort;
- Consists of linked parts or components, at least one of which moves, and which are joined together for a specific application.

Examples include all construction plant, power tools, process machinery and vehicle servicing lifts.

E.2 Interchangeable Equipment

Interchangeable equipment is defined as a device:

- Which is assembled with a machine by the machine's operator, after the machine is put into service; and
- Changes the function of the machine or attributes a new function to the machine.

NOTE: *Interchangeable equipment is not classified as a tool.*

The European Commission's 'Guide to application of the Machinery Directive 2006/42/EC' says of interchangeable equipment:

- If it's not intended to be changed by the user it is not interchangeable equipment, it is part of the machine;
- Even if it is supplied with the machine, it must be treated as a separate product;
- Blades, bits, and 'simple earth-moving buckets' are not interchangeable equipment.

Examples include: Hydraulic breakers, integrated work platforms, demolition shears, stump grinders and lifting points.

E.3 Lifting Accessories

Lifting accessories are defined as components which:

- Are not attached to the lifting machine;
- Are placed between the machine and the load, or on the load itself, in order to support the load during the lifting operation;
- Include lifting slings and their components.

Examples include: chain slings, fabric slings, shackles, spreader beams, threaded eyebolts, lifting forks and plate clamps.

NOTE: Products that are independently placed on the market to be incorporated into loads for the purpose of supporting the load during the lifting operation are also considered as lifting accessories. Equipment placed between the holding device of lifting machinery and the load is considered as a lifting accessory, even if it is supplied with the lifting machinery or with the load.

E.4 Safety Component

A safety component is defined as a component:

- Which serves to fulfil a safety function;
- Which is independently placed on the market;
- The failure and/or malfunction of which endangers the safety of persons;
- Which is not necessary in order for the machinery to function, or for which normal components may be substituted in order for the machinery to function.

NOTE: A safety component does not need to meet the definition of a 'machine'.

Examples include:

- Protective devices designed to detect the presence of persons;
- Valves with additional means for failure detection intended for the control of dangerous movements on machinery (e.g. hose burst valves);
- Monitoring devices for loading and movement control in lifting machinery (e.g. safe load indicators);
- Restraint systems to keep persons on their seats;
- Systems and devices to reduce the emission of noise and vibrations.

NOTE: If a safety component meets the definition, it is in scope.

E.5 Partly Completed Machinery

The definition of partly completed machinery is an assembly which:

- Does not meet the definition of machinery and cannot perform a specific application;
- Is intended to be assembled with other parts or machines in order to make a machine;
- Is not CE marked;
- Must comply with special provisions.



This example of a jaw crusher without guards:

- Cannot be CE marked (not safe as it stands);
- Can be sold for incorporation into a mobile crusher.

Other examples of partly completed machinery are MEWPs for mounting on vehicles, actuators and guillotines for incorporation into a print line.

E.6 Who is the Manufacturer?

The manufacturer is the person/company who/which:

- Designs and/or manufactures machinery in scope;
- Is responsible for conformity;
- Places the product on the market under his own name or trademark.

If nobody else can be identified, it is the person who places the product on the market.

E.7 Information Required

When a product in the scope of the machinery directive - including safety components - is first supplied, it must be accompanied by the following:

- Markings specified by the Directive as follows:
 - A CE mark (except for partly complete machinery);
 - The business name and full postal address of the manufacturer (a website address is not acceptable);
 - The machine designation - type of machine/safety component – not just a commercial name;
 - The machine's serial number;
 - The year of construction - pre or postdating is not permitted;
 - The machine's mass;
 - The nominal power in kW (for mobile machinery);
 - The maximum working load (for lifting accessories and lifting machinery);
 - Safety warnings – Pictorial sign are preferred. Requirements are given in Product Standards such as EN 474-1 and ISO 6405.

NOTE: All marking must be visible, legible and indelible.

- Instructions in the language of the country in which it will be used;
- A EC Declaration of Conformity.

E.8 Modifying Machinery

E.8.1 Safety Components

A **Safety Component** can be added on to an existing machine as follows:

- Anything which meets the **definition** of a safety component is one and must be treated accordingly;
- The supplier CE marks the safety component;
- The supplier must have completed all the conformity assessment for the product, including risk assessment;
- This assessment must include risk assessment for the safety component fitted to the exact model of machine to which it is to be added;
- The supplier must provide instructions to enable the safety component to be installed and used safely.

