



Safe Use of Self Erecting Tower Cranes



CPA Best Practice Guide

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Working in Partnership

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Foreword

The Construction Plant-hire Association (CPA) has, for many years, been in the vanguard of plant safety. This *CPA Best Practice Guide on the Safe Use of Self Erecting Tower Cranes* is one of a number of guidance documents which confirm the Association's continued and dedicated commitment to safety and training.

The use of Self Erecting Tower Cranes (SETCs) in the UK has increased significantly over the past few years and they are now commonplace on medium and small construction sites, where the cost and complexity of conventional top slew tower cranes is not justified. Whilst the SETC brings many benefits in terms of efficiency and safety, particularly in the reduction of manual handling on small sites, like all lifting equipment it needs to be used safely, by adequately trained personnel, if the maximum benefits they can bring are to be seen.

This document's aim is to provide guidance on the planning, installation, safe use, maintenance and thorough examination of SETCs. It sets out in readily understandable terms what the user of an SETC needs to do to ensure that the crane can be used safely and efficiently, including advice on the training of personnel and further sources of information.

This CPA Best Practice Guide has been produced by a very experienced team of people with an in-depth knowledge of SETCs and who understand the practical issues of using them on sites. The work has been carried out by a Working Group drawn from members of the CPA's Tower Crane Interest Group, in partnership with specialist inspectors from the Health and Safety Executive

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

A handwritten signature in black ink, appearing to read 'P Phillips', with a horizontal line underneath.

Paul Phillips
Chairman
Tower Crane Interest Group
Construction Plant-hire Association.

1.0 Introduction

Self-erecting tower cranes (SETCs) are becoming increasingly popular on small construction sites, where the size of the project does not justify the installation of a conventional tower crane. The management of the installation and use of self-erecting tower cranes follows exactly the same principles as other tower cranes. The details however, vary between the two generic types and the purpose of this Best Practice Guide is to provide guidance on the safe siting, erection, use, maintenance, thorough examination and dismantling of SETCs, together with the management and planning of these activities.

In addition to SETCs that are towed or transported to site on a vehicle, truck mounted tower cranes have become popular in the UK over the past few years. These cranes, which have many of the attributes of the self erecting tower crane, are permanently mounted on a mobile crane carrier chassis and in operational requirements fall between SETCs and conventional mobile cranes. However, the guidance provided in this Best Practice Guide, on managing the safe use of SETCs, applies equally to truck mounted tower cranes.

SETCs are sometimes referred to as “pedestrian operated tower cranes”. This may not always be correct as although the majority of SETCs are operated with the operator standing on the ground adjacent to the crane using remote controls, some are provided with cabs at a high level or operating stations at the base. It is also possible for some conventional top-slew tower cranes to be operated by remote controls at ground level.

Attention is drawn to the following statutory regulations :-

The Health and Safety at Work etc. Act 1974;

The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER);

The Provision and Use of Work Equipment Regulations 1998 (PUWER);

The Management of Health Safety & Welfare Regulations 1999 (MHSWR);

The Work at Height Regulations 2005 (WAHR);

The Supply of Machinery (Safety) Regulations 1992;

The Construction (Design and Management) Regulations 1994 (As amended) (CDM);

Personal Protective Equipment at Work Regulations 1992 (PPE);

The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR);

The Air Navigation Order 2000.

2.0 Types of Hire Contract

2.1 General

There are a wide variety of contractual arrangements used in the construction industry and it is important to ensure that the planning, organization, control and management of lifting operations is not compromised. In general, any organization requiring a load to be moved by crane, which does not own its cranes, has two basic options:

- Hiring a crane (Hired Crane) *or*
- Employing a contractor to carry out the lifting operation (Contract Lift).

The difference between the two options is summarized in Figure 1.

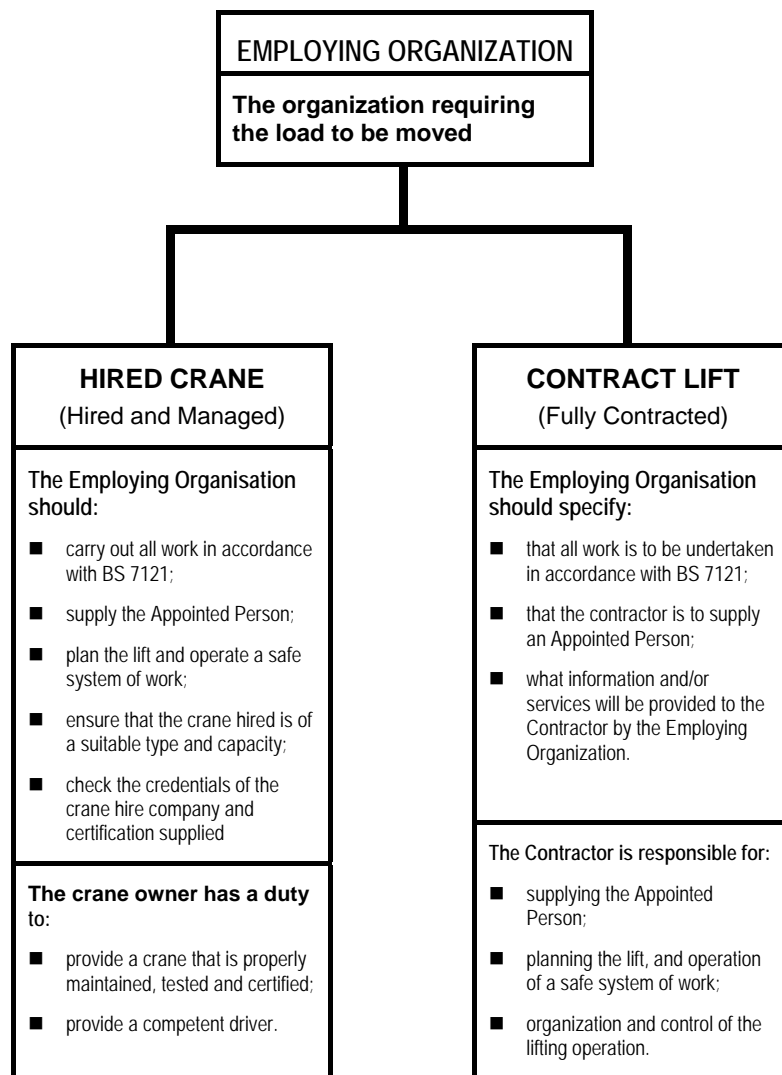


Figure 1 – Contract Options

If an individual or organization does not have expertise in lifting operations they should not hire in cranes and manage the lifting operation but should opt for a contract lift.

Before entering into a contract, employing organizations should satisfy themselves that the contractor has the necessary competence to carry out the work. The responsibilities for insurance of the crane, personnel, the load and third parties will also need to be clarified.

2.2 *Contract lifting operations*

The employing organization may enter into a contract with a contractor who undertakes the work on their behalf.

The parties to the contract should ensure that :-

- All work is carried out in accordance with the BS 7121 series;
- The contractor appoints a person, in accordance with **Section 3** to the satisfaction of the employing organization;
- All information or services provided by the employing organization to facilitate compliance with the BS 7121 series are notified to the contractor in writing.

The contractor should carry out lifting operations in accordance with the BS 7121 series. The contractor should be given full authority by the employing organization to work in accordance with the BS 7121 series including, where appropriate, authority to control and instruct the employing organization's personnel.

Although the BS 7121 series is intended to assist organizations to comply with their statutory and common law obligations, it does not relieve them from these obligations.

Before entering into a contract, the employing organization should ensure that the contractor has the necessary competence to carry out the work in accordance the BS 7121 series.

The normal contract conditions used for carrying out contract lifts are the Construction Plant-hire Association's *Standard Terms & Conditions for Contract Lifting Services*. The user organization (hirer) should ensure that they are fully aware of their liabilities under these conditions and, if necessary, arrange for adequate additional insurance cover for possible loss of or damage to the goods being lifted.

2.3 *User's duties when using hired cranes*

When a crane is hired out to the user organization, the crane owner should provide a crane that is properly maintained and inspected and tested in accordance with BS 7121-2, and has a current report of thorough examination. Where an operator is provided with the crane he should be competent (see **Section 4**).

The user organization retains the responsibility for nominating the Appointed Person in accordance with **Section 3** of this document for those matters for which the Appointed Person is expressly made responsible and for following the recommendations given in the BS 7121 series. Although the crane owner may offer advice on the selection of a particular crane or other matters, such as clearances or ground conditions, the responsibility for ensuring that the crane is of a suitable type, size and capacity for the task being undertaken and for planning the operation remains with the user organization

Therefore, if an individual or organization does not have expertise in lifting operations, they should not hire cranes but should opt for a contract lift.

The normal form of contract conditions used when hiring a crane are the Construction Plant-hire Association's *Model Conditions for the Hiring of Plant (July 2001)*. The user organization (hirer) should ensure that they are fully aware of their liabilities under these conditions, including ground conditions, and arrange for adequate insurance cover for all risks including possible loss of or damage to the crane.

3.0 Planning

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

The siting, setting up, use, dismantling and removal from site of a Self Erecting Tower Crane (SETC) requires careful planning if all these activities are to be carried out safely and efficiently. One person with sufficient training, practical and theoretical knowledge and experience should be appointed to be responsible for planning and supervising the tasks. This person is known as the “Appointed Person”.

In practice the tasks may well fall into two groups:-

- Delivery to site, erection, movement and dismantle – This will generally be carried out by the crane owner or supplier, who will carry out the planning in conjunction with the hirer and occupier of the site. The occupier of the site is responsible for ensuring that both access and foundations are adequate for the crane before it is brought on to site and erected.
- Lifting operations on site when erected. – This will normally be carried out by the hirer (user) of the SETC who is responsible for the planning, supervision and execution of each lift.

