



# **Safe Use of Top Slew Tower Cranes**



**CPA Best Practice Guide**

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## CPA Best Practice Guide



**Working in Partnership**

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## Foreword

The Construction Plant-hire Association has, for a quarter of a century, been in the vanguard of tower crane safety. This first edition of the CPA's Best Practice Guide on the Safe Use of Top Slew Tower Cranes confirms to all connected with tower cranes, the Association's continued and dedicated commitment to safety and training.

There are alas, still too many accidents in our industry. This totally unacceptable situation can only be changed by a combination of training, experience and, above all awareness to risk, of all those involved in the use of tower cranes. Continuing advances in technology help to improve the safe operation of tower cranes but it must never be forgotten that it is effective planning and control of the lifting operation that above all ensures success.

This guide covers the whole of the lifting operation from the tower crane user's perspective. It sets out to provide guidance in an easily assimilated form, paying particular attention to the duties of the whole lifting team, the hazards involved in tower crane operation and precautions to be taken if accidents are to be avoided.

On behalf of its members and in particular the tower crane owners within the CPA Tower Crane Interest Group, the Association wishes to express its thanks to the Working Party for their hard work and expertise in the drafting process.

This guide, encapsulating the essentials of BS 7121 "Safe Use of Cranes" Parts 1, 2 and 5, is a must for every user of tower cranes.

In addition to this guide, the CPA Tower Crane Interest Group has produced an A6 pocket guide which provides a ready source of reference for the tower crane operator.

I thoroughly recommend both documents to you.

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

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

## 1.0 Introduction

Top slew tower cranes (TSTCs) have for many years been one of the primary means of lifting and placing materials on construction projects and often have a disproportionate effect on the smooth delivery of the construction programme. It is consequently of vital importance that they are installed and used correctly to ensure that both the safety of people and the efficiency of the construction process is maintained.

The purpose of this Best Practice Guide is to provide tower crane users with guidance on the safe, erection, use, maintenance, thorough examination and dismantling of TSTCs, together with the management and planning of these activities. The erection, alteration and dismantling of TSTCs is normally carried out by the TSTC owner or supplier, consequently the guide concentrates on the use of a TSTC for lifting operations once it has been erected on site and only deals with those aspects of erection, alteration and dismantling which interface with, or are the responsibility of, the user.

The CPA Tower Crane Interest Group has produced a series of Technical Information Notes (TINs) giving guidance on specific aspects of tower crane operation. These TINs, which are continually being updated and added to, are referenced throughout this document and are available as free downloads on the CPA website at [www.cpa.uk.net](http://www.cpa.uk.net)

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 2007 (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.

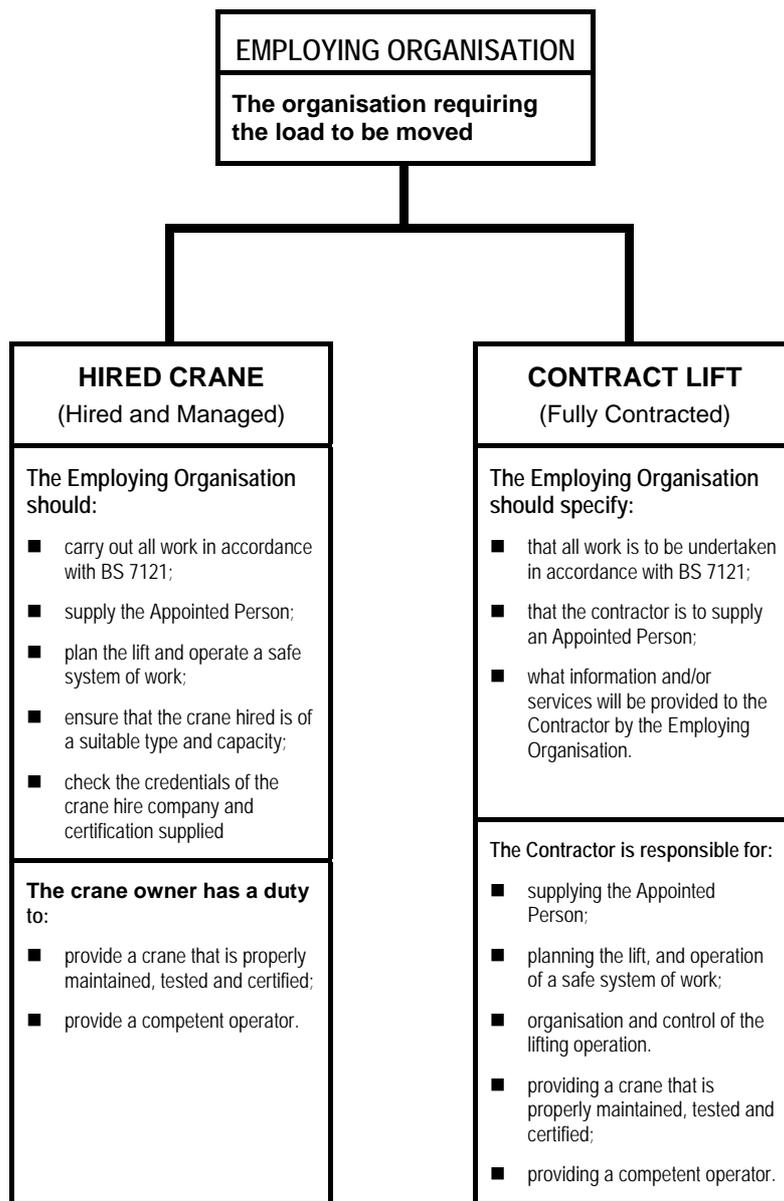
## 2.0 Types of Hire Contract

### 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, organisation, control and management of lifting operations is not compromised. In general, any organisation 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 organisation 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 organisations 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 organisation 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 organisation;
- All information or services provided by the employing organisation 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 organisation to work in accordance with the BS 7121 series including, where appropriate, authority to control and instruct the employing organisation's personnel.

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

Before entering into a contract, the employing organisation 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 organisation (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 organisation, 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 organisation 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 organisation

Therefore, if an individual or organisation 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 organisation (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. (See **TIN 019**)

### 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 Construction (Design and management) Regulations 2007 place specific duties on Clients, Designers and Principal Contractors to ensure that work on construction projects is planned so that it can be carried out safely. The use of a TSTC should be considered during pre-tender planning of lifting operations. A checklist to assist with this process is included at **Annex L**.

The siting, erection, use, alteration, dismantling and removal from site of a TSTC 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” (see **Section 4.1**).

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

- Delivery to site, erection, alteration 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 TSTC 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;

- Ensuring that adequate first aid and welfare facilities are available on site at all times;
- Taking account of any possibility of lone working.

### **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.

Certain lifting operations require particular care and attention. Further advice can be found in BS 7121 Part 5. The appointed person should be familiar with these and plan the lift accordingly.

These operations include:

- lifting of persons (See **Annex H**);
- blind lifting (See **Annex J**);
- operating in hazardous environments (chemical, nuclear, power stations etc).

***Tower cranes should not be used for tandem or multiple lifting, demolition or piling duties.***

### **3.2 Site surveys**

The planning of delivery to site, erection, alteration and dismantling of a TSTC will require 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 TSTC, 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 TSTC 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;
- Height and maximum radius.

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

### **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 (including the Principal Contractor) 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 Duties of Personnel Involved in Lifting Operations**

The Health and Safety at Work, etc Act 1974 demands that employers have safe systems of work, so that their employees are protected from any risk, so far as is reasonably practicable. Using tower cranes without a safe system of work is a breach of this Act.

The British Standard Code of Practice for the Safe Use of Cranes, BS 7121 Part 5, gives advice to organisations requiring lifting operations to be carried out with tower cranes and on ways of meeting their legal obligations. It also details who is responsible and what their duties are.

It is a requirement of the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER 98) and BS 7121 Part 5 that one person should be appointed to have overall control of each lifting operation to ensure that it is carried out safely.

### **4.1 *The Duties of the Appointed Person***

The appointed person is nominated by management of the user organisation (generally the Principal Contractor) to be in overall control of the lifting operations and the members of the lifting team. This person must have had training, experience, and be competent.