NOTE: There is no need for a new CE mark for the whole machine, provided that the above steps have been complied with.

E.8.2 Need for Reassessment after Modification

If modifications to an existing machine are significant, the machine becomes a “new” machine and the person modifying the machine becomes the manufacturer.

The European Commission's 'Guide to application of the Machinery Directive 2006/42/EC' states;

“If the addition of new units in an existing machine has a substantial impact on the operation or the safety of the assembly, or involves substantial modifications of the assembly, it may be considered that the modification amounts to the constitution of a new machine. In that case, the whole assembly must comply with the Machinery Directive.”

Examples of what constitutes a substantial modification are:

- Where the modifications affect the original risk assessment done by the machine manufacturer;
- If the modification affects the control system;
- The installation of partly completed machinery;
- If the modification has a significant impact on the performance or safety of the machine.

If the modification is significant, the 'new' machine will have to undergo the conformity assessment process set out in Annex VIII of the Directive. Following this, a new CE mark and Declaration of Conformity for the machine will be required.

The new designation could take the form: "*Machine X as modified by Company Y*"

E.9 Machinery Manufactured for the Manufacturer's Own Use

Where machinery is manufactured for in-house use, the person carrying out the manufacture is considered to be the manufacturer and must fulfil all the obligations set out in Article 5 of the Machinery Directive. The machinery must comply with the Machinery Directive before it is put into service, even though it is not placed on the market by being made available to a third party.

E.10 'Grey market' Machinery

The term 'grey market' refers to plant which is placed on the UK market through routes other than the manufacturer's distribution network. This can be via auctions, import companies or by individuals buying abroad and importing machines for their own use. Often these machines were never intended for the European market by the manufacturer and were therefore not built in compliance with European legislation on machinery safety, engine emissions and machinery noise levels. Machines which were designed for markets with lower levels of regulation might not comply on some key points.

E.10.1 Safety

- Machines may not have been subject to the same risk assessment that is required for machines sold in Europe, meaning that some hazards may not have been addressed.
- The lever operating pattern on plant such as excavators may differ from machines intended for Europe, leading to a high risk of unintended movement.
- Warning decals may not be in English. Warnings in Japanese script have been seen on many machines.
- Operator's Manuals may not be available, or those that are may not have been translated into English.
- Access systems and guard rails might not comply with EU levels of safety. Machines have been seen with much lower handrails than would be installed on machines designed for Europe.
- Lifting safety may be compromised. Machines for built for countries outside of Europe are not always equipped with hose burst protection valves, overload warning systems and lift capacity charts.
- ROPS strength. Not all World markets have the same level of operator protection in the event of a roll-over. Machines may have no protection at all or have a lower level than is required in Europe.
- FOPS. Some countries do not require falling object protection.

E.10.2 Engine emissions

- Many World markets, which do not benefit from clean diesel and clean air legislation, either have no regulation on diesel emissions or have regulations which are less rigorous than those in Europe. Engines are unlikely to comply with the current emission requirements in the United Kingdom.

E.10.3 Machine noise emissions

- Machines designed for other World markets may not meet the EU requirements on noise emissions.

From the above it can be seen that there are risks to the owners of such machines, and to anyone allowing them to be used on sites.

Machines which were intended by their manufacturer for the European market will be CE marked and be accompanied by a genuine EC Declaration of Conformity. This document is the manufacturer's statement that the machine conforms to all relevant supply legislation.

Fake CE markings have been found affixed to grey market machines. Such machines may also have Declarations of Conformity issued by third party companies, rather than the manufacturer. These are almost certainly not valid, as such companies do not have access to the manufacturer's risk assessment and other data.

Annex F - Examples of Additional Measures

F.1 Introduction

Care should be taken in the selection of additional measures as not all will prevent unintended movement, some may only reduce the probability of occurrence.

F.2 Clothing

A significant number of incidents have occurred where the operator's clothing has caught on controls, resulting in inadvertent movement of the machine. Bulky clothing can also increase the size of an operator, restricting movement in small cabs and increasing the likelihood of inadvertent operation of controls.

Operators should be provided with short 'bomber-style' jackets with elasticated cuffs to reduce the risk of coat skirts and cuffs becoming entangled with controls.