On construction sites where lifting operations are carried out by various subcontractors (including the crane supplier), the Principal Contractor should appoint the Appointed Person for the site. Each of the sub-contractors on site may employ individuals who have undergone Appointed Person training but they should remain subservient to the Principal Contractor’s Appointed Person.

Both the Principal Contractor’s (hirer’s) Appointed Person and the crane supplier’s Appointed Person must ensure that the planning for each task includes the following :-

- Identifying the task to be undertaken;
- Identifying the hazards associated with the task;
- Carrying out a risk assessment;
- Identifying control measures;
- Developing the method to be used;
- Recording the planning in a Method Statement (including any contingency activities for rescue);
- Communicating the plan to all persons involved;
- Reviewing the plan before the tasks starts and incorporating any changing circumstances.

3.1 *Identifying the task to be undertaken*

As the first stage in the planning process, the task to be undertaken should be clearly identified, together with the location and sequence.

If, under exceptional circumstances, persons are to be lifted with an SETC additional planning and constraints will be required. See **Annex H**.

3.2 Site surveys

The planning of delivery to site, erection, movement and dismantling of a SETC will normally involve a site survey, carried out by a representative of the crane owner. This involves visiting the location where the task is to be carried out, preferably with a representative of the hirer, so that both the task and any hazards involved can be identified. For simple tasks the remainder of the planning process may be completed at the same time, whilst for more complicated jobs the site surveyor may need to complete the process off site.

3.3 Identifying the hazards associated with the task

The hazards associated with the task should be identified. These might be associated with the location where the work is to be carried out, the nature of the SETC, load to be lifted or the people associated with the task or located in the vicinity.

3.4 Carrying out a risk assessment

Having identified the hazards associated with the task, a risk assessment should be carried out to identify who might be harmed, the chance of them being harmed and the consequences of any harm. This assessment should be recorded.

3.5 Identifying control measures

Once the risk assessment has highlighted the risks involved in the task, the procedures and measures required to control them should be identified.

3.6 Developing the method to be used

Having identified the hazards, evaluated the risks and worked out the control measures required to carry out the task safely, these components should be developed into a coherent plan. Any contingency measures and rescue procedures should be included in the plan.

3.7 Recording the planning in a Method Statement

Once the plan has been developed it should be recorded in a Method Statement. The length and detail of this document depends on the complexity of the task to be undertaken and on the risks involved. A simple low risk job such as a routine lift of dry lining sheets might only require the use of a brief generic method statement, whilst a more complex and high risk job such installation of the SETC on site would require a more detailed job specific method statement. The method statement covering all planned lifting on a site is often referred to as the "lift plan". The method statement should include a "lifting schedule" listing each type of item to be lifted together with the following information:

- Item description;
- Weight;
- Dimensions;
- Lifting points/method;
- Type of lifting accessories to be used and configuration;
- Pick up and landing locations referenced to the site plan.

An example of a lifting schedule is shown in **Annex C** and an example of a method statement in **Annex D**.

3.8 *Communicating the plan to all persons involved*

One of the most important aspects of successful planning is to ensure that the contents of the plan are communicated effectively to and between all parties involved, taking account of language differences. Arrangements should be made to ensure that copies of any method statements are given to the appropriate people and that others involved in the job are fully briefed. Similarly any changes to the plan should be communicated to all parties.

3.9 *Reviewing the plan before the job starts*

Immediately before a job starts the risk assessment and method should be reviewed to check if any aspect of the job has changed and the effect that these changes could have on the safety of the operation. If any modifications to the plan are required these should be communicated to all those involved. The Appointed Person should amend the method statement (lift plan) and initial any significant changes.

3.10 *Further guidance*

Further guidance on planning of lifting and installation is given in:

- BS 7121 *Code of practice for safe use of cranes – Part 1 General and Part 5 Tower Cranes*;
- L113 *Safe Use of Lifting Equipment - Lifting Operations and Lifting Equipment Regulations 1998 Code of Practice* - ISBN 0 7176 1628 2;
- HSE Leaflet INDG218 – Guide to Risk Assessment;
- HSE Leaflet INDG163 – Five Steps to Risk Assessment.

4.0 Training

The Provision and Use of Work Equipment Regulations 1998 require that all persons involved in the installation and operation of a SETC must be adequately trained and assessed as competent. Current arrangements, including those that are nationally accredited, are shown in the table below :-

Activity	Provided By	Qualification
Slinger	CPCS Accredited Training Provider	CPCS Scheme Category A40
Signaller	CPCS Accredited Training Provider	CPCS Scheme Category A40
SETC Operators	CPCS Accredited Training Provider	CPCS Scheme Category A63
	Additional training required for operating from cab	CPCS Scheme Category A04A or A04B
Configuration (erect & dismantle)	Crane manufacture to crane owner for each model of SETC	In-house assessment by a competent assessor
Maintenance	Crane manufacture to crane owner for each model of SETC	In-house assessment by a competent assessor
Operator familiarisation	Crane owner to operator for each model of SETC	In-house assessment by a competent assessor
Appointed Person	CPCS Accredited Training Provider	CPCS Scheme Category A61
Site survey - fundamental	Crane owner to representative	In-house assessment by a competent assessor
Site survey - familiarisation	Crane owner to representative for each model of SETC	In-house assessment by a competent assessor
<p><i>Information on accredited training providers can be obtained from the Construction Plant Certification Scheme Help Desk on 0870 417 7274 or www.citb.co.uk/cardschemes/cpcs</i></p>		
<p>In addition to initial assessment on appointment/employment, arrangements should be made to reassess/review the competence of personnel at periodic intervals.</p>		

5.0 Siting of SETCs

The area in which a SETC is to be sited must be carefully assessed to ensure that it is suitable **before** the crane is taken to site and put into service. During this assessment, the following points should be considered.

5.1 Clearances

The area chosen must be of a sufficient size to enable the SETC to be manoeuvred into position, set up, operated and dismantled, with sufficient clearances between the crane and surrounding structures, as detailed in the manufacture's operation and instruction manual. This is to ensure that trapping points are not created and that damage does not occur to either the crane or the surrounding structures (including the building under construction). The Guidance to LOLER specifies a minimum gap for areas into which persons may enter of 0.6m. Fencing or barriers should be erected around the base of cranes to restrict access to pedestrians or damage from workplace transport moving in the immediate vicinity. Entry to the area should be controlled by a safe system of work.

5.2 Ground conditions

Insufficient consideration and assessment of ground conditions has been found to be a major cause of accidents with SETCs.

All SETCs rely for their stability on the ability of the ground on which they are standing to safely absorb the loads imposed by the crane. Most SETC manufacturers supply information on the loads imposed by the crane on the ground in the various operating and set up configurations of the crane. These generally consist of :-

- Maximum vertical load per stabiliser;
- Maximum horizontal reactions;
- Dimensions of stabiliser support plate (pad);
- Ground-level pressure on stabiliser support plate.

An assessment of the ability of the ground to accept these loads should be made by a competent person. This assessment may indicate that the ground has insufficient bearing capacity to accept the loads imposed by the crane, in which case additional measures will need to be taken before the crane can be set up. These may include using timber sleepers, proprietary mats or concrete pads to spread the applied load to an acceptable bearing pressure. In extreme circumstances piled foundations may be required. Wherever a concrete pad, steel grillage or piled foundation is constructed to accept the loads from a SETC, the contractor constructing the foundation should complete a foundation completion form to certify that the foundation has been correctly designed and constructed **before erection of the crane starts**. An example of such a form is shown in **Annex G**.

Where timber is to be used it is important that the timber sections employed are of sufficient dimensions to transmit the applied loads to the ground and that the timbers are pinned together to form a grillage. The use of individual loose timbers has been found to be a major cause of accidents (see **Figure 2 & 3**).

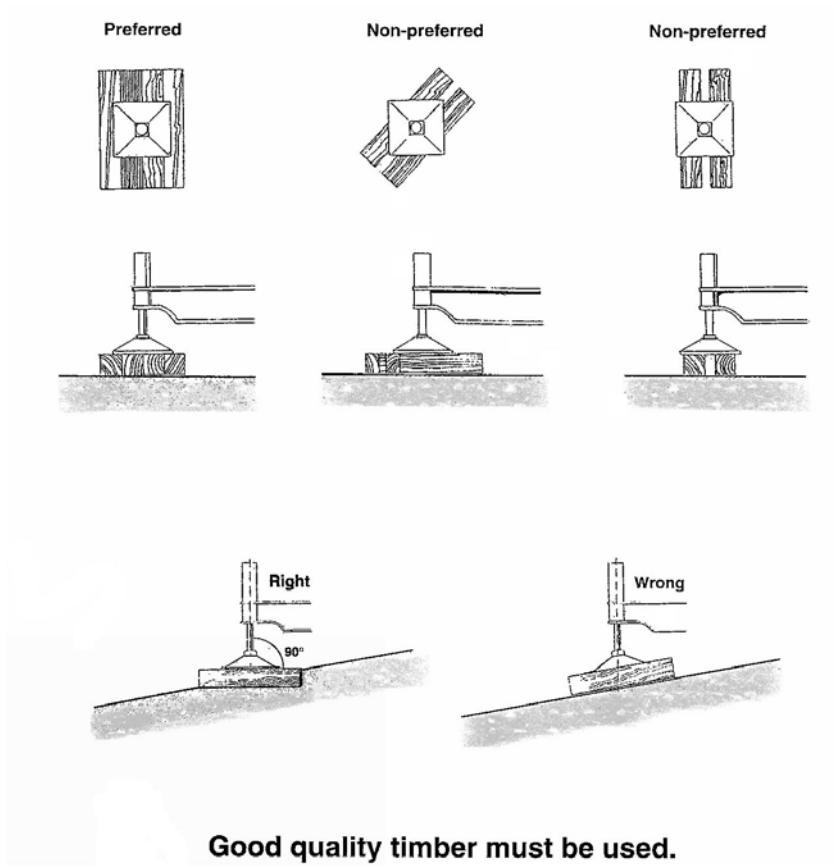


Figure 2 – Timber packing under outriggers

When siting the crane, consideration should be given to the length of time that the crane will be erected in one position and the likely deterioration of the supporting ground or foundation over time (e.g. timber rotting, undermining by water or frost, drying out, adjacent excavations)