His duties include ensuring that:

- the lifting operation is properly planned and carried out;
- a suitable and sufficient risk assessment is carried out to evaluate the hazards associated with the lifting operation and identify control measures;
- planning is recorded in a lift plan which is effectively communicated to all members of the lifting team;
- accurate weights, radii, heights, etc are established;
- suitable tower cranes, lifting accessories and other equipment are selected ;
- suitable access is provided to unload and store materials within the operating area of the tower crane;
- competent, properly trained personnel are provided and that they are fully briefed;
- all tower cranes, lifting accessories and other equipment are properly maintained, inspected, examined and tested (when necessary);
- appropriate steps are taken to exclude persons not directly involved with the lift from the lifting zone using barricades etc.

The appointed person needs to appoint a tower crane supervisor to be present throughout the lifting operation in order to control it and ensure that it is carried out in accordance with the planning. The appointed person may choose to act as the tower crane supervisor. The tower crane operator must know who the tower crane supervisor is and, if they have any problems whilst on site, they should consult him.

The appointed person retains overall responsibility for the lifting operation and has the authority to stop the lifting operation at any time if it is considered that there is a risk to safety. If the appointed person is not present, then this authority passes to the tower crane supervisor.

It is not appropriate for the tower crane operator, to be in control of the lifting operation because he has to concentrate on the control of the tower crane during lifting.

On multi-crane sites the appointed person should appoint a crane co-ordinator for the site and a crane supervisor for each crane.

Figure 2 shows the relationship between members of the “Lifting Team”

#### **4.2 The Duties of the Crane Co-ordinator**

The crane co-ordinator’s duties include:

- planning and directing the sequence of operations of tower cranes to ensure that they do not collide with other cranes, loads and other equipment (e.g. concrete placing booms, telehandlers, and piling rigs).

#### **4.3 The Duties of the Tower Crane Supervisor**

The tower crane supervisor's duties include:

- ensuring that the tower crane and other equipment are in accordance with the lifting plan prepared by the appointed person;
- ensuring that sufficient personnel are available to safely carry out the lifting operation;
- ensuring that the conditions on site are the same as those identified by the lifting plan;
- reporting back to the appointed person if there are any problems;
- briefing the personnel before the lifting operation begins;
- supervising and directing the slinger, signaller and tower crane operator;
- only lifting items that have been detailed in the lifting plan;
- stopping the operation in the event of any risk to safety.

For some basic lifting operations the slinger/signaller may, with appropriate authority and training, act as the crane supervisor. Crane supervisors should not act as a slinger/signaller unless they are trained and competent to do so. (This generally means holding a CPCS slinger/signaller qualification).

#### **4.4 The Duties of the Tower Crane Operator**

The tower crane operator's duties include:

- establishing who is in charge of the lifting operation and the other members of the team and their roles;
- establishing which signalling system is to be used and following instructions from only one nominated signaller at a time;
- stopping operations if given any instructions that would take the tower crane outside its permitted duties;
- informing the crane supervisor if any problems arise which would affect the lifting operation;
- carrying out the daily checks and weekly inspections;
- carrying out specified maintenance in accordance with the manufacturers and employer’s instruction and training;
- using the tower crane to lift only the loads that are identified in the lift plan.

If the tower crane operator believes that the operation they are being asked to carry out is unsafe, they should initially speak to the crane supervisor or appointed person. In the event that there is a disagreement between the operator and the crane supervisor or appointed person the operator should notify his employer.

#### 4.5 The Duties of the Slinger

The slinger's duties include:

- attaching and detaching the load to and from the tower crane;
- using the correct lifting gear in accordance with the lifting plan or procedure;
- visually checking the lifting gear for damage before use;
- initiating and directing the movement of the load by giving the appropriate signals;
- to place the load safely.

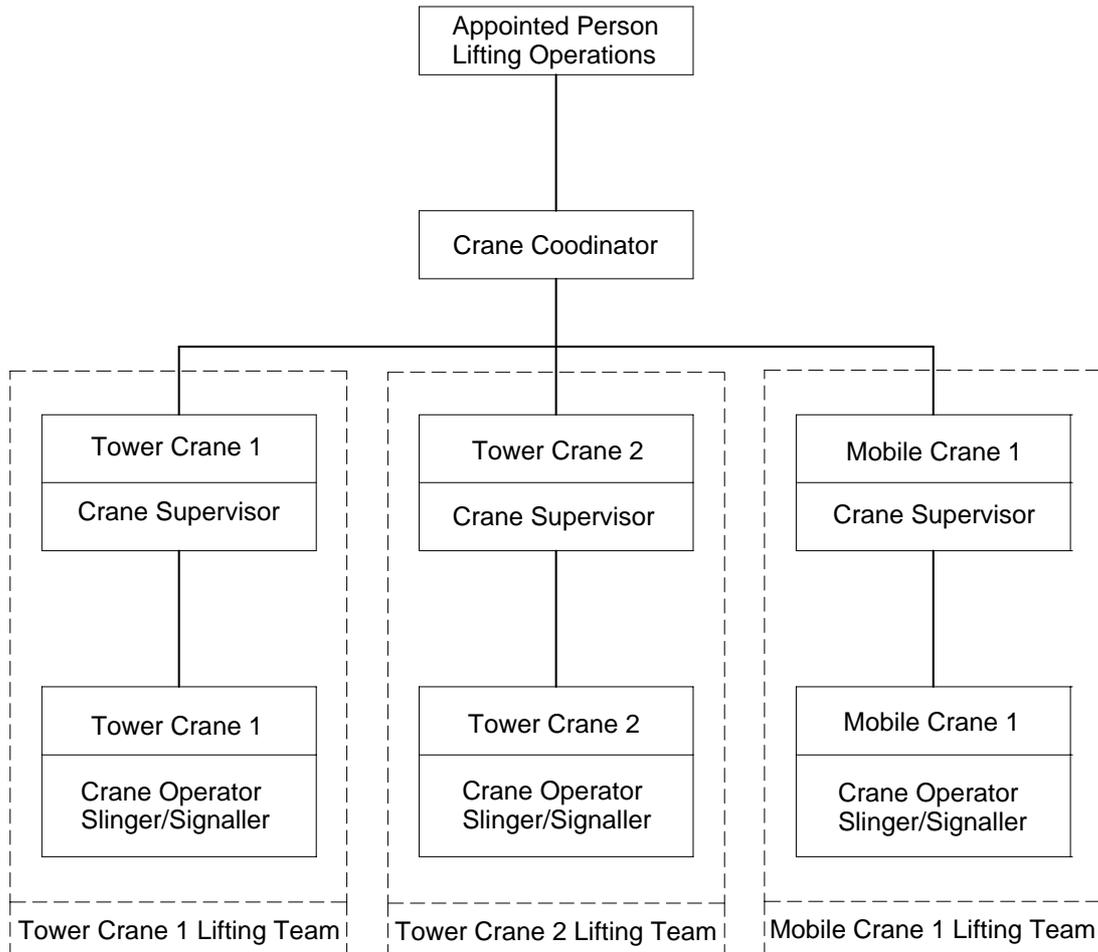
On some occasions the appointed person may ask the slinger to act as the signaller.

#### 4.6 The Duties of the Signaller

The signaller's duties include:

- relaying signals from the slinger to the tower crane operator.

**NOTE:** The roles of slinger and signaller are generally combined in one person.



**Figure 2 – The Lifting Team**

## 5.0 Training

The Provision and Use of Work Equipment Regulations 1998 require that all persons involved in the installation and operation of a TSTC 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
TSTC Operators	CPCS Accredited Training Provider	CPCS Scheme Category A04A or A04B
Erection, alteration and dismantling	Crane manufacture to crane owner for each model of TSTC CPA/ConstructionSkills Tower Crane Erection Training Scheme	In-house assessment by a competent assessor NVQ Level 2 and 3 Plant Installation (Tower Cranes)
Maintenance	Crane manufacture to crane owner for each model of TSTC	In-house assessment by a competent assessor
Operator familiarisation	Crane owner to operator for each model of TSTC	In-house assessment by a competent assessor
Appointed Person	CPCS Accredited Training Provider	CPCS Scheme Category A61
Crane Supervisor	CPCS Accredited Training Provider	CPCS Scheme Category A62
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 TSTC	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 at <a href="http://www.citb-constructionskills.co.uk/cardschemes">www.citb-constructionskills.co.uk/cardschemes</a></i></p>		
<p><b>In addition to initial assessment on appointment/employment, arrangements should be made to reassess/review personnel's competence at periodic intervals.</b></p>		
<p><b><i>Operator Familiarisation</i></b></p> <p>Tower cranes come in many shapes and sizes with significant differences in control layouts and operating characteristics. It is therefore essential that operators are given adequate familiarisation on an unfamiliar type or model of tower crane before they begin lifting operations. This generally carried out by an experienced person employed by the tower crane owner.</p>		

## 6.0 Siting of TSTCs

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

### 6.1 Clearances

The area chosen must be of a sufficient size to enable the TSTC to be erected, operated and dismantled, with sufficient clearances between the crane and surrounding structures, as detailed in the manufacturer'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.