Figure F.1 - Elasticated Cuff



Figure F.2 - Short Jacket

F.3 White Noise/Audible Movement Alarm

As soon as the item of plant starts moving, an audible alarm sounds which alerts all persons in the area that the machine is moving and that they are potentially in the danger zone.

F.4 Reversing Camera

Provides the operator with an image of the area behind the machine to avoid collisions with people and other machines when reversing.

F.5 Quick Hitch Attachment/Detachment Alarm

An alarm mounted on the exterior of the machine which sounds when the operator is either attaching or detaching a bucket or attachment to the quick hitch. Most machines have an audible alarm in the cab of the machine which will be inaudible to persons outside the cab, who will consequently be unaware that the changeover of a bucket/attachment is taking place. This system alerts anyone in the potential danger zone of what is happening and that they should not enter the zone around the machine (see **Figure F.3**).

F.6 Quick Hitch Coupler Alert Safety System

Rather than having a simple switch in the cab for switching on and off the mechanism for releasing the bucket from the quick hitch, a console in the cab guides the operator step-by-step through every stage of a bucket detachment or attachment in line with the manufacturer's specific procedure. This prevents the operator taking short cuts when carrying out this task and also prompts the operator to carry out the required safety checks

(visual check and 'bump test' etc.). The system can log the last 100 movements of the machine to help with incident investigation (see **Figure F.4**).

Further guidance on the use of quick hitches is given in *Safe Use of Quick Hitches on Excavators - Best Practice Guide*. Strategic Forum for Construction - Plant Safety Group (free download from www.cpa.uk.net).



Figure F.3 - Quick Hitch Attachment/Detachment Alarm



Figure F.4 - Quick Hitch Coupler Alert Safety System

F.7 Secondary Isolation Devices

Secondary isolation devices are additional to the control isolating (dead man) lever and help to prevent operators from making inadvertent movements of their machine whilst getting in or out of the cab, even with the isolating lever placed in the engaged position. Examples of such devices are:

F.7.1 Seat belt monitoring

The machine's systems do not become operational until the seatbelt is fastened, even with the control isolating lever engaged. A green beacon mounted on the outside of the cab flashes when the isolating lever is engaged and the seat belt fastened, indicating to pedestrians and ground workers that the machine is operational.

F.7.2 Enabling control

Another device on the market operates over three safety levels:

- a. Firstly, the operator is required to fasten his lap-belt - preferably a high visibility seatbelt which can be easily seen by supervisors/ site managers;
- b. Secondly, the safety lever is required to be in the active position, preventing the operator from leaving their cab;
- c. Thirdly, an additional button is fitted in the cab and once the first two requirements have been successfully completed, it will illuminate allowing the operator to press the button and activate the machine's hydraulic system. This allows the machine to become operational.

F.7.3 Operator presence sensing

A new system - currently under development - senses that the operator is sitting in the seat and isolates the machine controls if they attempt to stand up.

F.8 Proximity Sensing Systems

These systems sense the presence of people in the vicinity of the machine and alert the machine operator if a pre-set zone is breached. This system relies on people near the machine wearing transponder units and means that the system will not sense the presence of casual bystanders who are not wearing transponder units.

F.9 Handheld Remote Cut-off

This allows a banksman or slinger/signaller with a hand-held wireless control to stop the machine remotely, and is particularly useful when working in a confined area excavating around buried services. Once the control has been activated and the machine stopped, it cannot be restarted until the handheld control is reset. As control of the machine is taken away from the operator, these devices are only suitable for certain applications.



Figure F.5 - Handheld Remote Cut-off

Annex G - Factors for a Training Syllabus (for those working around or near construction plant)

There are a number of courses intended for those who need to work within close proximity to construction plant - including all earthmoving and lifting equipment commonly found on construction sites. Courses should incorporate excavation awareness and traffic/vehicle movements within site activities.

G.1 Course aims

The aim of any course should be to provide the delegate with theoretical knowledge and understanding of common construction plant and vehicles, their individual specific hazards and ensure compliance with current legislation and good practice.

Delegates should be taught the skills, knowledge and legislative requirements of working near to plant to ensure the safe collaboration between a plant marshaller or controller of a variety of common-place construction site plant and site based situations and tasks.