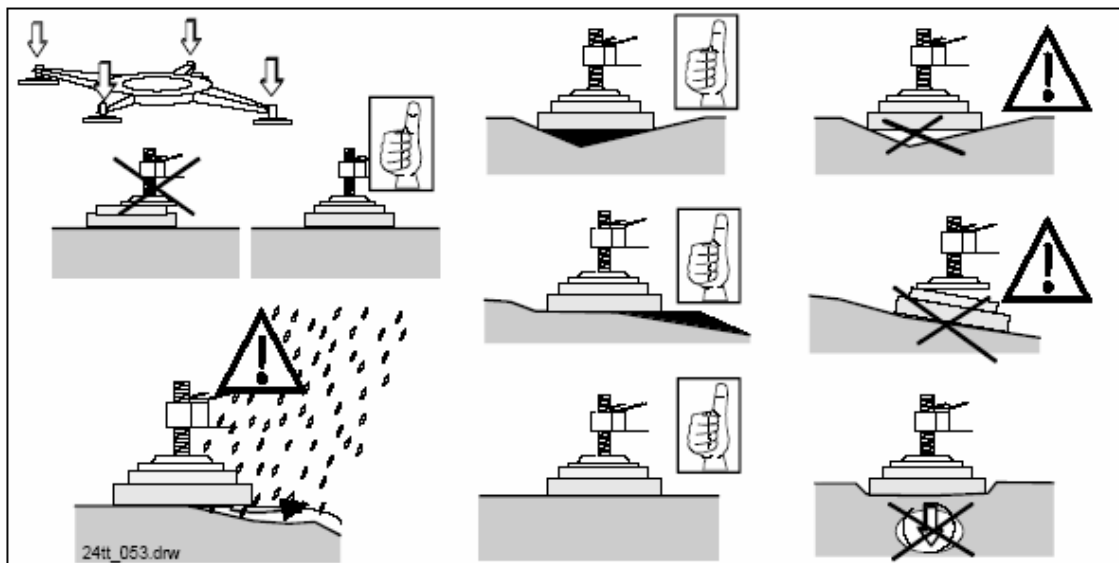


Figure 3 Siting of Outriggers

Some of the hazards that need to be considered when assessing ground include:-

- Underground services;
- Paved areas;
- Uncompacted fill;
- Open excavations;
- High water table;
- Basements;
- Cellars;
- Proximity to canals and rivers;
- Changes to site conditions during construction.

Details of any foundation or load spreading arrangements should be recorded in the method statement by the Appointed Person.

Further guidance on assessment of ground conditions and crane foundations is given in the CIRIA publication C703 - *Crane Stability on Site*

5.3 Overhead hazards

When siting a SETC care must be taken to ensure that the crane will not contact or approach overhead hazards such as power lines, communications cables or overhead structures.

Advice on siting cranes near to overhead power lines can be found in HSE Guidance Note GS6 - *Avoidance of danger from overhead electric power lines*.

5.4 Proximity to railways and airports

If the SETC is to be sited adjacent to a railway or in the vicinity of an airfield or airport the Appointed Person should contact the operator of the facility as they may well impose restrictions on the height, lifting capacity and use of the crane.

Information on the use of cranes near airfields/airports is given in the Airport Operators Association leaflet *Cranes and planes — Guide to procedures for operation of cranes in the vicinity of aerodromes*.

5.5 Oversailing adjacent property

If the siting of the crane will result in oversailing of an adjacent property not in control of the Principal Contractor, oversailing rights must be obtained in advance by the Principal Contractor (hirer). Consideration needs to be given to inadvertent oversailing whilst the crane is left, when not in use, in free slew. Should the crane need to be guyed, tethered or the slew locked, when out of service this **must** be considered at the initial planning stage and foundation loads for the specific configuration obtained from the manufacturer. This information must be provided to the hirer and included in both the erection and use method statements. Cranes should not be left in a part erected condition overnight (i.e. jib partially folded back) unless allowed for in the manufacturer's manual or without prior written approval from the crane manufacturer.

A self erecting tower crane was erected on a site adjacent to a row of occupied houses. Over the first weekend the occupants of the houses became alarmed when the crane, which had been left in free slew, moved over their houses. Their concern was heightened by the presence of a generator slung from the hook. A complaint to the Health and Safety Executive resulted in a prohibition notice being served on the construction company.

5.6 Access & egress to and from the site

It is important when siting a SETC to ensure that there is adequate access to the crane position for both the SETC and any supporting transport. It is equally important to ensure that adequate egress will be available when the crane is removed from site. It has been known for a building to be constructed around a crane, making it extremely difficult and costly to remove at the end of the job!

A self erecting tower crane was being used for lifting on a refurbishment project in a town centre. The crane stood in a courtyard for the duration of the project and the only way in to the courtyard was through a single archway, which was just high enough to allow the folded SETC to pass below. During construction a beam was inserted at the top of the arch to support a wall being constructed above. When it was time to remove the crane from site it was found that the headroom had been reduced to such an extent that the crane could not pass through the archway. The only way to remove the crane was to dismantle it at considerable cost and inconvenience to the site.

5.7 Power supply

Before the SETC arrives on site, checks should be made to ensure that there is an adequate mains electricity supply. Larger SETCs require a three phase supply, whilst smaller cranes can run on a single phase supply. The SETC manufacturer's instruction manual will specify the type and size of supply required. If a suitable mains supply is not available on site, the alternative is to use an engine driven generator which must be adequately earthed and sized to cope with the potentially high starting currents of the SETC motors. The use of frequency controlled motors on later designs of crane will reduce starting currents and consequently the capacity of the power supply which is particularly beneficial when a generator is used. Some control systems however, require that the power supply to the control panel heaters is left on at all times to ensure to maintain a stable temperature, in this case when power from a generator is not available a temporary night supply will be required.

All cables should be of the steel wire armoured type to give adequate mechanical protection in site conditions. The power supply should terminate in a suitable weatherproof isolator adjacent to the crane. If earth fault protection is provided by the use of Residual Current Devices (RCDs) these may need to be set with higher trip current and delay setting than normal, to prevent nuisance tripping caused by frequency control drives on the SETC. RCDs with a 30mA rated tripping current are only required on final sub circuits such as socket outlets.

The electrical installation should be in accordance with BS 7671 *Requirements for electrical installations — IEE Wiring Regulations 16th edition*. Guidance on electrical safety on construction sites is also given in HSE Guidance document HS(G) 141 *Electrical safety on construction sites*.

5.8 Wind

The crane supplier/manufacturer will be able to advise on the maximum in-service and out of service wind conditions for the specific model of crane to be used. The out of service wind loadings will often be much greater than the in-service loads and the load bearing capability of the ground (foundation) must be sufficient for the extra imposed loads due to out-of-service wind. Where the SETC is to be taken down when high winds are anticipated, the operator must be made aware of any wind speed restrictions for dismantling.

There have been a number of accidents where the ground conditions were not suitable for the out of service loadings or SETC have been dismantled at wind speeds in excess of the manufacturers maximum recommended speeds.

SETC's should be left in free slew when out of service to allow the crane to "weathervane", to ensure that the out of service foundation loads are not exceeded.

Where an anemometer is not fitted to the crane (many new cranes are now supplied with an anemometer as a standard fitting), wind speeds should be monitored by the use of handheld anemometers. Windspeed measurements should be carried out, where possible, at approximately the same height as the crane jib. A record of windspeed monitoring should be kept.

All operating personnel should be aware of windspeed action levels for the particular crane in use.

5.9 Lightning Protection

When a SETC is to left erected on a site for a period of time, consideration should be made to providing lightning protection. Reliance should not be placed on the earth conductor of any mains power supply. Normally the earth bonding can be connected to the lowest metallic part of the crane structure as the metal structure of a SETC provides good continuity. Following installation of lightning protection an earth continuity check should be made to check that the resistance to earth is less than 10 ohms.

5.10 Floodlights

It is not recommended that SETC are used for mounting flood lights unless both the lights and installation are approved by the crane manufacturer.

5.11 Written plan

After completion of the survey the Appointed Person should prepare, or have drawn up under his direction, a scale drawing of the site. The drawing should include the following information :-

- Plan and side elevation views;
- Outline envelope of the building under construction;
- The planned location of the crane with dimensions to reference points to aid location;
- The make and model of crane selected;
- The radius that the crane can reach;
- SWL at max radius;
- Height under hook;
- Proximity hazards and delivery vehicle unloading areas.

5.12 Further guidance

Further detailed guidance on the siting of cranes is given in:

- BS 7121 *Code of practice for safe use of cranes* – Part 1 *General* and Part 5 *Tower Cranes*.
- CIRIA publication C654 - *Tower Crane Stability*.
- CIRIA publication C703 - *Crane Stability on Site*

6.0 SETC Operation

SETCs should be operated by operators who have been trained and assessed as competent (see **Section 4**).