### 6.2 Ground conditions

All TSTCs rely for their stability on a foundation which transmits the in-service and out-of-service loads into the ground on which they are standing. There are several types of foundation available, the most common being:-

- Concrete foundations with cast in anchors
- Rail mounted ballasted cruciform
- Static ballasted cruciform
- Steel grillage anchored to the permanent structure

Most TSTC manufacturers supply information on the loads imposed by the crane at the base of the tower as:-

- Maximum vertical force;
- Maximum horizontal force;
- Maximum overturning moment;
- Maximum torsional moment due to slewing.

This information may be shown for the maximum in-service and out-of-service conditions. On TSTCs the out of service foundation loads often exceed the in-service foundation loads by a considerable margin.

This loading information should be used by the foundation designer employed by the user, to produce an adequate design, taking into account the ground conditions on site. Wherever a concrete pad, steel grillage, piled foundation or rail track is constructed to accept the loads from a TSTC, 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**.

Assessment of ground conditions must also take into account the position and magnitude of the outrigger loads of any mobile crane used in the erection process.

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 the TSTC foundation, and load spreading arrangements for any mobile crane(s) should be recorded in the method statement by the Appointed Person.

Further guidance on assessment of ground conditions and the design of mobile and tower crane foundations is given in:-

- CIRIA publication C703 - *Crane Stability on Site*.
- CIRIA publication C654 - *Tower Crane Stability*.

### **6.3 Overhead hazards**

When siting a TSTC 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*.

### **6.4 Proximity to railways and airports**

If the TSTC 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 hours of use of the crane. There could also be a requirement to fit warning (obstacle) lights to the top of the crane.

Further guidance on the use of cranes in the vicinity of airfields is given in:-

- *Cranes and planes - A guide to procedures for operation of cranes in the vicinity of aerodromes*. Airport Operators Association (AOA).
- *A voluntary code of practice for the safe use of cranes in and around airports*. Off-highway Plant and Equipment Research Centre.

### **6.5 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.

### **6.6 Access & egress to and from the site**

It is important when siting a TSTC to ensure that there is adequate access to the crane position for both the vehicles carrying the TSTC components and the mobile crane used for erection. 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!

## **6.7 Power supply**

Before the TSTC arrives on site, checks should be made to ensure that there is an adequate mains electricity supply. Most TSTCs require a three phase supply and the TSTC 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 TSTC 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 TSTC. 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 16<sup>th</sup> edition*. Guidance on electrical safety on construction sites is also given in HSE Guidance document HS(G) 141 *Electrical safety on construction sites*.

## **6.8 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 foundation must be sufficient for the extra imposed loads due to out-of-service wind.

TSTCs should be left in free slew when out of service to allow the cranes to "weathervane", to ensure that the out of service foundation loads are not exceeded. On luffing jib TSTCs it is also important that the jib is left at the correct out of service radius (specified by the crane manufacturer, which is not always the **minimum** radius. This will ensure that there is sufficient wind area to enable the crane to "weather vane".

When taking a TSTC out of service on a multi crane sites steps must be taken to ensure that the crane in free slew will not enter the area of other cranes that are still operating.

It is essential that tower cranes are fitted with anemometers or other wind-speed monitoring devices. These should have their indicators located in clear view of the tower crane operator.

The correct operation of these devices should be determined regularly and they should be maintained in good working order. The sensor of the indicator should be positioned so that it can measure air flow uninterrupted by the tower crane or adjacent structures. Sensors are often positioned on the highest point of the tower crane.

The TSTC operator should be encouraged to report the wind speed to their supervisor on site on a regular basis. Where the wind speed is rising this will give the opportunity to plan concrete deliveries etc before the crane has to be taken out of service.

All operating personnel should be aware of windspeed action levels for the particular crane in use (See **TIN 020**). (See also **7.4**)

### **6.9 Lightning protection**

Lightning protection should be provided for all TSTCs erected on site. 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 TSTC 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.

### **6.10 Floodlights and Decorations**

It is not recommended that TSTCs are used for mounting flood or decorative lights unless both the lights and installation are approved by the crane manufacturer (See **TIN 011**).

### **6.11 Duty Boards**

The Duty Board, normally located at the base of a tower crane tower, is an extremely important source of information for all those associated with the use of tower cranes on site. The board is specific to the individual tower crane and should contain the following information for the crane in its current configuration:-

- Make
- Model
- Serial Number
- Owners Number
- Weight of Base Ballast
- Weight of Counter Ballast
- Height under Hook
- Jib Length
- Capacity at Minimum Radius
- Capacity at Maximum Radius
- Owner's name and emergency contact number

Further information is contained in **TIN 007**

### **6.12 Safe access to and from TSTCs**

Safe access to and from the base and cab of a TSTC is of primary importance for the operator. Principal Contractors should complete a risk assessment as to the route and means of access to the base or point of access on the mast of the crane. Adequate access means must be put in place to mitigate the risks identified by the risk assessment. The following points should be born in mind when considering access:-

- Clear access to the TSTC base is essential to enable daily checks, inspections, maintenance and thorough examination to be carried out. Bases must be kept free from water and debris at all times;
- On high rise structures TSTC access is sometimes provided from the structure as the building progresses to reduce the distance and climbing time to the TSTC cab. In such a case it is essential that any access is designed to provide adequate strength and fall protection. Under no circumstances should the

access be fixed to both the TSTC tower and the adjacent structure as this will prevent the tower from deflecting and may well cause the access to collapse;

- A TSTC tower must always have a clearance from adjacent structures of at least 0.5m in all directions to allow for tower deflection.
- Lone workers should not be allowed to access TSTCs unless a site specific risk assessment has been undertaken and adequate control measures put in place.

Unlike scaffolds and working platforms, tower cranes on construction sites are complex machines, which present additional hazards to people accessing the tower crane structure, once it has been commissioned. It is therefore appropriate to designate tower cranes as places of controlled access (See **TIN 001**, **TIN 003**, **TIN 006**, **TIN 012** and **TIN 015**).

### **6.13 Anti collision systems**

On multi-crane sites, tower cranes are often fitted with anti-collision systems to warn of potential clashes between the jibs and hoist ropes of adjacent tower cranes. Anti-collision systems should be regarded as an aid to operator vigilance and not as a foolproof system. It should be borne in mind that an anti-collision system will only warn the operator of the proximity of other tower cranes, it will not warn of the proximity of other high reach mobile plant such as mobile cranes, crawler cranes and concrete placing booms.

Anti collision systems should not be relied on exclusively in place of the primary safe system of work including the crane coordinator, operator vigilance and crane to crane communication using anti-collision radios. Consideration of the need for a safe system of work to avoid collisions between adjacent tower cranes and other high reach mobile plant should be made during planning at tender stage (See **TIN 010**).

#### **NOTE:**

- Anti collision systems should be subjected to daily function checks before lifting operations are started.
- The appointed person should periodically confirm and check that the anti-collision systems are both functional and sufficient.

### **6.14 Anti collision radio systems**

In multiple tower crane installations it is essential to have an anti-collision radio system installed. This comprises of a separate radio in each tower crane cab operating on a unique frequency to allow open unimpeded communication between all tower crane operators. In the event of the jib or counter jib of one crane approaching the hoist rope of a higher crane the operator of the higher crane can immediately warn the operator of the lower crane (See **Annex 1 - TIN 017**).

#### **NOTE:**

- Anti collision radio systems should be subjected to daily function checks before lifting operations are started.
- The appointed person should periodically confirm and check that the anti-collision radio systems are both functional and sufficient.