G.2 Learning Outcomes

Suitable courses should ensure that the following outcomes are learnt through relevant training and impartial assessment:

- Identify acceptable and suitable PPE relevant to the job role and for working around plant;
- Describe the proximity hazards of working near to plant, including machinery work areas, safe banksman work operating zones, operator blind spots and operator safety devices;
- Identify manufacturer's requirements of specific aspects of hazardous areas, using the operator's handbook/manual;
- State relevant regulations and legislation in respect to quick hitch couplers and other attachment devices;
- Describe the essential relevance of a standard permit-to-dig/break-ground form and the necessity for its use;
- Recognise various types of commonplace spoils and the angle of repose tolerances;
- Name types of underground services found on commonplace construction sites and wider industries, including materials used in services construction and warning marker tapes used;
- Describe the function and positioning of plant cab safety mechanisms that render the operating levers inactive;
- Recognise hazards associated within machine travel and working on slopes/gradients together with best practice for siting a machine for excavating and other working operations;
- Identify on-site vehicle hazards and guided movements via recognised signs and signals, including personnel/pedestrian crossing points, segregation requirements of pedestrians from vehicle movements, and potential confined spaces/entrapment hazards when directing/guiding;
- Describe potential hazards during loading/unloading operations of plant on to and off road going transporters;
- State the noise levels commonly faced by supporting ground worker operatives in close conjunction with machinery general site operations;
- Describe best practice requirements during lifting operations with common-used plant including excavators and telehandlers, together with the specific lifting points that must be utilised;
- Describe specific attachments for commonly used plant and their individual traits. (Grabs, breakers, piling equipment etc.);

- Explain the dangers of working around open excavations and the potential hazards this poses, including working at height, guarding, and safe access and egress issues;
- State how to protect the environment from fuel and/or oil spillages, and describe advancements that have been made within bio fuels;
- Explain requirements for substantial individual site inductions, and the necessity for emergency plans and procedures to be both fully in place and fully explained to all site personnel;
- State the powers and general role of an HSE inspector and the levels of sanctions that can be administered;
- Name the various types of asbestos found commonly within construction sites.

G.3 Assessment of learning

Course delegates should be assessed using a variety of theoretical and practical methods that confidently confirms their individual ability to meet the learning outcomes.

The above learning outcomes were kindly supplied by the National Construction College who run a 2-day Safe Practices around Construction Plant Equipment course through a number of their centres and can be contacted on **0344 994 4433**.

Annex H – Examples of Health and Safety Prosecutions

H.1 General

Employers and individuals can be prosecuted for infringements of HSWA, regulations made under the act and SMSR, which can result in punitive fines and custodial sentences. The following are several examples.

H.2 Road Roller

The operator of a ride-on roller was killed when his seat became detached from the machine. The operator fell with the seat beneath the rollers and was run over by his moving machine. The subsequent investigation found that the seat cut-out switch had been defeated and the emergency stop button was missing. The operator was also untrained.

The construction company was fined a total of £10,000, with costs of £30,750, after pleading guilty to an offence under Section 3 of the Health and Safety at Work etc. Act 1974. The Director of the company was sentenced to two months in prison suspended for two years. He was also ordered to do 200 hours of community service for a breach of Section 37 of the Health and Safety at Work etc. Act 1974.

H.3 Road Sweeper

A fitter working on a road sweeper was killed when the raised body fell on him during maintenance work. The prop provided to support the body during maintenance could not be used due to the poor condition of the vehicle.

The company pleaded guilty to Corporate Manslaughter and was fined £8,000 with costs of £4,000. The low fines were due to the company having ceased trading, however the Judge said that in normal circumstances the fine would have been between £500,000 and £1 million.

A Director of the company pleaded guilty to a charge under Section 2 of the Health and Safety at Work etc. Act 1974 and was fined £183,000 with £8,000 costs and disqualified from holding the position as a company director for five years.

H.4 Excavator Quick Hitch Fatality

A site engineer was killed when he was struck on the head by the bucket of an excavator which had become detached from the excavator's quick hitch coupler. The subsequent investigation established that the quick hitch's safety pin had not been inserted by the excavator operator.

The operator pleaded guilty to charges of perverting the course of justice, perjury and failing to ensure the safety of a non-employee and was sentenced to a seven-month prison sentence, suspended for two years, and told to carry out 200 hours of unpaid community work.

H.5 Forklift Truck Fatality

A forklift operator was reversing the truck when it struck some steps causing it to overturn. The operator was not wearing a seatbelt and suffered crush injuries which proved fatal.