NOTE: Where SETCs are to be operated from a cab, the operator will require additional training (see **Section 4**).

6.1 Manuals and Signs

All operations should be carried out in accordance with the manufacture's operating instruction manual, a copy of which should be with the crane at all times. Checks should be made by the supplier to ensure that the manual :-

- Has been left with a responsible person on site;
- Is the correct manual for the crane supplied;
- Conveys information the users in a simple and understandable format and is in a language (normally English) that is readily understood by the operator.

All signs labels and decals on the crane must be in a language (normally English) that is readily understood by the operator.

6.2 Slings, Signalling and Crane Operation

The operator of a pedestrian operated SETC has some flexibility in where he stands and may be able to take on some of the responsibilities normally undertaken by a signaller. He should however, not normally take on the additional role as the slinger. Combining the roles of slinging, signalling and crane operation requires very careful planning. This should take the form of a specific risk assessment to identify risks and any necessary control measures. These should be used to develop a job specific method statement which identifies the roles that may be combined.

6.3 Pedestrian Crane Operation

The operation of SETCs is frequently carried out by a pedestrian operator at ground level, using remote controls that may be hard wired or use a wireless data transmission system. Whilst pedestrian control provides flexibility with the possible combination of roles (see **6.2**) there are several potential disadvantages that must be taken into account in planning the lifting operations:-

- The crane operator may well be at risk of tripping and falling when trying to move around the site over uneven ground whilst concentrating on controlling the crane. Pedestrian operated SETCs should only be controlled whilst the operator is stationary;
- The crane operator has no feel for the machine and could, under certain circumstances, be tempted to handle the machine more roughly than if the crane were operated via a cabin control;

- The operator may not have a good view of the load and any obstructions, consequently the operator must always have the crane jib and load in sight at all times;
- Infra-red remote control can be unreliable on tower cranes if the receiving sensor rotates with the crane and thus loses alignment with the transmitter.

6.4 Wireless Controls

To prevent unauthorized use, the operator of a SETC that is controlled by transmitted signals, such as radio signals, should retain the transmitter in their physical possession or remove the key from its key-lock switch and, for short periods, retain the key in their possession. For longer periods, or when the crane is not in use, the transmitter should be kept in secure storage.

When the transmitter is fitted with a belt or harness, the operator should be wearing the harness before switching on the transmitter so that accidental operation of the crane is prevented. The transmitter should only be switched on when operating the crane and should be switched off before removing the harness.

The design of controls and shrouding should comply with *BS EN 13557:2003 – Cranes – Controls and control stations* to prevent inadvertent operation. Wireless controls should be fitted with a warning signal of the approach to the rated capacity as required by *BS EN 14439:2006 Cranes – Tower cranes*.

Wireless controls must only be used to control one crane at one time.

A site with two top slew tower cranes requested that they be fitted with wireless remote controls. This enabled the contractor to save money by allowing one operator to operate both cranes whilst sitting in the cab of one of them. Inevitably this led to an incident where a load on the hook of the remote crane became entangled with scaffolding, when the operator's view was obscured.

6.5 Rated Capacity

The rated capacity of a SETC should not be exceeded, except when testing the crane under the supervision of a competent person.

Care should be taken to prevent pendulum swinging of the load, by careful control of the operating motions to match the swing of the load and to keep it under control at all times.

Rated capacities apply only to freely suspended loads. The hoisting, slewing, traversing, luffing or travelling motions of a crane should not be used to drag any load along the ground with the hoist rope out of the vertical position. Before lifting a load, the hoist line should be plumb. Failure to observe these points can adversely affect the stability of the crane or introduce loadings (stresses) into the crane for which it has not been designed and, even with a rated capacity indicator/limiter fitted, a sudden can occur.

Tag lines should be attached to loads where movement of the load during the lifting operation may be hazardous.

6.6 Handling of Loads Near Persons

When loads have to be handled in the vicinity of persons, extreme care should be exercised and adequate clearances allowed. The route of the load should be planned to prevent lifting over persons. Operators and signallers should pay particular attention to possible dangers of persons working out of sight.

All persons should be instructed to stand clear of the load being lifted. When lifting from a stack, all persons should be instructed to stand away from the stack in case adjacent materials or objects are displaced.

Where possible, lifting of loads over highways, railways, rivers or other places to which the public have access should be avoided. If this is not possible, permission should be obtained from the appropriate authority and the area kept clear of traffic and persons.

7.0 Lifting Accessories

In preparing the method statement (lift plan) consideration should be made to the selection of lifting accessories such as wire rope slings, chains slings, webbing slings and shackles to ensure that they are sized for the anticipated loads to be handled.

All the lifting accessories on a site should be listed in a lifting accessory register (see **Annex E**).

The following points should be considered when selecting lifting accessories :-

- The secure storage of lifting accessories when not in use should be considered at the planning stage and suitable arrangements made;
- Lifting accessories should be protected with protective sleeves or suitable packing, where loads with sharp edges are to be lifted;
- For the lifting of awkward materials or items with a non-central centre of gravity, lifting beams, spreader bars or purpose designed lifting beams may be required;
- All accessories should be marked with a Working Load Limit (Safe Working Load);
- The type, size, rating and configuration of lifting accessories to be used for each load or generic type of load to be lifted should be recorded in the method statement (lift plan);
- Before each use of lifting accessories pre-use checks should be carried out to ensure that they are in good condition and that a current report of thorough examination is available.
- LOLER requires that lifting accessories are thoroughly examined at intervals not exceeding six months.

8.0 Transportation to Site including loading, unloading and positioning on Site

SETCs can be transported to site in a number of ways depending on their design.

These are:-

- Carried to site on a low-loader;
- Towed to site on high speed axles;
- Towed to site on low speed axles;
- Be mounted on a road going chassis.

When towed on the road the SETC should comply with the requirements of the Road Traffic Act and the Construction and Use Regulations. Vehicles that cannot comply

with the Construction and Use Regulations will need to be moved under the Motor Vehicles (Authorisation of Special Types) General Order 2003 (STGO) which requires advance notice to be given to the Police and Road & Bridge Authorities.

8.1 Transportation to site

All transportation of the SETC should be planned and the method statement should include :-

- Vehicle routes, taking into account height restrictions etc;
- Parking restrictions around the site;
- Access to the site;
- Towing vehicle, if the SETC is to be towed;
- Access on site for off loading;
- Unloading of the SETC from a trailer – winch, crane etc;
- Preparation for transport - Slew lock engaged and correct configuration (prop to take load off slew ring);
- Marking of lifting points to avoid confusion with tie-down points.

8.2 Positioning on site

Moving and positioning an SETC on site should be taken into account by the Appointed Person at the Planning stage (see **Section 3**) and fully detailed in the method statement.

The method statement should include:-

- Method used to position the SETC e.g. mobile crane, winch, site vehicle;
- Route to be taken on site;
- Protection of bystanders;
- Any ground preparation required of the planned route;
- Timing of operation and personnel required.

9.0 Erection, Alteration and Dismantling

9.1 Erection personnel

Erection, alteration and dismantling procedures should be carried out by personnel, who have been trained and assessed as competent (see **Section 4**), in accordance with the manufacture's instruction manual for the specific model of SETC.

9.2 Working at height

Erection, dismantling or reconfiguration of an SETC may require persons to work at height (e.g. installation of counterweights or reconfiguration of the jib). The Work at Height Regulations require that before working at height a risk assessment is made and control measures are taken to reduce the risk of a person falling and being injured. These should include the provision of fixed ladders or steps at all access points. If fall arrest systems are used a plan should be drawn up to cover the rescue of persons suspended from fall arrest equipment.



An operator who had not received training on the manufacturer's dismantling procedure attempted to dismantle a SETC in high winds. During the dismantling process the jib was damaged.

9.3 Erection

The SETC should be erected in accordance with the method statement (lift plan) prepared by the Appointed Person (see **Section 3.7**). Attention should be paid to the following :-

- That a copy of the manufacture's installation manual is available on site and is followed;
- That the crane is erected in the position shown on the site plan;
- That a foundation handover certificate (see **Annex G**) is provided prior to erection;
- That spreader mats and grillages to spread the outrigger loads are installed as specified by the Appointed Person;
- That a check is made to see if there are any new or additional hazards on the site prior to erection. The Appointed Person should be consulted if any significant hazards are identified and appropriate control measures agreed with the Appointed Person;
- That after erection a full functional check on the crane should be completed and any slewing/zoning restriction systems set and tested. The functional testing should include the lifting of a test weight in accordance with the manufactures instructions.
- That the correct functioning of the Rated Capacity Indicator and Limiting Device is tested;
- That following erection a handover sheet should be completed and signed by the erector and handed to the user (employing organisation);

A SETC was being used to construct a four storey building on a congested site. As the building increased in height the jib was luffed to enable the crane to reach over the pitched roof under construction. Unfortunately during re-rigging the selector switch in the control panel was not reset for the new duty and the crane was used in the new configuration to lift a pack of timber onto the roof. The operator was able to hoist and trolley out the load, but when he put the trolley control in neutral the brake was not able to hold the trolley on the inclined jib and the trolley, with the load, moved down the jib until it reached the mast. As the load rotated and hit the mast, the timbers broke loose from the pack with individual lengths falling like javelins to the ground below. Although the operator was severely shaken, fortunately no one was hurt.

If the selector switch been correctly reset for the new duty, the lifting capacity of the crane would have been reduced to compensate for the increased loading placed on the trolley motor by the inclined jib and the accident avoided.