### **6.15 Zoning systems**

Some tower cranes are fitted with working space limiters or “zoning devices”. These prevent the load and/or parts of the tower crane from entering a prohibited place such as a railway line.

#### **NOTE:**

- Zoning systems should be subjected to daily function checks before lifting operations are started.

- The appointed person should periodically confirm and check that the zoning systems are both functional and sufficient.

### **6.16 Radio communication systems**

Tower cranes often work on congested construction sites where the signaller is out of sight of the tower crane operator and the standard hand signals specified in BS 7121 cannot be used. As an alternative, hand held VHF/UHF radios are often used. This however, can lead to a number of problems which may interfere with the clear communication vital for safe lifting operations:-

- Loss of signal and thus communication, leading to loss of control of the lifting operation;
- Interference from radios on adjacent sites, which can lead to loss of communication or directions being given to the wrong tower crane operator;
- Misunderstanding between the tower crane operator and the signaller, leading to problems such as a load being lifted before the slinger has his hands clear, loads colliding with the building structure and the load being lowered before people are clear of the landing area.

Further details on radio communications, including call signs and standard commands are given in **Annex I (TIN 017)**.

### **6.17 Written plan (method statement or lifting 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.

### **6.18 Further guidance**

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

- BS 7121 *Code of practice for safe use of cranes* – Part 1:2006 *General* and Part 5:2006 *Tower Cranes*.
- CIRIA publication C654 - *Tower Crane Stability*.
- CIRIA publication C703 - *Crane Stability on Site*

## 7.0 TSTC Operation

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

### 7.1 *Manuals and signs*

All operations should be carried out in accordance with the manufacture's operating instructions, a copy of which should be with the crane at all times (these may be the appropriate section of the full manual. 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. General information for operators is contained in the CPA's *Tower Crane Operator's Handbook*. (See *Bibliography*)

### 7.2 *Rated capacity*

The rated capacity of a TSTC 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 failure can occur.

Tag lines should be attached to loads where movement of the load during the lifting operation may be hazardous. (See **TIN 022**)

### 7.3 *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 (see **Annex J**).

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.

### 7.4 *Wind and taking the crane out-of-service*

The wind forces exerted on a tower crane and any load suspended from it, may well be quite large and affect the safe handling of the crane and the load. It is not always appreciated that these forces are due to wind pressure, not wind speed, and that wind

pressure varies as the square of the wind speed. Consequently if the wind speed doubles, the wind pressure increases by a factor of **four** times. This means that a small increase of wind speed can have a significant effect on the safe operation of the tower crane.

The tower crane's manual will specify the maximum wind speed at which the tower crane is to be taken out of service and the precautions to be taken when putting the tower crane in the out of service condition. These must be observed at all times.

It must be emphasised that the wind speed given in the tower crane manual, at which the crane must be taken out of service is a maximum and that the operator may decide to take the crane out of service at a lower speed due to the type of load being lifted or difficulty in controlling the crane. ***The operator has the primary responsibility for making the decision, in conjunction with the appointed person or crane supervisor. The operator's decision to take the crane out of service should not be overridden by site management under any circumstances.***

It is important that the operator monitors the wind speed constantly using the anemometer display in the cab. This will give early warning of rising wind speeds and enable him to take action to take the tower crane out of service and descend the tower whilst it is still safe to do so. If the wind is gusting around the limiting wind speed it may be appropriate, following consultation with his supervisor, to remain in the cab whilst establishing if the wind speed is rising or falling.

Putting the crane in the out of service condition generally includes ensuring that the jib is free to "weather vane" when out of service so that the minimum wind area is presented to the prevailing wind. On luffing jib tower cranes it is also important that the jib is left at the correct out of service radius, not the minimum radius, to ensure that there is sufficient wind area to ensure that the crane is able to "weathervane" (See **TIN 020**).

### **7.5 Pedestrian Crane operation**

The operation of TSTCs is occasionally 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 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 TSTCs 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.

### **7.6 Wireless controls**

To prevent unauthorized use, the operator of a TSTC 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.

### **7.7 Health**

A tower crane operator's job is demanding in both skill and concentration. It cannot be carried out properly if the operator is not medically fit, have problems with their eyesight, hearing, or with alcohol or drugs. Employers must ensure that an operator's state of health does not make them a risk to themselves and others working with or near them. If operators have doubts about their fitness, they should speak to their employer and doctor.

BS 7121-5 recommends that evidence that a tower crane operator is medically fit to drive a tower crane should be obtained at not more than 5 yearly intervals.

The Principal Contractor must ensure that arrangements are put in place to allow tower crane operators adequate access to sanitary and washing facilities as required by Schedule 2 of the *Construction (Design and Management) Regulations 2007*. This may be by the provision of relief operators (See 7.9) or by the provision of adequate facilities in or adjacent to the crane cab.

### **7.8 Rest breaks**

The Working Time Regulations require employees to take rest breaks during the working day. It is important that breaks are taken to ensure that employees can maintain concentration and combat fatigue.

Detailed guidance on interpretation of the Working Time Regulations is given in "Your Guide to the Working Time Regulations" which is available on the DTI website at <http://www.dti.gov.uk/employment/employment-legislation/employment-guidance/page28978.html>

**NOTE: Climbing to the operating cab of a tower crane may take some time depending on the height of the crane and sufficient allowance should be made for this in the planning of lifts.**

### **7.9 Operator working hours and resources**

British Standard BS 7121-5:2006 *Code of practice for the safe use of cranes – Tower cranes* says that "Planning should take account of the effect that long working hours can have on the concentration of personnel engaged in the operation of tower cranes and ensure that the work is adequately resourced to allow rest breaks to be taken. Table 1 gives the minimum number of operators required for continuous single shift operation of a given number of tower cranes."

<b>Number of Tower Cranes</b>	<b>Number of Operators</b>
1	2
2	3
3	5
4	6
5	7
6	9

## 8.0 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 F**).

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. All packing pieces should be secured to prevent them from becoming accidentally dislodged;
- 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.

## 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 TSTC.

### 9.2 Working at height

Erection, dismantling or reconfiguration of a TSTC will 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.

### 9.3 Erection

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

- That the erection of tower cranes is carried out by specialist personnel under the continuous control of the erection supervisor.
- That the supervisor is given the authority to stop the operation if he or she considers such action is warranted by ground conditions, weather, obstructions or any other cause.
- That the erection supervisor should be in close liaison with the site management and should carefully consider any comments or warnings that management, any members of the site team, or any other appropriate person or body make.
- 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 of the mobile crane are installed as specified by the Appointed Person;
- That a suitable exclusion zone is established and enforced around the base of the crane to provide protection from falling objects;
- 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 the erection team is fully briefed on the tasks they must complete;
- That pre-erection checks of TSTC components are carried on site (See **TIN 014**);
- 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 a thorough examination of the erected crane is carried out and any defects are rectified before the crane is taken into use;
- That following erection a handover sheet should be completed and signed by the erector and handed to the user (employing organisation);
- That the owner of the crane should familiarise the user's intended operators with the controls, functions and limitations of the TSTC before it is taken into use;
- Ballast weights of TSTCs 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 TSTC 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 the dismantling of tower cranes is carried out by specialist personnel under the continuous control of the erection supervisor.
- That the supervisor is given the authority to stop the operation if he or she considers such action is warranted by ground conditions, weather, obstructions or any other cause.
- That the erection supervisor should be in close liaison with the site management and should carefully consider any comments or warnings that management, any members of the site team, or any other appropriate person or body make.
- 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 of the mobile crane are installed as specified by the Appointed Person;
- That a suitable exclusion zone is established and enforced around the base of the crane to provide protection from falling objects;
- 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 mobile crane to operate as planned. The Appointed Person should be consulted if any significant hazards are identified and appropriate control measures agreed with the Appointed Person;
- That the erection team is fully briefed on the tasks they must complete;
- That before dismantling a full functional check of the crane should be completed;
- Ballast weights of TSTCs 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.

## **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.*
- CIRIA publication C654 - *Tower Crane Stability.*

## **10.0 Maintenance Including Checks and Inspections**

The effective maintenance of a TSTC is an essential part of safe operation. As with all lifting machines the TSTC 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.

Both the user and owner of the tower crane have a responsibility to ensure that the tower crane is maintained in a safe working condition. In practice the maintenance is normally undertaken by the tower crane owner.