An investigation by the Health and Safety Executive into the incident found that the employer failed to manage forklift truck driving operations. They did not enforce the wearing of seatbelts or control the speed at which some FLT operators drove their trucks.

In April 2016, following the introduction of the new sentencing guideline, the employers pleaded guilty to a breach of Regulation 5(1) of the Management of Health and Safety at Work Regulations 1999, and was fined £135,000 and ordered to pay costs of £46,020.

Annex I - The Role of Supporting Staff (Direct Support)

Plant operations may involve the use of additional staff to directly support the operator in carrying out their duties such as manoeuvring, work preparation, operational and the completion of work.

I.1 Manoeuvring Activities

The manoeuvring of plant can be a high-risk activity and requires the use of an additional person or persons to ensure that persons, structures and the work area are not directly impacted by plant movement. Manoeuvring activities involve the traveling of a machine from, to and between work zones, during which the area in which this is carried out should be kept clear of unauthorised personnel and other equipment. The person undertaking this role is normally referred to as a Plant Marshaller and falls within the remit of the works management traffic plan.

I.2 Working Activities

During work, an additional person or persons may be utilised to directly assist with the operation and carrying out additional duties such as:

- providing working signals to the operator;
- attaching non-lifting accessories and ancillary equipment;
- observing the activity and relaying information to the operator where they have limited sight of the work;
- operating specific attachments where separate controls exist;
- maintaining the exclusion zone for preventing ingress by unauthorised personnel;
- Control the movement of a machine or machine within a zone of work where re-positioning, re-configuring, loading or unloading may need to take place.

This person undertaking this role is normally referred to as the Plant Controller and falls within the remit of the safe system of work.

I.3 Key Requirements

Plant controllers and marshalls need to be trained, competent and authorised to both keeping the manoeuvring/working area free of pedestrians/other workers and guiding drivers/operators during manoeuvring.

Both a plant controller and marshaller respectively must:

- be familiarised with and conform with the works management traffic plan and other relevant site plans;
- be familiar with the characteristics of the machine or vehicle type they are marshalling;
- use a clear, agreed system of signalling (standard signals with all drivers/operators) or other forms of communication;
- be visible to drivers/operators at all times;
- be in a safe position, from which to guide the manoeuvring machine and be clear of any movement of or part of the machine;
- wear suitable hi-visibility clothing or use other methods to ensure that they are conspicuous;
- ensure that any signals are clearly seen by the driver/operator.

Portable radios or other similar communication systems may be appropriate and helpful in some instances in maintaining contact between the operator and supporting staff.

Those undertaking duties as a plant controller may carry out the following additional activities:

- provide a wide range of working instructions through verbal or visual means;
- assist in or control the connection/removal of components, attachments and equipment for work activities;
- operate/activate specific attachments where controls are located on the attachment itself.

In addition, the plant controller needs to:

- conform with the requirements of the safe system of work;
- be conversant with the type of machine, operation and activity;
- be conversant with the types and amount of movement of the components and attachments of the machine;
- be in a safe position from which to guide or control the plant activity;
- ensure that unauthorised persons are kept out of the exclusion zone while plant is operating/moving;
- be trained to use specific attachments and ancillary equipment;
- be provided with and wearing specific health and safety control equipment/Personal Protective Equipment (PPE) relevant to the activity;
- be in a safe place during machine movements and activities at all times;
- be briefed on all the aspects of the work.

1.4 Training and Certification

A number of card schemes provide certification following training and/or assessment for those who need to marshal plant and vehicles.

1.5 Management of Marshalling Activities

In terms of plant and machinery movement, a hierarchy of control measures should be implemented. At the top of the hierarchy is the total segregation of plant and people. Where this is not possible reversing should be eliminated or if this is not possible marshallers should be used. If drivers/operators lose sight of the plant controller or marshaller, they must stop all movements immediately.

Guidance documents from the HSE provide further guidance on the management and planning of vehicle and plant movements in the workplace including HSG 144 – Safe Use of Construction Vehicles on Sites, HSG 136 – Workplace Transport Safety.