- That the owner of the cranes should familiarise the user's intended operators with the controls, functions and limitations of the SETC before it is taken into use;
- Ballast weights of SETCs are often made from precast reinforced concrete. Checks should be made before lifting the weights into place that the weights are not damaged and that the lifting points are in good condition.

9.4 Dismantling

The SETC should be dismantled in accordance with the manufacture's instructions and the method statement prepared by the Appointed Person (see **Section 3.7**). Attention should be paid to the following :-

- That a copy of the manufacture's installation manual is available on site and is followed;
- That before starting dismantling the crane is still erected in the position shown on the site plan;
- That spreader mats and grillages to spread the outrigger loads are still installed as specified by the Appointed Person;
- That a check is made to see if there are any new or additional hazards on the site prior to dismantling. Particular attention should be paid to ensuring that sufficient space is available for the jib/mast assembly to be lowered. The Appointed Person should be consulted if any significant hazards are identified and appropriate control measures agreed with the Appointed Person;
- That before dismantling a full functional check on the crane should be completed and the slew brake/pins set according to the manufacturer's instructions.
- Care should be taken that any outrigger jacks are retracted evenly to prevent the crane becoming unstable;
- Ballast weights of SETCs are often made from precast reinforced concrete. Checks should be made before lifting the weights that the weights are not damaged and that the lifting points are in good condition. After removal the weights should be stacked correctly in a safe location.

A SETC was being dismantled to a point where the mast and jib had been stowed. The erection team were in the process of retracting the outriggers. Unfortunately the crane had been left in free slew and as the superstructure tilted it swung round severely crushing one of the erectors against the newly constructed building.

Had the manufacturer's instructions been followed the accident could have been prevented.

9.5 Further guidance

Further detailed guidance on the erection, alteration and dismantling of tower cranes of cranes is given in :-

- BS 7121 *Code of practice for safe use of cranes – Part 5: Tower cranes.*
- CIRIA publication C654 - *Tower Crane Stability.*

10.0 Checks and Inspections

The effective maintenance of a SETC is an essential part of safe operation. As with all lifting machines the SETC wears and deteriorates over time and the maintenance process, including checks and inspections, both 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.

SETCs are complex machines with electrical, mechanical and hydraulic systems that require the manufacturer's preventative maintenance instructions to be strictly complied with, if safety is to be maintained in use. Checks and inspections should be carried out taking account of the frequency of use of the SETC and the environmental conditions in which it regularly works. If the operator is considered to be competent, they may be authorized to carry out routine pre-use and weekly checks.

The employer of the person carrying out these checks should ensure that the machine is taken out of use for the period of time required to carry them out. Also, the employer or authorized person carrying out the checks should ensure that a safe system of work is in place to prevent personnel from being exposed to risk, for example from the inadvertent operation of the equipment.

It is essential that the base of the SETC is well drained and kept free of obstructions that would impede access for checks and inspections.

A SETC was placed on a site where conditions dictated that the crane was erected and dismantled on a daily basis. The maintenance schedule for the crane was not adjusted to take account of the high frequency of erection and dismantling, and the pinned joints on the folding jib were not greased at sufficient frequency. During a Thorough Examination excessive wear on the pins and joints was discovered and the crane was taken out of service. This resulted in considerable down time, delay to the site and expense which could have been easily avoided by revision of the lubrication schedule.

10.1 Daily pre-use checks

At the beginning of each shift or working day before work commences, the following visual and functional routine checks, if appropriate for the type of SETC, should be carried out :-

- Checks as required by the manufacturer's handbook;
- Cleanliness and general signs of damage;
- Lubrication as required by the manufacture's handbook;
- Visual check of the ground supporting the base;
- Visual check of packers/grillages;
- Visual check that the base is level;
- Visual check of the chassis and outriggers;
- Visual check of base fencing;
- Visual check of the condition of the power supply cable;
- Visual check of wire ropes, anchorages and hook block;
- Check of the wire rope spooling on the winch drums;
- If fitted, check levels of the engine cooling-water and lubricating oil;
- Check security of any pin locating arrangements and for visible damage to the structure;
- No load operation of the crane motions to check correct functioning of motors and brakes and for movement under outriggers during slewing;
- Check for correct functioning of controls and safety devices.

A record of the daily check should be kept (for example on a timesheet) and a defect reporting system should be in place so that any defects are rectified promptly.

10.2 Intermediate (weekly) inspections

The intermediate inspections listed should either be carried out once a week or at intervals recommended by the manufacturer. These inspections are in addition to the daily pre-use checks and are to ensure that all systems function correctly, that the SETC is free from damage and that fluid levels are within the manufacturer's limits. Inspections should be appropriate for the type of SETC and include the following :-

- Inspections as required by the manufacturer's handbook;
- All structural parts should be sound and free from visible defects. The structure should be inspected for damage, loose or missing retaining pins, damaged hoses and wiring, and any loose or missing fittings;
- Hydraulic systems (if fitted) should be free from leaks;
- Hydraulic fluid levels should be checked where accessible;
- The base structure, including any safety guards, should be free of damage and clear of debris;
- The crane base should be level. Any stabiliser support plates should be firmly founded, the screw jacks in good condition and locked;

- All engine, water, oil and fuel levels should be checked and topped up where necessary;
- All hoses, fittings, wiring and valves etc. should be inspected for leaks, security and damage;
- Any emergency lowering and slewing equipment fitted should be tested;
- All operating and warning decals should be clear and readable;
- All controls, including any emergency systems, should be tested;
- Drive systems, brakes, steering and speed controls should all be tested for correct operation;
- The correct operation of the Rated Capacity Limiter should be checked;
- The operation of limit switches should be checked by carefully carrying out load-free manoeuvres at all speeds;
- The condition of the hook and latch should be checked;
- Wire ropes on the accessible area of the crane should be checked for lubrication, wear and damage;
- Automatic lubrication systems should be checked for correct functioning.

11.0 Thorough Examination

The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER) require that all lifting equipment, including SETCs, is thoroughly examined by a competent person in the following circumstances :-

- At regular intervals (a period not exceeding 12 months, if persons are not lifted, or 6 months if persons are lifted);
- After erection on a new site;
- After any major alteration or damage (event).

Top slew tower cranes are invariably erected on site from a selection of components and must therefore be thoroughly examined after erection and before they are taken into use. They are then thoroughly examined at the appropriate periodic intervals for as long as they remain on that site. Thorough examination is also required when any alteration is made to the crane's structure or configuration.

11.1 Thorough Examination of SETCs

The requirement for thorough examination of self erecting tower cranes will depend on the extent of assembly from components carried out during the deployment of the crane on site. In the case where a self erecting tower crane arrives at site, is positioned on a prepared base, connected to a power supply, deployed by unfolding using its own winches and where no additional components are put into the structure; then no thorough examination following erection will be required as the crane will not have materially altered since its last periodic examination. A parallel may be drawn here with mobile cranes.

On the other hand a self erecting tower crane where after delivery to site and positioning on a prepared base, the deployment of the crane structure requires the assembly of additional components will require a thorough examination after erection as is the case with a top slew tower crane.

In either case checks should be carried out on site after installation to ensure that all crane motions and limits are functioning correctly.

11.2 Thorough Examination of Lifting Accessories

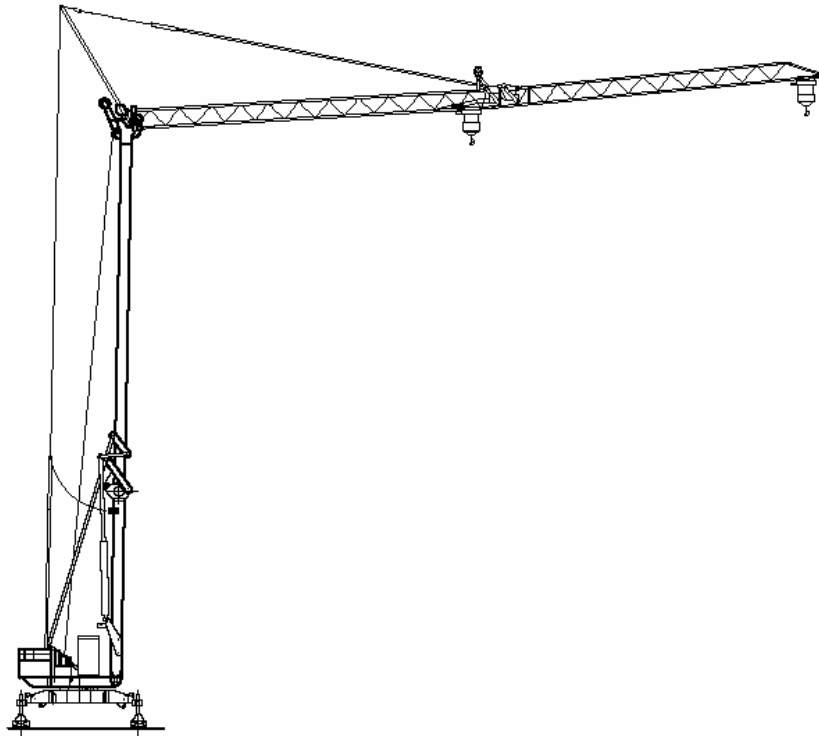
LOLER requires that lifting accessories are thoroughly examined at intervals not exceeding six months.