TSTCs 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 TSTC 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 TSTC is well drained and kept free of obstructions that would impede access for checks and inspections.

Basic checks and inspections should be carried out in accordance with company instructions and the manufacturer's recommendations, these should be recorded:

- Daily Pre-use Checks - these are carried out at the start of every shift (or day) and include checks such as function of safety devices, tower connections, access ladders etc. (See list in **Annex A.**) and can be carried out without accessing the jib or A frame (See **TIN 016**)
- Weekly Inspections - these are additional inspections to the pre-use checks. (See **Annex B.**)

If there is a defect that affects the safe operation of the tower crane it must be reported and repaired immediately. If it does not affect the immediate safe operation of the tower crane the defect should be reported as required by the tower crane owner's procedures (See **TIN 021**).

### **10.1 Scheduled Lubrication**

Tower crane operators may be required to carry out lubrication of certain items, such as the slew ring bearing or ropes, 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.

### **10.2 Scheduled Maintenance**

It is the responsibility of the user (generally the Principal Contractor) to ensure that all tower cranes are adequately maintained in efficient working order and in a state of good repair. A scheduled preventative maintenance program helps to meet these requirements. The frequency at which the 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 tower crane.

The tower crane owner should inform the Principal Contractor at the time the hire contract is placed of the intervals at which maintenance will take place and the length of time the crane will be taken out of service on each occasion.

### **10.3 Breakdowns**

Breakdowns should be avoided by adequate inspection and preparation of the crane components prior to delivery on site and an effective pre-erection inspection once the components have arrived on site (See **TIN 014**). The replacement of major components on an erected TSTC should be avoided wherever possible and should only be undertaken following a thorough job and site specific risk assessment and the implementation of a safe system of work, including inspection of the work following completion.

### **10.4 Replacement Components**

Replacement components should be in accordance with the TSTC manufacturer's specification.

### **10.5 Housekeeping on Tower Cranes**

All accessible areas of tower cranes should be kept clean and free of loose material at all times. Loose material on walkways and platforms can be both a trip hazard and a falling object hazard, whilst grease and other liquids can cause slips. Care should also be taken to ensure that tower crane cabs are kept free of paper and other combustible materials.

Where stocks of small materials such as grease guns, grease cartridges and gloves are required on the tower crane they should be stored in a secure container mounted securely on the counter jib or other suitable area. (See **TIN 005**)

### **10.6 Raising and Lowering of Small Tools and Materials**

From time to time operators will need to take small tools and various other items up to, and down from, the cabs and machinery decks of tower cranes. It is essential that this is accomplished safely, with minimum risk to the operator and those below.

The primary means of accomplishing this task is by the use of a rucksack worn on the chest of the person ascending the tower (Figure 1). Care should be taken to ensure that loads are light enough not to cause muscular-skeletal problems and small enough to avoid jamming on ladder hoops etc.

If loads are too heavy or bulky to be transferred using the rucksack method, they should be raised using a rope and pulley system following the precautions detailed in **TIN 002**.

### **10.7 Actions in the Event of Defects and Breakdowns**

- All defects that make the tower crane unsafe for use should be recorded and immediately reported to both the tower crane owner and site's appropriate representative (such as service manager, site manager, crane supervisor or appointed person), and work with tower crane should cease. Steps should be taken to ensure that the tower crane cannot be used by others in the absence of the nominated operator;
- All other defects should be recorded and reported as soon as possible;
- All breakdowns should be reported promptly to the tower crane owner and steps should be taken to ensure that the tower crane cannot be used by others in the absence of the nominated operator;

- Following a breakdown or identification of a significant defect, steps should be taken to ensure that the tower crane cannot be used until repairs have been carried out or the defect has been assessed by a competent person;
- Repairs or adjustments should only be carried out by authorised persons;
- The record of all defects and breakdowns should be signed by the person rectifying the defects and breakdowns on completion.

### **10.8 Further guidance**

Further detailed guidance on the maintenance of TSTCs is given in:-

- *Best Practice Guide on the Maintenance and Thorough Examination of Tower Cranes* – Construction Plant-hire Association (Available April 2008)

## 11.0 Thorough Examination

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

- After erection on a new site and before it is taken into use;
- At regular intervals (a period not exceeding 12 months, if persons are not lifted, or 6 months if persons are lifted);
- 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.

Reports of thorough examination should contain the details required by Schedule 1 of LOLER (See **Annex K**) including details when testing was last carried out on the tower crane, (this may include: non destructive testing, overload testing, testing of the rated capacity indicator with loads).

Thorough examinations should be carried out by persons who are sufficiently independent and impartial, and are separate from the erection team.

### 11.1 Thorough Examination of Lifting Accessories

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

### 11.2 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*
- *Best Practice Guide on the Maintenance and Thorough Examination of Tower Cranes – Construction Plant-hire Association (Available April 2008)*





## **Annex B - Weekly Checks**

Weekly checks must be made in addition to the daily checks listed in Appendix 1 and should include everything on the following list. There may be additional checks required by the tower crane owner based on advice given to them by the manufacturer of the crane. The results of these checks should be recorded in an appropriate form.

1. Counter jib components
2. Counter jib access
3. Counter jib ballast security
4. Illuminated sign condition and security
5. Oil leaks on motors and gearboxes
6. Control enclosure condition and security
7. Slew ring teeth and lubrication
8. Hoist rope condition
9. Hydraulic fluid levels
10. Rope lubrication

## **Annex C - 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 organisation***

person or organisation 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 organisation'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.

### ***top slew tower crane***

tower crane with a slewing jib located at the top of a vertical tower which is assembled on site from components

### ***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”.

***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 D – 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	Storage 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	Storage 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		
1.8m MKII Soldiers ( 21 No.)	800 kg	Formwork Compound	Grid D10, D11 & D12	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	Storage Compound	Grid A6, B9 & C12	25 m	14 m	Forks	2000 kg	180 kg	Use net to prevent falling objects	
LOGIK 60 Panel 2.7m x 2.4m	400 kg	Formwork Compound	Grid D10, D11 & D12	28.5m	14 m	2 leg 8mm chain sling 2m leg length	2000 kg	7.5 kg	Check windspeed before lifting. Max windspeed 20mph	

<b>Crane Details</b>	
<b>Make</b>	Wolff
<b>Model</b>	100EC
<b>Height under Hook</b>	20.6 m
<b>Maximum Radius</b>	35 m
<b>SWL at Maximum Radius</b>	2.7 tonne
<b>Maximum SWL</b>	6.0 tonne
<b>Radius at Maximum SWL</b>	18.8 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 E – Example of a Method Statement (Lift Plan) for In-Service Lifting Operations

### CPA TSTC Lifting Risk Assessment/Method Statement

Job No. <i>BBH/003</i>		Date of Risk Assessment: <i>9/4/07</i>	
Appointed Person carrying out the Assessment:	<i>Charles Crane</i>	Time of Assessment: <i>09:45</i>	
Customer: <i>Narrow Boat Construction</i>			
Office contact:	Phone:	Fax:	
Site contact: <i>John Doe</i>	Phone: <i>01234 567891</i>	Fax:	
Site address: <i>Canal Street, Bury</i>			

**Details of Loads** - See separate Lifting Schedule

#### Details of Crane

Make:	<i>Wolff</i>	Max In-Service Wind Speed:	<i>20 m/s</i>
Model:	<i>100EC</i>		
Height under Hook:	<i>20.6 m</i>		
Maximum Radius:	<i>35 m</i>		
SWL at Maximum Radius:	<i>2.7 tonne</i>		
Maximum SWL:	<i>6.0 tonne</i>		
Radius at Maximum SWL:	<i>18.8 m</i>		
Jib Configuration:	<i>Luffing/Flat</i>		

#### Electrical Power Supply

Mains/ Generator:	<i>Mains</i>	Single/Three Phase:	<i>Three Phase</i>
Voltage:	<i>400 V</i>	Capacity:	<i>44 kVA</i>
Max Current:	<i>63 A</i>	Distance crane to supply:	<i>36 m</i>

#### Ground Conditions (Visual assessment)

Access/egress for transport:	<i>Site roads prepared with hardcore</i>
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**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	Personnel working under lifting path	
<b>Oversailing Issues</b>			
Have any restrictions on oversailing been shown on the site plan?		No	
What is the crane's overnight configuration?		Free Slew	
Is a zoning system required?		No	

## 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)
Personnel working under lifting path	Med	All	Planning of path of lift away from personnel. Use of nets on loose loads. Double wrapping of bundles of material such as scaffold tubes.	Low

## 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	Charles Crane	Crane Driver(s)	Andy Driver
Crane Coordinator	Klaus Koordinator	Slinger(s)	Sid Slinger
Crane Supervisor (s)	A Foreman	Signaller(s)	

**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

#### Maximum In-Service Windspeed

20 m/s

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.