NOTE: *Nearly a quarter of all deaths involving vehicles at work occur during reversing. Many other reversing incidents do not result in injury but cause costly damage to vehicles, equipment and premises.*

1.6 Role of a 'Banksman'

The term 'banksman' has been traditionally used within the construction and allied sectors to identify someone who may undertake a range of activities such as marshalling, slinging, signalling and direct support duties identified within this section. This guidance document avoids the use of the term 'banksman' to identify the segregation of responsibilities and activities so that the function and training requirements can be understood and applied collectively across the sector.

I.7 *Role of a Slinger/signaller and Signaller*

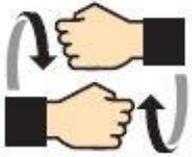
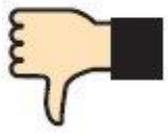
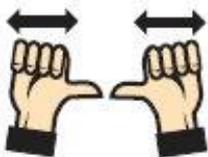
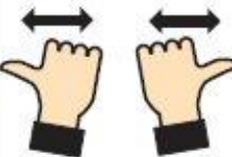
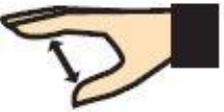
The term slinger/signaller is used to identify the individual who attaches and detaches a load to and from a crane (or other lifting equipment's) load-lifting attachment, uses the correct lifting accessories according to the lift plan and carries out pre-and post-checks of the lifting accessories used. The slinger/signaller is also responsible for initiating and directing the safe movement of the crane.

The slinger principally relays signals from the slinger/signaller to the crane/lifting equipment operator, and may be given responsibility for directing movement of the crane/lifting equipment and load instead of the slinger/signaller.

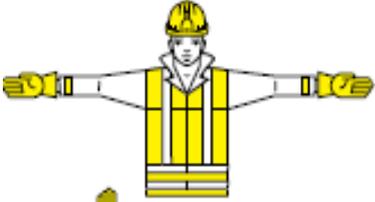
The duties and attributes of slingers/signallers and signallers are further detailed in BS 7121-1:2016.

Annex J - Recommended Hand Signals

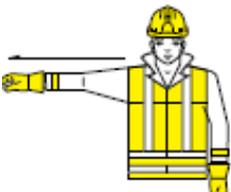
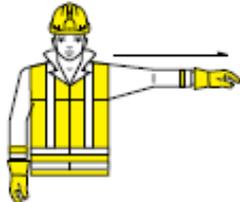
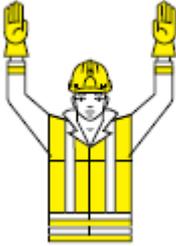
The hand signals shown are generic and can apply to a range of plant and encompasses specific signals for excavating plant. An alternative set of signals taken from *The Health and Safety (Safety Signs and Signals) Regulations 1996* is given overleaf.

					
Load Up Slow	Load Down Slow	Swing Left	Swing Right	Travel	
					
Emergency Stop	Stop	Stop Engine	Boom Up	Boom Down	
					
Telescope In	Telescope Out	Dipper In	Dipper Out	This Far To Go	
				<p>NO RESPONSE SHOULD BE MADE TO UNCLEAR SIGNALS</p>	
Open Bucket	Curl Bucket	Counter Rotate	Counter Rotate		
					
Open Clam on Front End	Close Clam on Front End	Curl Out Front Bucket	Curl In Front Bucket		
		Assume a stationary position in a safe area and ensure eye contact with operator when using front end.	Assume a stationary position in a safe area and ensure eye contact with operator when using front end.		
<p>Right Side Front End Loader</p>				<p>Left Side Front End Loader</p>	

Signals Taken from The Health and Safety (Safety Signs) Regulations 2006

<i>Meaning</i>	<i>Description</i>	<i>Illustration</i>
<i>General Signals</i>		
START Attention Start of command	Both arms are extended horizontally with the palms facing forwards.	
STOP Interruption End of movement	The right arm points upwards with the palm facing forwards.	
END of the operation	Both hands are clasped at chest height.	
<i>Vertical Movements</i>		
RAISE	The right arm points upwards with the palm facing forward and slowly makes a circle.	
LOWER	The right arm points downwards with the palm facing inwards and slowly makes a circle.	
VERTICAL DISTANCE	The hands indicate the relevant distance.	