11.3 Further guidance

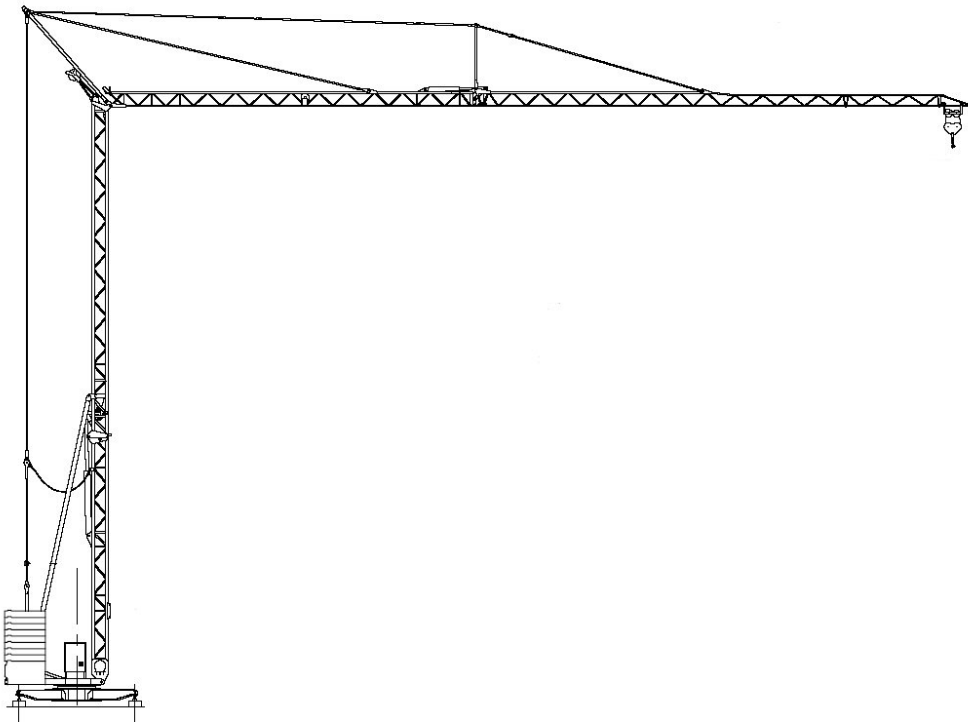
Further detailed guidance on the thorough examination of cranes is given in:-

- *BS 7121 Code of practice for safe use of cranes – Part 2: Inspection, testing and examination.*
- *L113 Safe Use of Lifting Equipment - Lifting Operations and Lifting Equipment Regulations 1998 Code of Practice - ISBN 0 7176 1628 2*

Annex A – Types of SETC



Box Section Tower



Lattice Tower

Annex B - Definitions

Appointed Person

person with the training, practical and theoretical knowledge and experience required to comply with **3.0**

crane operator

person who is operating the crane for the purpose of positioning loads or erection of the crane

NOTE Sometimes referred to as "crane driver".

employing organization

person or organization who requires a lifting operation to be carried out and is responsible for safe use of the crane

NOTE In the case of a hired crane the degree of the employing organization's responsibility for the safe use of the crane will depend on whether the crane is being supplied under a crane hire contract or a part of a contract lift See **2.0**

lifting

any movement of loads or persons that includes a change of height

lifting accessory

equipment from which the load can be suspended

lift plan

see method statement

load

weight which is lifted by the crane

NOTE If cranes are used to lift loads from water, the load could also include forces due to water flow or suction.

method statement

document produced by the Appointed Person to describe how the crane installation or lifting operation should be carried out

NOTE: The Appointed Person may delegate the task of preparing the method statement to another person however they retain responsibility for the method statement. It is essential that the Appointed Person sign and date the document before it is issued for use to signify their approval of the method statement's content.

truck mounted tower crane

self-erecting tower crane permanently mounted on a road-going chassis

pedestrian operated tower crane

a tower crane of any type (top slew or self erecting) which is controlled by an operator standing at a position not on the crane structure using a hard wire or wireless (cableless) control station.

rated capacity

load that the crane is designed to lift for a given operating condition (e.g. configuration, position of the load)

NOTE The rated capacity was formerly known as “safe working load”.

self-erecting tower crane (SETC)

slewing jib type crane with jib located at the top of a vertical tower which is a pre-assembled unit transported to site and deployed from its travelling configuration for use

NOTE: Additional jib or tower sections may be added to the crane once it has been deployed at site.

signaller

person responsible for directing the crane operator to ensure safe movement of the crane and load

slinger

person responsible for attaching and detaching the load to and from the crane, 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

thorough examination

examination by a competent person in such depth and detail as the competent person considers necessary to enable them to determine whether the equipment being examined is safe to continue in use

NOTE The thorough examination is not part of the maintenance regime for the equipment but provides owners with information which could be used to determine the effectiveness of the regime.

weight

the vertical force exerted by a mass as a result of gravity

Annex C – Example of a Lifting Schedule

Lifting Schedule										
Site Location	Canal Street, Bury		Employing Organisation	A & B Construction		Appointed Person	F Bloggs		Contact Telephone No	0161 953 8765
Item to be Lifted	Item Weight	Lifted From	Lifted To	Max Radius	Max Lift Height	Lifting Accessories			Comments	
						Type	SWL	Weight		
Crofters Brick Pack (500 pack)	1400 kg	Compound	Grid A12	22 m	14 m	Forks	2000 kg	180 kg	Use net to prevent falling objects	
Durox Superbloc 125 (100 pack)	1100 kg	Compound	Grid B20	27 m	14 m	Forks	2000 kg	180 kg	Use net to prevent falling objects	
Roof Truss K480 (5 pack)	500 kg	Delivery Area	Grid D10	29 m	19 m	Violet web sling 2m long with choker hooks	1400 kg	4 kg		
Floor Beams 4m (10 pack)	800 kg	Delivery Area	Grid D10	28.5 m	14 m	2 leg 8mm chain sling 2m leg length	2000 kg	7.5 kg	Double wrap choke hitch	
Finishing Plaster (10 bag pack)	300 kg	Compound	Grid A6	25 m	14 m	Forks	2000 kg	180 kg	Use net to prevent falling objects	

Crane Details	
Make	Vanson
Model	VC33
Height under Hook	20.0 m
Maximum Radius	33.0 m
SWL at Maximum Radius	1000 kg
Maximum SWL	3000 kg
Radius at Maximum SWL	13.3 m

Notes

1. Additional items may be added but must be countersigned by the Appointed Person
2. A separate Lifting Schedule should be completed for each crane
3. The following hazards should be taken into account when completing the Lifting Schedule :-
 - Slinging difficulties
 - Top heavy
 - Sharp edges
 - Other hazards identified

Annex D – Example of a Method Statement Format (Lift Plan)

CPA SETC Lifting Risk Assessment/Method Statement

Job No.		Date of Risk Assessment:	
Appointed Person carrying out the Assessment:		Time of Assessment:	
Customer:			
Office contact:		Phone:	Fax:
Site contact:		Phone:	Fax:
Site address:			

Details of Loads - See separate Lifting Schedule

Details of Crane

Make:		Max In-Service Wind Speed:	m/s
Model:		Outrigger Load:	tonne
Height under Hook:	m	Spreader Area:	m ²
Maximum Radius:	m	Spreader Dimensions:	
SWL at Maximum Radius:	tonne	Resultant Ground Pressure:	tonne/m ²
Maximum SWL:	tonne	Ground Bearing Capacity:	tonne/m ²
Radius at Maximum SWL:	m	Calculated Factor of Safety (> 2) :	
Jib Configuration:	Luffing/Flat		

Electrical Power Supply

Mains/ Generator:		Single/Three Phase:	
Voltage:	V	Capacity:	kVA
Max Current:	A	Distance crane to supply:	m

Ground Conditions (Visual assessment)

Access/egress for crane & transport:	
Lifting position:	

Lifting Accessories – List all available on site on separate Lifting Accessory Register

Identification of Hazards

Proximity Hazard	Present ?	Proximity Hazard (cont.)	Present ?
Overhead power lines	Yes / No	Confined working area	Yes / No
Other overhead obstacles	Yes / No	Restricted access - width	Yes / No
Underground services	Yes / No	Restricted access - height	Yes / No
Excavations	Yes / No	Other vehicles	Yes / No
Unstable/ Soft ground	Yes / No	Other hazards identified	Yes / No
Hazardous chemicals/materials	Yes / No		
Oversailing Issues			
Have any restrictions on oversailing been shown on the site plan?			
What is the crane's overnight configuration?			
Is a zoning system required ?			

Assessment of Risk

Note: All hazards identified above must be considered and if the residual risk is not acceptably low the assessment must be repeated using different or additional controls.

Hazard	Risk (Low, Med, High)	Personnel Affected	Controls Applied	Residual Risk (Low, Med, High)

Method Statement

Personnel

The following personnel will be involved in carrying out the lifting operation. The duties of these people will be as defined in British Standard 7121:-

Title	Name	Title	Name
Appointed Person		Slinger(s)	
Crane Supervisor (s)		Signaller(s)	
Crane Driver(s)		Crane Erectors	

Note: The Appointed Person may decide that one person, can carry out more than one duty. This does **not** however, include the crane driver who must concentrate on operating the crane.

Weather Conditions

The Appointed Person or, in his absence, the Crane Supervisor, will ensure that the lifting operation only takes place if the weather conditions are within the limits recommended by the crane manufacturer.

Ground Conditions

Have checks/calculations been completed to ensure that the maximum outrigger/base loads can be safely accepted by the ground?

Yes/No

Installation (Erection, reconfiguration or dismantle) Sequence

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	

Appointed Person's Acceptance of Responsibilities

I confirm that the lifts have been planned and will be carried out in accordance with current legislation and British Standard 7121 and that I accept responsibility for the preparation of this Risk Assessment and Method Statement.