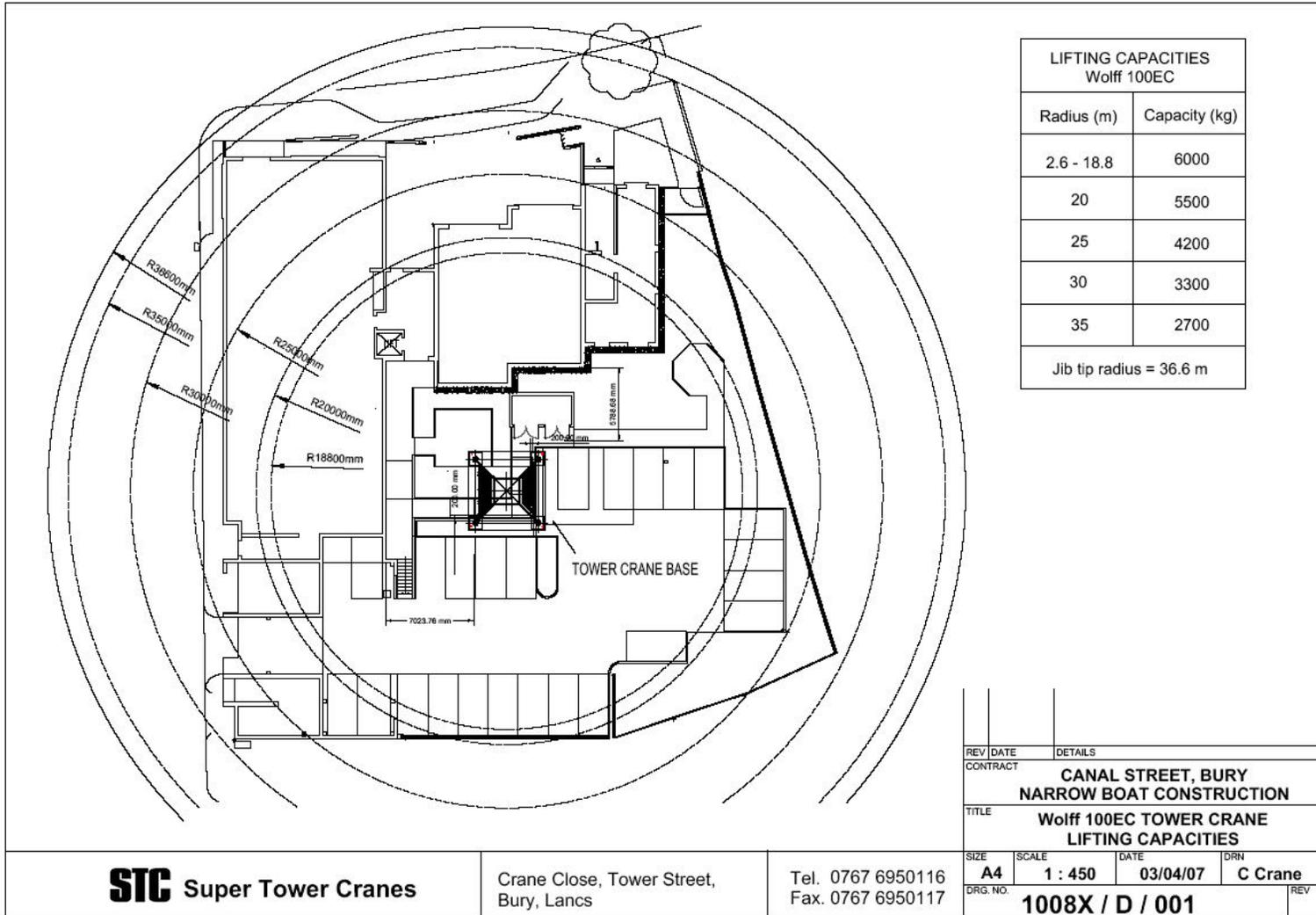
<b>Appointed Person's Acceptance of Responsibilities</b>		
I confirm that the lifts have been planned and will be carried out in accordance with current legislation and British Standard 7121 and that I accept responsibility for the preparation of this Risk Assessment and Method Statement.	<b>Signed:</b> <i>Charles Crane</i>	<b>Date:</b> <i>9/4/07</i>

<b>Crane Supervisor's Acceptance of Duties</b>		
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.	<b>Signed:</b> <i>A Foreman</i>	<b>Date:</b> <i>9/4/07</i>
	<b>Signed:</b>	<b>Date:</b>

<b>Crane Operator's Acceptance of Duties</b>		
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 crane will be operated in accordance with the methods and procedures set out in this document.	<b>Signed:</b> <i>Andy Driver</i>	<b>Date:</b> <i>12/4/07</i>
	<b>Signed:</b>	<b>Date:</b>

**Site Plan Showing Position of Cranes and Loads**

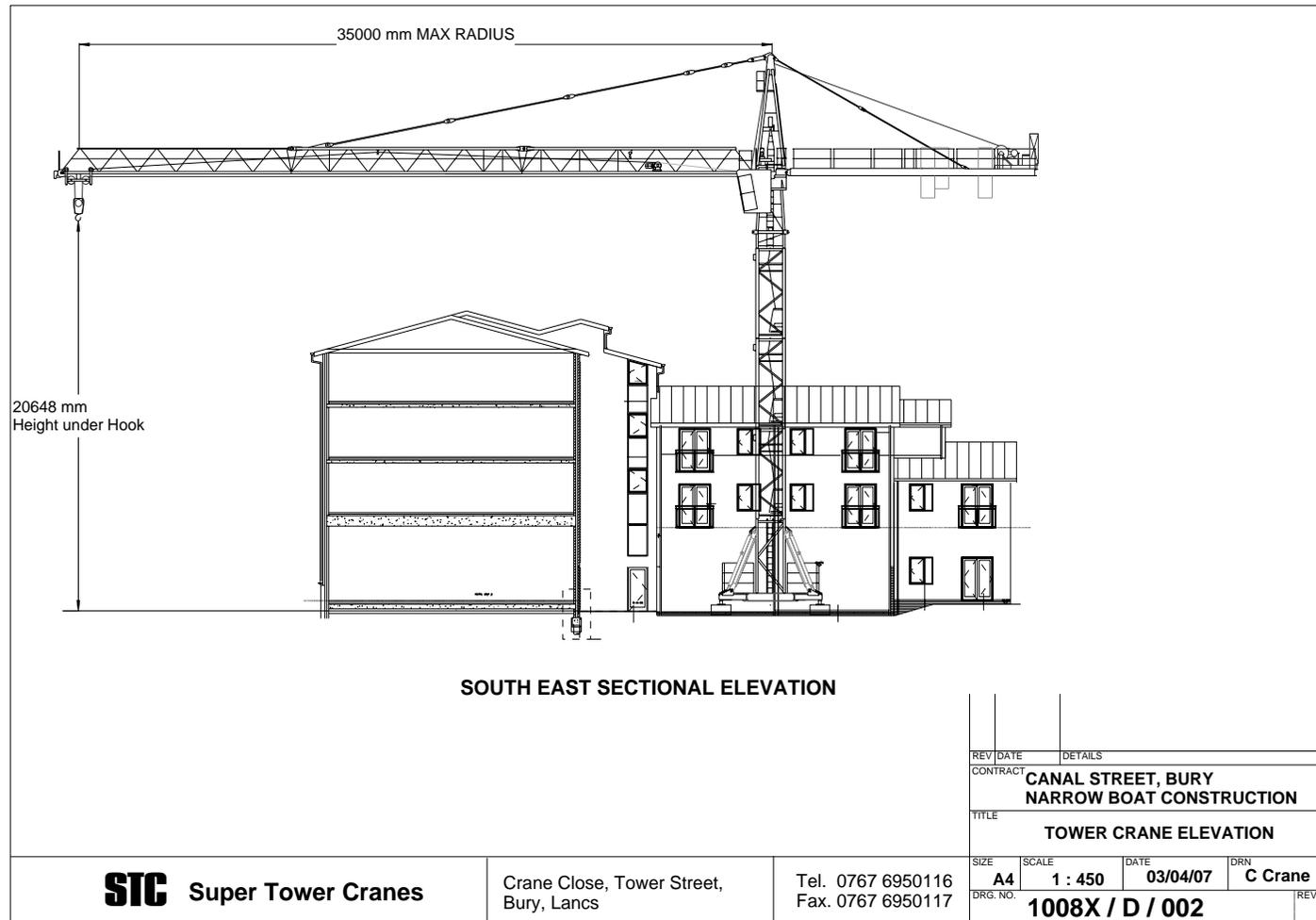
Site	Canal Street Bury	Job Number	BBH/003
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Appointed Person's Signature: Charles Crane	Date: 3/4/07
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### Elevation Showing Position of Cranes and Loads