Signals Taken from The Health and Safety (Safety Signs) Regulations 2006

<i>Meaning</i>	<i>Description</i>	<i>Illustration</i>
<i>Horizontal Movements</i>		
MOVE FORWARDS	Both arms are bent with the palms facing upwards and the forearms make slow movements towards the body.	
MOVE BACKWARDS	Both arms are bent with the palms facing downwards and the forearms make slow movements away from the body.	
RIGHT to the signalman	The right arm is extended more or less horizontally with the palm facing downwards and slowly makes small movements to the right.	
LEFT to the signalman	The left arm is extended more or less horizontally with the palm facing downwards and slowly makes small movements to the left.	
HORIZONTAL DISTANCE	The hands indicate the relevant distance.	
<i>Danger</i>		
DANGER Emergency stop	Both arms point upwards with the palms facing forwards.	
QUICK	All movements faster.	
SLOW	All movements slower.	

Annex K - Radio Communications

The use of hand held VHF/UHF radios can lead to a number of issues which may interfere with the clear communication vital for safe operation of plant on site which include:

- Loss of signal and thus communication, leading to loss of control of the operation;
- Interference from radios on adjacent sites, which can lead to loss of communication or directions being given to the wrong operator;
- Misunderstanding between the operator and the signaller, leading to problems such as part of the machine colliding with people or the building structure.

K.1 Radio Specification

The first two issues should be addressed by specifying the correct radio equipment for the application taking into account:

- Signal strength – if it is too low, there is a risk of signal loss and if too high, will cause interference with adjacent sites. When working blind, the structure may well cause signal loss and a booster aerial could be required. Signal strength should be checked at the beginning of each shift before operations are started;
- Frequency – choosing a different frequency from other radios on the site or in the area will avoid interference from or to other radios;
- Durability – radio hand-sets should be sufficiently durable to withstand use on site;
- Charging – adequate charging arrangements to ensure that batteries are charged at the end of a shift and that spare charged batteries are available at all times;
- Battery capacity – sufficient capacity to last for a full shift;
- Radios in machine cabs should be equipped with foot switches allowing the operator to transmit whilst leaving both hands free to operate the controls.

K.2 Calls Signs and Standard Commands

The third issue, misunderstandings between the excavator operator and supporting personnel should be addressed as follows:

- Both parties must have a sufficient command of a common language (normally English) to ensure that clear, unambiguous communication can take place;
- A clear, unique call sign should be allocated to each supporting person and machine operator;
- Each message should be preceded by the call sign;
- The machine operator should not respond to any command (other than Stop) that is not preceded by the call sign;
- Voice commands must only be given by one person, normally the supporting person, at any one time;
- Voice commands should be given using an agreed set of signals.

K.3 Radio System Familiarisation

It is essential that all radio users are familiar with the controls and operation of the model of radio that they are required to use.

K.4 Radio Licensing Requirements

Radios used for two-way communication on construction sites, and for industrial use, are referred to as Private Mobile Radio (PMR). Some low powered PMR radios use a European system called PMR446 and do not require a licence. This system is however limited to 8 UHF frequencies - each with 38 channels, which may lead to interference from other users.

PMR446 radios are also limited to a maximum of 500 mW Effective Radiated Power, giving a range of 0.5 to 1 mile in built up areas and 2 miles in open country.

More powerful radios work on VHF and UHF radio frequencies which are assigned to a user by OFCOM, who also regulate the frequency bands. To obtain a licence on one of these frequencies, an application needs to be made to OFCOM. The benefits of a licensed frequency are generally greater range, less interference from other users and more features available on the radio sets.

These frequencies are allocated to businesses only, on a case-by-case basis. Once the licence has been issued, radios can subsequently be purchased. The supplier will need to see a copy of the licence to program the radios to the correct frequency before shipping.

Additional guidance is given in:

- Information Sheet RA 195. *Business radio communications for tower cranes* published by OFCOM at www.ofcom.org.uk/static/archive/ra/publication/ra-info.htm
- BS 7121-5:2006 *Code of Practice for Safe Use of Cranes – Part 5: Tower Cranes*

Annex L - Further Information and Guidance

Legislation

Health and Safety at Work etc. Act 1974. London: The Stationery Office;

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

The Provision & Use of Work Equipment Regulations 1998/SI2306
L22 *Safe use of work equipment*, HSE Books

The Lifting Operations & Lifting Equipment Regulations 1998/SI2307
L113 *Safe use of lifting equipment*, HSE Books

The Construction (Design and Management) Regulations 2015 (CDM 2015);
L153 *Managing health and safety in construction*, HSE Books