Signed:

Date:

Crane Supervisor's Acceptance of Duties

I confirm that I have been fully briefed on the contents of this Risk Assessment and Method Statement and that I accept the duty of ensuring that the lift(s) will be carried out in accordance with the method and procedures set out in this document.

Signed:

Date:

Signed:

Date:

Crane Erector's Acceptance of Duties

I confirm that I have been fully briefed on the contents of this Risk Assessment and Method Statement and that I accept the duty of ensuring that the installation will be carried out in accordance with the method and procedures set out in this document.

Signed:

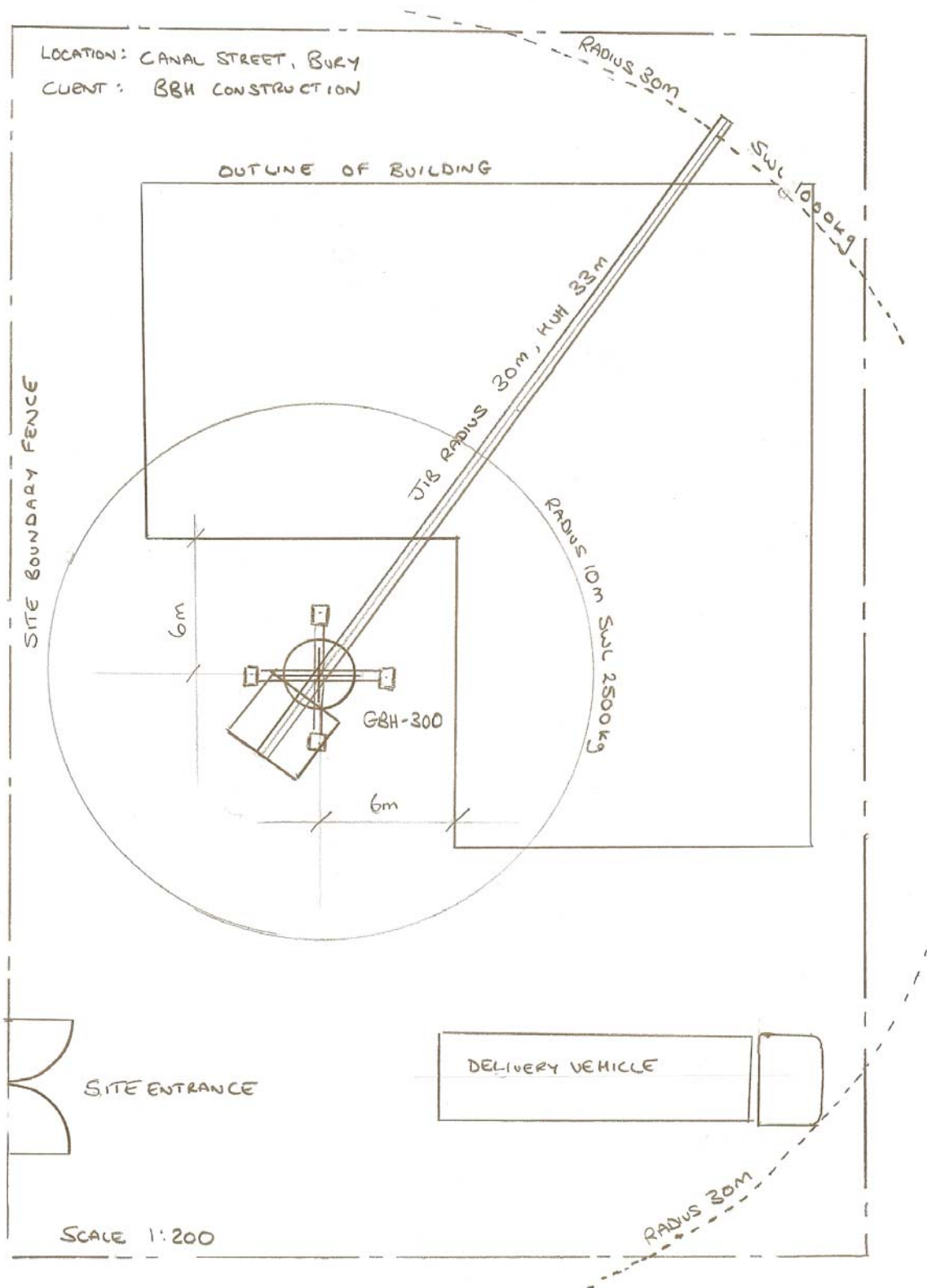
Date:

Signed:

Date:

Site Plan Showing Position of Cranes and Loads

Site	Canal Street Bury	Job Number	BBH/003
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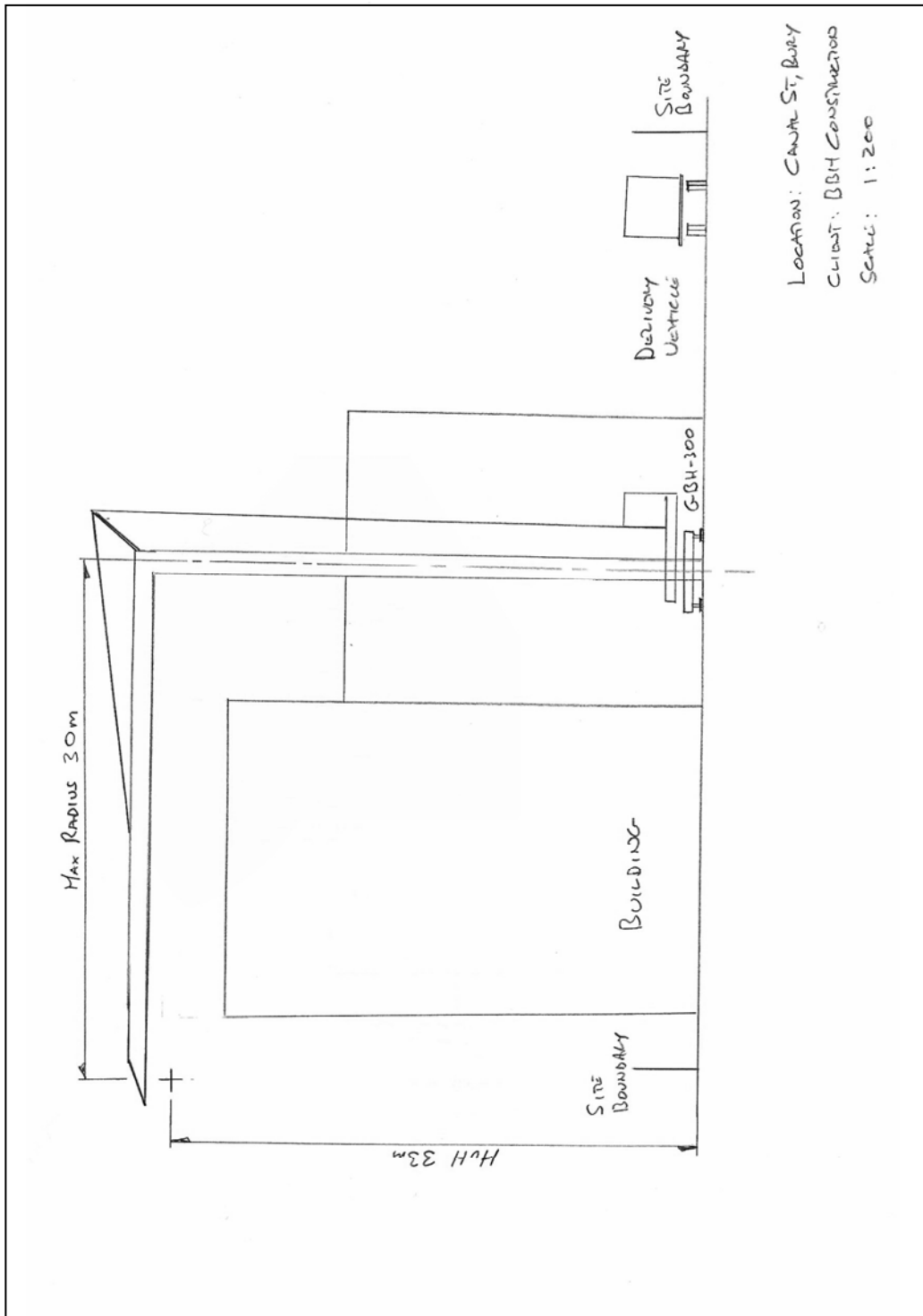


Appointed Person's Signature: Charles Crane

Date: 3/4/06

Elevation Showing Position of Cranes and Loads

Site	Canal Street Bury	Job Number	BBH/003
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Appointed Person's Signature: Charles Crane

Date: 3/4/06

Annex E – Example of a Lifting Accessory Register

Lifting Accessory Register							
Site Location	Canal Street, Bury	Employing Organisation	A & B Construction	Appointed Person	F Bloggs	Contact Telephone No	0161 953 8765
	Description	SWL	Weight	Ident. No.	Location	Date of Last Thorough Examination	Date of Next Thorough Examination
1.	Crane Forks	2000 kg	180 kg	S32869	Compound	13.11.05	13.05.06
2.	Crane Forks	2000 kg	180 kg	S32755	Compound	02.12.05	02.06.06
3.	Violet web sling 2m long with choker hooks	1400 kg	4 kg	W22228	Ganger Box	23.01.06	23.07.06
4.	2 leg 8mm chain sling 2 m leg length	2000 kg	7.5 kg	K26977	Ganger Box	19.12.05	19.05.06
5.	4 leg 10mm chain sling 2.5m leg length	4750 kg	31 kg	K17396	Ganger Box	19.12.05	19.05.06