Site	Canal Street Bury	Job Number	BBH/003
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Appointed Person's Signature: Charles Crane	Date: 3/4/07	
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## Annex F – 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 G – Example of a Foundation Completion Form

<b>Tower Crane Foundation Approval/Completion Certificate</b>			
Site Details :			
<b>Crane Details</b>			
Make:		Model:	
Height under Hook:		Jib Length:	
Base Type:			
<b>Foundation/Grillage Design</b>			
Document and Drawing References:			
Design Carried Out By:			
Company:			
<b>Foundation/Grillage Design Approval</b>			
Design Approved By:			
Signature:			Date:
NOTE: A separate approval/completion certificate is required for each tower crane			
<b>Permit To Erect</b>			
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 TSTC 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 at maximum radius 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.3.6 *Hook Block Rope Fall Changeover Device***

Before the lifting of persons begins any hook block rope fall changeover device should be checked to ensure that it is locked and secure.

## **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 rail mounted cranes are 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 Organisational 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 – Radio Communications for Lifting Operations –TIN 017

### Introduction

Tower cranes often work on congested construction sites where the signaller is out of sight of the tower crane operator and the standard hand signals specified in BS 7121 cannot be used. As an alternative, hand held VHF/UHF radios are often used. This however, can lead to a number of problems which may interfere with the clear communication vital for safe lifting operations:-

- Loss of signal and thus communication, leading to loss of control of the lifting operation;
- Interference from radios on adjacent sites, which can lead to loss of communication or directions being given to the wrong crane operator;
- Misunderstanding between the crane operator and the signaller, leading to problems such as a load being lifted before the slinger has his hands clear, loads colliding with the building structure and the load being lowered before people are clear of the landing area.

### Radio Specification

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

- Signal strength – if it is too low there is a risk of signal loss - too high and it 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 lifting 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.

### Calls Signs and Standard Commands

The third issue, misunderstandings between the crane operator and signaller, 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 signaller and crane operator;
- Each message should be preceded by the call sign (e.g. TC1....);
- The crane 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 signaller, at any one time;
- Voice commands should be given using the signals in the following table.

<b><u>Standard Voice Commands For Lifting Operations</u></b>		
	<b><u>Command</u></b>	<b><u>Crane Type</u></b>
1.	<b>“Take the Weight”</b>	All
	<b>“Hoist”</b>	
	<b>“Hoist Slowly”</b> (See Note 1 below)	
2.	<b>“Lower”</b> (See Note 1 below)	All
	<b>“Lower Slowly”</b>	
3.	<b>“Slew Left”</b> (See Note 2 below )	All
	<b>“Slew Right”</b> (See Note 2 below)	
4.	<b>“Trolley In”</b>	Saddle jib tower cranes
	<b>“Trolley Out”</b>	
5.	<b>“Jib Up”</b>	Luffing jib tower cranes, mobile cranes and crawler cranes
	<b>“Jib Down”</b>	
6.	<b>“Extend Jib”</b>	Mobile and some self erecting tower cranes
	<b>“Retract Jib”</b>	
7.	<b>“Travel Forward”</b> (see Note 3 below)	All travelling cranes
	<b>“Travel Backward”</b> (see Note 3 below)	
8.	<b>“Stop”</b>	All
	<b>“Stop Now”</b> (Emergency Stop)	
<p><b>NOTE 1:</b> When fine positioning control is required, the person giving the signal should repeat the command continuously for as long as motion is required <b>“Lower slowly, Lower, Lower, Lower, Lower, Lower, Lower, Stop”</b>. As long as the crane operator can hear the command he will know that the radio is working. If the commands cease before the final <b>Stop</b> he will know that communication has broken down and stop the operation.</p> <p><b>NOTE 2:</b> Left and Right are defined from the viewpoint of an operator sitting in a cab looking down at the load. This also applies when a crane is being operated using remote controls.</p> <p><b>NOTE 3:</b> In the case of a travelling tower crane <b>Forwards</b> and <b>Backwards</b> should be clearly designated by signs on the tower crane track that are visible to both the signaller and the operator. If the signaller cannot see the track, he must be provided with a site plan indicating the designated directions.</p>		

## **Annex J - Blind Lifting**

Blind lifting, where the tower crane operator cannot see the full path of the load from pick up area to set down area involves particular hazards. Consequently great care should be exercised in the planning and carrying out of such lifts.

### ***Planning***

- The path of the load should be surveyed for hazards such as obstructions, people working below, snagging points and radio blind spots.
- The hazards should be assessed and adequate measures put in place to control those hazards (e.g. sufficient signallers to keep the load in sight at all times and direct the tower crane operator).
- The personnel involved in the lift should be fully briefed on the lift plan and their role in the operation.
- The use of tag lines to control long loads should be assessed for potential snagging. (See **TIN 022**)

### ***Lifting***

- Before starting to lift the load path should be checked to ensure that additional hazards have not occurred such as changes to scaffolding or the permanent structure.
- Weather conditions should be checked to ensure that wind speeds are at or below an acceptable level for the size and weight of the load. Wind speed may well differ on opposite sides of a building or other structure.
- All radios used for signalling should be checked for battery charge and correct functioning at all signalling positions.
- All lifting motions should be carried out at a slow speed to ensure that the load does not swing and snag on the structure.
- The standard voice commands for lifting operations contained in Appendix 4 (TIN017) should be used at all times.
- If the tower crane operator loses contact with the slinger or any of the signallers at any time during the lifting operation he must immediately stop the lift and contact the crane supervisor for instructions.

## **Annex K – Information to be contained in a report of a thorough examination**

The following is an extract from the Lifting Operations and Lifting Equipment Regulations. Schedule 1 of Regulation 10 is quoted here in full. It details information to be contained in a report of a thorough examination.

- 1) The name and address of the employer for whom the thorough examination was made.
- 2) The address of the premises at which the thorough examination was made.
- 3) Particulars sufficient to identify the equipment including where known its date of manufacture.
- 4) The date of the last thorough examination.
- 5) The safe working load of the lifting equipment or (where its safe working load depends on the configuration of the lifting equipment) its safe working load for the last configuration in which it was thoroughly examined.
- 6) In relation to the first thorough examination of lifting equipment after installation or after assembly at a new site or in a new location:
  - a) that it is such thorough examination;
  - b) (if such be the case) that it has been installed correctly and is safe to operate.
- 7) In relation to a thorough examination of lifting equipment other than a thorough examination to which paragraph 6 relates -
  - a) whether it is a thorough examination:
    - i) within an interval of 6 months;
    - ii) within an interval of 12 months;
    - iii) in accordance with an examination scheme;
    - iv) after the occurrence of exceptional circumstances;
  - b) (if such be the case) that the lifting equipment is safe to operate.
- 8) In relation to every thorough examination of lifting equipment:
  - a) identification of any part found to have a defect which is or could become a danger to persons, and a description of the defect;
  - b) particulars of any repair, renewal or alteration required to remedy a defect found to be a danger to persons;
  - c) in the case of a defect which is not yet but could become a danger to persons –
    - i) the time by which it could become such a danger;
    - ii) particulars of any repair, renewal or alteration required to remedy it;
    - iii) the latest date by which the next thorough examination must be carried out;
- 9) Where the thorough examination included testing, particulars of any test;
  - a) The date of the thorough examination.
  - b) The name, address and qualifications of the person making the report; that he is self-employed or, if employed, the name and address of his employer.
- 10) The name and address of a person signing or authenticating the report on behalf of its author.