Supply of Machinery (Safety) Regulations 2008

The Health and Safety (Safety Signs and Signals) Regulations 2006
L46 *Safety signs and signals. The Health and Safety (Safety Signs and Signals) Regulations 1996. Guidance on Regulations*, HSE Books

Standards

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

BS 7121-3:2000, *Code of practice for safe use of cranes — Part 3: Mobile cranes*

BS 7121-4:2010, *Code of practice for safe use of cranes — Part 4: Lorry loaders*

BS 8004:1986, *Code of practice for foundations*

BS 8460:2005, *Safe use of MEWPs - Code of practice*

Other Publications

HSE Research Report RR1000, *Inadvertent operation of controls in excavator plant - insight, analysis and recommendations for prevention by design* (free download from www.hse.gov.uk)

Safe Use of Quick Hitches on Excavators - Best Practice Guide. Strategic Forum for Construction - Plant Safety Group (free download from www.cpa.uk.net).

Safe Use of Concrete Pumps - Good Practice Guide. Strategic Forum for Construction - Plant Safety Group (free download from www.cpa.uk.net).

Safe Use of Telehandlers in Construction - Good Practice Guide. Strategic Forum for Construction - Plant Safety Group (free download from www.cpa.uk.net).

Medical Fitness to Operate Construction Plant - Best Practice Guide. Strategic Forum for Construction - Plant Safety Group (free download from www.cpa.uk.net).

Competence to Operate Construction Plant - Good Practice Guide. Strategic Forum for Construction - Plant Safety Group (free download from www.cpa.uk.net).

Safe Use of Lorry Loaders - Best Practice Guide. Construction Plant-hire Association and Association of Lorry Loader Manufacturers and Importers (free download from www.cpa.uk.net).

Maintenance, Inspection and Thorough Examination of Mobile Cranes - Best Practice Guide. Construction Plant-hire Association (free download from www.cpa.uk.net).

Voluntary Code of Practice for Plant and Equipment Operator Training, Off-highway Plant and Equipment Research Centre (free download from www.cpa.uk.net).

A Practical Guide to Enhancing the All-round Awareness of Plant Operators, Off-highway Plant and Equipment Research Centre.

What do you risk when you use, buy or sell a non-compliant construction machine?
Committee for European Construction Equipment (free download from www.cece.eu).

Is this excavator compliant with European legislation? Committee for European Construction Equipment (free download from www.cece.eu).

CECE guidance on the classification of attachments to construction equipment for the machinery directive 2006/42/EC, Committee for European Construction Equipment (free download from www.cece.eu).

Useful Websites

Build UK (formally UKCG)	www.builduk.org
Committee for European Construction Equipment.	www.cece.eu
Construction Equipment Association	www.thecea.org.uk
Construction Plant-hire Association	www.cpa.uk.net
Construction Industry Training Board	www.citb.co.uk
Health and Safety Executive	www.hse.gov.uk
International Powered Access Federation	www.ipaf.org
National Plant Operators Registration Scheme	www.npors.com
Strategic Forum for Construction	www.strategicforum.org.uk

Annex M - Working Group Membership

Chairman: K Minton - Construction Plant-hire Association

Members:

Name	Employer	Representing
G Barnes	Costain	Build UK
B Bolton	HSE	HSE
M Cafferkey	Flannery Plant Hire	CPA
J Confrey	Clancy	CPA
D Daly	Select Plant	CPA
C Dealey	Morrison Utility Services	Morrison Utility Services
M Dixon	Morrison Utility Services	Morrison Utility Services
P Dratwa	Environment Agency	Environment Agency
P Flannery	Flannery Plant Hire	CPA
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H Jones	NPORS	NPORS
M Kent	CEA	CEA
R Maclean	Land and Water Plant	CPA
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G O'Neil	John Reilly Civil Engineering	John Reilly Civil Engineering
N Perrin	Merlo	BITA
P Whitehead	Highways England	Highways England
P Wilson	UCATT	UCATT

Project Manager: P Brown – Construction Plant-hire Association

Secretary & Editor: T P Watson - Construction Plant-hire Association

NOTE: The above list includes all those who have kindly given freely of their time and expertise to work on any of the versions of the guidance document and does not necessarily reflect the current membership of the Working Group.



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Construction Plant-hire Association
27/28 Newbury St
London
EC1A 7HU
Telephone: 020 7796 3366

Email: enquiries@cpa.uk.net

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