Annex F – Example of Daily Check List

Self Erecting Tower Crane Daily Check List				
Location:				
Make:		Model:		Serial / Plant No.:
Item	Description	<input type="checkbox"/> or <input type="checkbox"/>	Comments	
1.	Checks as required by the manufacturer's handbook			
2.	Cleanliness and general signs of damage			
3.	Lubrication as required by the manufacture's handbook			
4.	Visual check of the ground supporting the base			
5.	Visual check of packers/ grillages			
6.	Visual check that the base is level			
7.	Visual check of the chassis and outriggers			
8.	Visual check of base fencing			
9.	Visual check of the condition of the power supply cable			
10.	Visual check of wire ropes, anchorages and hook block			
11.	Check of the wire rope spooling on the winch drums			
12.	Check levels of the engine cooling-water and lubricating oil (if fitted)			
13.	Check security of any pin locating arrangements and visible damage to the structure			
14.	No load operation of the crane motions to check correct functioning of motors and brakes and for movement under outriggers during slewing			
15.	Check for correct functioning of controls and safety devices			
Check By:		Signature:		Date:

Annex G – Example of a Foundation Completion Form

Tower Crane Foundation Approval/Completion Certificate			
Site Details :			
Crane Details			
Make:		Model:	
Height under Hook:		Jib Length:	
Base Type:			
Foundation/Grillage Design			
Document and Drawing References:			
Design Carried Out By:			
Company:			
Foundation/Grillage Design Approval			
Design Approved By:			
Signature:			Date:
NOTE: A separate approval/completion certificate is required for each tower crane			
Permit To Erect			
I confirm the tower crane foundation has been constructed to the specifications detailed above, the foundation anchors/base pads are level and plumb as specified, and that the tower crane may be erected.			
Signature:			Date:
Name:		Position:	
NOTE: The tower crane cannot be erected until the completed form is returned to the Operations Department			

Annex H – Guidance on the Lifting of Persons

H.1.0 General

Raising and lowering of personnel by a SETC that is not specifically designed for this purpose should only be carried out in exceptional circumstances, when it is not practicable to do so by other less hazardous means (e.g scaffolding, mobile elevating work platform, mast climbing work platform).

Careful planning of the event should be carried out prior to each raising and lowering operation.

NOTE 1 Attention is drawn to LOLER [1] regarding the planning of lifting operations.

NOTE 2 Further details on raising and lowering personnel are given in ISO 12480-1 & BS EN 14502-1.

H.2.0 Carrier

The type of carrier selected when raising/lowering personnel should depend on a risk assessment and varies according to the application, for example construction, forestry, rescue. New carriers should comply with BS EN 14502-1

H.3.0 Compatibility of carrier and crane

H.3.1 Capacity

The crane selected to lift the carrier should have a rated capacity on the fixed load lifting attachment of at least twice the minimum rated capacity of the crane configuration in use.

H.3.2 Motion control system

The crane should be equipped with a motion control system that brings motion to rest automatically when the controls are released.

The crane should be equipped with power lowering. Cranes with free-fall capability should not be used to lower and raise persons unless the free-fall facility is locked out.

Load bearing hydraulic cylinders should be fitted with a device to stop movement in case of hose rupture or pipe fracture.

The crane control system should be able to provide a smooth transition of the carrier. The working speed of the carrier should be limited to a maximum of 0.5 m/s on all motions.

Means should be provided so that if the power supply or control system fails, the carrier can be positioned to enable access/egress without risk.

H.3.3 Ropes

Ropes used for hoisting and lowering the carrier should have a minimum diameter of 8 mm.

H.3.4 Hook

The crane hook should be provided with a safety catch.

H.3.5 Lifting Accessories

Lifting accessories used to connect the carrier to the crane hook should :-

- require a tool to make or break any connection to the carrier and masterlink;
- only to have been used previously for the lifting of persons;
- have a masterlink sized to fit the crane hook.

H.4.0 Thorough examination and pre-use checks

Additional recommendations for the thorough examination and pre-use checks of cranes and carriers for lifting persons are given in BS 7121-2:2003, Clause 11.

H.5.0 Other devices/facilities

H.5.1 Anemometer

The crane should be fitted with an anemometer or other device to monitor in-service wind speeds.

H.5.2 Storage

Storage accommodation for equipment, including any emergency egress equipment, should be provided in the carrier.

H.5.3 Rated capacity limiter/rated capacity indicator

The rated capacity limiter/rated capacity indicator on the crane should be maintained in good working order.

Limit switches should be provided to prevent over-hoisting, over-lowering or over-derricking.

The operator should check limit switches for correct operation each day before personnel carrying operations are carried out. Limit switches are not necessarily fail safe and therefore care should be taken if motion limits are approached.

A fail safe procedure should be provided to ensure that sufficient hoist rope remains on the winch drum at all times to prevent the end of the rope running off the drum while lowering the carrier.

To ensure that sufficient rope remains on the drum at all times, the empty carrier should be lowered as a trial to the bottom of the shaft, cofferdam or caisson as follows:

- The first time it is lowered;
- After each time the shaft, cofferdam or caisson depth increases;
- If the crane hoist rope is replaced.

Care should be taken when the crane is moved to different locations to ensure that sufficient rope is fitted for each operation.

Operation of limit switches, check valves and similar devices could prevent some motions of the crane with the carrier still suspended. Precautions should be taken to ensure that persons in the carrier are not left suspended for an excessive period, and/or a procedure for raising or lowering the carrier to a safe position should be provided.

H.6.0 Operation

H.6.1 *Organizational requirements*

Lifting, lowering and supporting the carrier should be carried out by the operator in controlled conditions directed by an appointed signaller.

It is essential that the crane operator is present at the normal crane control station when the carrier is occupied. Visible and audible communication should be possible between the persons in the carrier and the crane operator at all times during the lifting operation. If a wireless control station is used it is essential that it is being worn by the operator whenever the carrier is occupied. The controls must be switched on and the carrier in full view of the operator at all times.

During the operation:

- An adequately trained and briefed person should be present to perform any emergency recovery procedure;
- The crane operator and signaller should not perform any other work at the same time. The crane operator and signaller should only be responsible for operating one crane or directing one carrier;
- Machines should not operate simultaneously in the same place if there could be a risk of collision;
- All movements should proceed gently and not exceed 0.5 m/s.

Carriers should not be used in the following conditions:

- Winds exceeding 7 m/s (25 km/h). Windspeed measurements should be taken using a calibrated handheld anemometer at a similar level to that to which the carrier will be lifted;
- Electrical storms;
- Snow or ice;
- Fog;
- Sleet;
- Other weather conditions that could affect the safety of personnel.

Unintentional rotation of the carrier should be prevented, for example by using guide ropes or anchoring. The means of preventing unintentional rotation should not inhibit any emergency procedures and otherwise interfere with the safe operation of the carrier.

Lifts should not be made on any other hoist lines of the crane while any person occupies a carrier attached to the crane.

The crane, load lifting attachments and carrier should be inspected prior to use every working day.

NOTE For further information on inspections see BS 7121-2. An example of a personnel carrier pre-use check form is given in BS 7121-2:2003, Annex E.

H.6.2 *Precautions for persons in the carrier*

The payload of the carrier should not be exceeded.

The stability of the carrier should not be affected by the operation.

Additional care should be taken if the carrier is of a length that could lead to excessive tilting through movement of persons or tools within the carrier.

It is strongly recommended that all users of carriers wear suitable full body harnesses with work restraint systems attached to a suitable anchorage point in the carrier. The most suitable type of work restraint system is an adjustable lanyard, adjusted to be as short as possible to ensure that a person is restrained within the carrier. Further information on the use of personal fall protection equipment is given in BS 8437.

Consideration should be given to the rescue of persons from carriers if the carrier is unable to be lowered for any reason, such as machine malfunction or carrier entanglement. Any rescue procedure should be properly planned, taking into account the reasons why the carrier is stranded at height and any need for urgent action. In many circumstances the rescue plan simply involves lowering of the carrier by the supporting crane.

In the event that fall arrest equipment is selected, a rescue plan is required to avoid the consequences of suspension trauma when a person is suspended from a fall arrest harness.

Any tools/materials in the carrier should be secured to prevent displacement, tipping and/or falling out.

Personnel should remain entirely inside the carrier during raising, lowering and positioning to avoid pinch points. Personnel should only stand on or work from the floor of the carrier.

Carriers should be secured so that access and egress can be accomplished without danger.

NOTE Crane suspended manriding cages should not generally be provided in lieu of fixed access/egress methods

H.7.0 Work from a carrier

NOTE 1 Exposed electrical conductors in the vicinity of the lifting operation can present electrical hazards. Exposed high voltage conductors can cause electric shocks or burns even if not touched by personnel. If there are electrical conductors adjacent to the work area, seek advice from the owner of the conductor. Overhead lines usually belong to the local electricity supplier or the National Grid company. These suppliers can provide advice on safe working distances from electrical conductors.

If electric arc welding is carried out from a carrier, precautions should be taken to prevent stray welding return currents from flowing through the load lifting attachments, crane hoist rope, or other part of the crane. Electric arc welding should be carried out in accordance with HS G 118 [23]. The return welding current lead should be secured to the welded part, as close as practicable to the point of the weld.

NOTE 2 Complete insulation of the crane hoist rope or use of clean dry webbing lifting attachments can also prevent stray currents.

Electric powered hand tools, if used, should be battery powered.

Power cables provided to the carrier should not interfere with safe operation of the carrier.

Power cables should not be used as steady lines.

Annex I – Examples of Bad Practice



Excavation too close to outrigger and track (See 5.3)



Insecure packing under outriggers (See 5.3)



Duty board not in English (See 6.1)



Lack of base fencing (See 5.2)