The date of the report.

## Annex L – Tender Checklist for Lifting Operations

	Item	Y/N?	Comment
1.	Has scope of lifting operations been identified?		
	- Programme dates & interfaces		
	- Items to be lifted		
	- Maximum weight & reach of items to be lifted		
	- Utilisation of cranes to suit programme		
	- Client restrictions or physical constraints		
2.	Has lifting method been considered & decided on (with Appointed Person input)?		
	- Tower Crane capacity, configurations, slewing arc & canopy		
	- Crawler Cranes		
	- Mobile Cranes		
	- Telehandler / Forklifts		
	- Jib Cranes		
	- Lorry loaders etc		
	- Hoists		
	- Concrete Pumps		
	- Subcontractors potential requirements		
3.	Have crane suppliers been consulted regarding:-		
	- Selection and specification of cranes		
	- Availability of cranes		
	- Erection & dismantling arrangements		
	- Delivery, road closure, axle weights etc		
	- Specialist lifting equipment		

	Item	Y/N?	Comment
4.	Have site logistics been developed		
	- Logistics Manager requirements		
	- Working hours		
	- Power source		
	- Lighting for lifting operations		
	- Over sailing adjacent properties consents		
	- Crane collision avoidance system/ procedures		
	- Communication methods radios etc		
	- Driver visibility of unloading position, extra Slinger/Signaller		
	- Protection of the public from lifting operations		
	- Restrictions imposed by Network rail / BAA etc		
5.	Consideration of crane team requirements?		
	- Appointed person (no./fulltime/part time)		
	- Crane coordinator		
	- Crane supervisor/s (no. / fulltime/part time)		
	- Crane drivers – (quantity / relief requirements)		
	- Slinger Signaller (quantity /relief requirements)		
6.	Have foundation requirements been considered by nominated engineer		
	- General ground conditions		
	- Tower crane base design and costs		
	- Pads for crawler and mobiles		
	- Ground bearing pressure including tests etc.		
7.	Emergency Communications between crane drivers and S/S		

## Annex M - Further Information and Guidance

### Technical Information Notes

The CPA Tower Crane Interest Group publishes a series of Technical Information Notes dealing with various aspects of tower crane operation. These can be downloaded free of charge from the CPA website at [www.cpa.uk.net](http://www.cpa.uk.net) and are in the *Special Interest Groups* section under *Tower Crane Interest Group*. At the time of publication the following TINs are available. New TINs are being added and readers should check the website for new additions and revisions.

TIN	Subject	Issue Date	Issue
000	Technical Information Note Index	30.07.07	F
001	Access to Tower Cranes After Commissioning	30.07.07	B
002	Raising and Lowering of Small Material	30.07.07	B
003	Tower Crane Access Procedures	30.07.07	B
004	Installing Wire Ropes on Winch Drums and Storage Reels	30.07.07	B
005	Housekeeping on Tower Cranes	30.07.07	B
006	Tower Crane Access Ladders	30.07.07	B
007	Duty Boards	30.07.07	B
008	Tower Crane Edge Protection	30.07.07	B
009	Security of Access to the Crane Base	30.07.07	B
010	Tower Crane Anti-Collision Systems	30.07.07	B
011	Attachment of Floodlights, Illuminated Signs and Christmas Decorations	27.02.06	A
012	Tower Crane Access Signage	30.07.07	B
013	Rescue of Personnel From Height on Tower Cranes	30.07.07	C
014	Pre-Erection Component Checks	30.07.07	B
015	Risk Assessment – General Access to Tower Cranes (including for maintenance)	30.07.07	B
016	Fall Protection Equipment For Tower Crane Operators	30.07.07	C
017	Radio Communication for Lifting Operations	30.07.07	B
018	Tower Crane Life	30.07.07	B
019	Contract Lifting and Crane Hire When Erecting, Dismantling and Using Tower Cranes on Construction Sites	30.07.07	B
020	The Effect of Wind on Tower Cranes In Service	12.06.07	B
021	Maintenance Principles for Tower Cranes	12.06.07	B
022	The Use of Tag Lines with Tower Cranes	12.06.07	B

## **Standards**

BS 6166-3:1998, *Lifting slings — Part 3: Guide to the selection and safe use of lifting slings for multi-purposes*

BS 6210:1983, *Code of practice for the safe use of wire rope slings for general lifting purposes*

BS 6968:1988, *Guide for use and maintenance of non-calibrated round steel lifting chain and chain slings*

BS 7121-1:2006, *Code of practice for safe use of cranes — Part 1: General*

BS 7121-2:2003, *Code of practice for safe use of cranes — Part 2: Inspection, testing and examination*

BS 7121-5:2006, *Code of practice for safe use of cranes — Part 5: Tower cranes*

BS 7262:1990, *Specification for automatic safe load indicators*

BS EN 12385-1:2002, *Steel wire ropes — Safety — Part 1: General requirements*

BS EN 12385-2:2002, *Steel wire ropes — Safety — Part 2: Definitions, designation and classification*

BS EN 12385-3:2004, *Steel wire ropes — Safety — Part 3: Information for use and maintenance*

BS EN 12385-4:2002, *Steel wire ropes — Safety — Part 4: Stranded ropes for general lifting applications*

BS EN 13557:2003, *Cranes — Controls and control stations*

BS EN 13586:2004, *Cranes — Access*

BS EN 14502-1:2005, *Cranes — Equipment for the lifting of persons — Part 1: Suspended baskets*

## **Legislation and Other Publications**

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

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

Provision and Use of Work Equipment Regulations 1998 (PUWER).

L113 *Safe use of lifting equipment*, HSE Books.

L22 *Safe use of work equipment*, HSE Books.

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

Work at Height Regulations 2005 (WAHR).

The Supply of Machinery (Safety) Regulations 1992.

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

Personal Protective Equipment at Work Regulations 1992.

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

The Air Navigation Order 2000.

HSE Leaflet INDG218 – Guide to Risk Assessment;

HSE Leaflet INDG163 – Five Steps to Risk Assessment.

HSE publication L73 - *A guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995*, HSE Books.

*Best Practice Guide on the Maintenance and Thorough Examination of Tower Cranes*, 2008 – Construction Plant-hire Association. (Available April 2008).

*Tower Crane Operator's Handbook* – Construction Plant-hire Association.

*Safe Use of Self Erecting Tower Cranes – CPA Best Practice Guide* – Construction Plant-hire Association.

*Tower crane stability*, 2006. CIRIA C654. Construction Industry Research and Information Association.

*Crane Stability on Site*, 2003. CIRIA C703. Construction Industry Research and Information Association.

*Cranes and planes - A guide to procedures for operation of cranes in the vicinity of aerodromes*. Airport Operators Association (AOA).

*A voluntary code of practice for the safe use of cranes in and around airports*. Off-highway Plant and Equipment Research Centre.

*Code of practice for the safe use of lifting equipment*. Lifting Equipment Engineers' Association.

### **Useful Websites**

Construction Plant-hire Association	<a href="http://www.cpa.uk.net">www.cpa.uk.net</a>
Health and Safety Executive	<a href="http://www.hse.gov.uk">www.hse.gov.uk</a>
Construction Industry Training Board	<a href="http://www.citb-constructionskills.co.uk">www.citb-constructionskills.co.uk</a>
Lifting Equipment Engineers Association	<a href="http://www.leea.co.uk">www.leea.co.uk</a>
Safety Assessment Federation	<a href="http://www.safed.co.uk">www.safed.co.uk</a>

## **Annex N - Working Group Membership**

### **CPA Tower Crane Interest Group –**

#### *Safe Use of Top Slew Tower Cranes – Best Practice Guide Working Group*

##### *Chairman:*

P E Phillips Tower Cranes Consultants Ltd

##### *Members:*

I Simpson HSE Specialist Inspector

G Fisher Kier Plant Ltd

A Odd Select Plant Hire Company Ltd

P Brightman Falcon Crane Hire Ltd

S Rowton HTC Plant Ltd

N Howard Milleneum Personnel Services Ltd

H Steele Construction Plant-hire Association

C Wood Construction Plant-hire Association

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