

Requirements for Tower Cranes Alongside Railways Controlled by Network Rail



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1.0 Introduction

Lifting operations by their very nature involve risk. The starting point for the reduction of risk should always begin with consideration of the need to carry out lifting operations, or whether other, less hazardous, techniques can be used.

Tower cranes are temporary structures which may present a risk to railways during erection, climbing, use, maintenance and dismantling. If the crane or its load falls onto the track a catastrophic accident may well result. It is therefore essential that best practice is followed to eliminate or reduce this risk. The following requirements must be adhered to when tower cranes are erected and used alongside Network Rail.

Network Rail must be consulted by the user of the crane in all circumstances where the tower crane and its load can collapse within 4m of a railway asset or property boundary. In these circumstances the following hierarchy of measures (see **2.0**) must be observed before Network Rail will permit the crane to be erected and used.

Where it is necessary to carry out lifting operations over or adjacent to a live railway, Network Rail infrastructure or railway public areas, Network Rail must be consulted at the earliest stage of planning. They will then determine the measures required, which may well include a railway possession and, if appropriate, isolation for which the lead time will be considerable.

NOTE: *The crane user may either be the person hiring in a crane from a supplier or a person using a crane which they own.*

NOTE: *Network Rail Contact details can be found at <http://www.networkrail.co.uk/National-asset-protection-contacts.pdf>*

Ideally, tower crane operations, positioning etc should be configured to eliminate any risk to Network Rail infrastructure, operations etc (see **2.1**)

Should however, such operation, positioning etc prove to be impossible and there is a risk a crane collapse could potentially affect Network Rail infrastructure, operations etc. additional measures and agreements must be put in place:-

- Where the crane jib does not oversail Network Rail infrastructure; measures to eliminate the risk of collapse should first be considered i.e. implement risk reduction measures by shielding, restraint, tying etc (see **2.2**).
- Where the crane jib does not oversail Network Rail infrastructure, and implementation of the above risk reduction measures of shielding, restraint, tying etc prove impossible; risk reduction by down-rating the crane, up-rating the base design etc must be implemented (see **2.3**).

The oversailing of Network Rail infrastructure by tower cranes is not normally approved, due to the inherent risks to Network Rail operations, personnel, the travelling public etc. It is recognised however, that occasionally at certain restricted/constrained sites it might prove unavoidable. Any proposed oversailing will be subject to a formal “*Crane Oversailing Agreement*” and strict site control measures:-

- Entry into a “*Crane Oversailing Agreement*” agreement is obligatory where the above elimination methods prove impossible and the crane jib is required to weathervane over the railway when out of use, even though it does not oversail whilst in operational use. Whilst in use, prevention of the crane oversailing Network Rail infrastructure will be required through the use of a zoning system (see **3.6**). When weather vaning the crane must be left in accordance with the manufacturer's instructions and without any load on the hook.
- Entry into a “*Crane Oversailing Agreement*” agreement is also obligatory where the above elimination methods prove impossible and the crane jib is required to weathervane over the railway when out of use and where it will also oversail in

operational use. Whilst in use, a zoning system (see 3.6) must be used to restrict the oversailing to limits specified by Network Rail. When weather vaning the crane must be left in accordance with the manufacturer's instructions and without any load on the hook.

These requirements are summarised in **Table 1** below for ease of reference.

Level	Tower Crane Operational Restrictions	Ref.	Collapse radius within NR infrastructure	Down rating required	Jib allowed to oversail when weather vaning	Jib allowed to oversail when In Service	Load permitted to encroach or oversail NR infrastructure
1	Positioning crane such that collapse radius wholly outside NR boundary.	2.1	No	No	No	No	No
2	Position crane and provide additional restraint such that crane collapse radius wholly outside NR boundary.	2.2	No	No	No	No	No
3	Crane NOT to oversail under any circumstances; Crane could collapse onto NR Infrastructure.	2.3, 3.1	Yes	Yes	No	No	No
4	Crane NOT to oversail when 'In Service'; Crane may oversail when weather vaning; Crane could collapse onto NR infrastructure.	2.3, 3.2	Yes	Yes	Yes	No	No
5	Crane Jib may oversail when 'In Service' or when weather vaning; Load <u>not permitted</u> to encroach or oversail; Crane could collapse onto NR infrastructure	2.3, 3.2	Yes	Yes	Yes	Yes	No
6	Loads may be lifted over the railway	3.10	Yes	Yes	Yes	Yes	Yes
Reference must be made to main text for full requirements.							
Table 1 - Hierarchy of Control Measures							

2.0 Hierarchy of Risk Elimination and Reduction

When planning the installation of a tower crane alongside Network Rail the hierarchy of measures in 2.1 to 2.3 must be observed (see **Figure 1**):

2.1 *Elimination of Risk by Position*

The crane is positioned so that if it does fail in the plane of the jib or counterjib, the collapse radius is at least 4m from a railway asset or property boundary.

Collapse radius is defined as the maximum extent of a crane collapse as follows:

- The diagonal dimension from the foot of the tower to the end of the jib (see **Figure 2**). In the case of a tower crane with a luffing jib, this dimension shall be the height of the jib foot pin (pivoting or hinge point) plus the length of the jib to its tip (see **Figure 3**);

plus

- Either 4 metres or one tenth of the height of the tower, whichever is greater;

plus

- Half the length of a horizontal load or the full height of any vertical load, whichever is greater.

NOTE: *The end of the jib is normally taken as the maximum lifting radius + 1.5m.*

2.2 *Reduction of the Risk of Collapse by Restraint*

If the crane cannot be positioned as specified in 2.1 the crane tower can be restrained to reduce the collapse radius. This can be achieved by the following methods:

2.2.1 Tying to an adjacent structure

This approach involves tying the crane to an adjacent structure of adequate strength, to reduce the collapse radius to that shown in **Figure 4**.

The tie design must be completed in accordance with guidance provided in CIRIA RP707 (C654) *Tower Crane Stability*. The design must then be subject to an independent design check, in accordance with Category 3 of Table 1 of BS 5975, to ensure that the concept, overall design and details of the tie proposed are adequate and that the tie designer's intentions have been properly reflected in the fabrication and installation drawings. The check is not intended to take the place of any checking carried out by the tie designer, who will retain full responsibility for the adequacy of the tie design.

Pre erection checks of the tie are to be carried out in accordance with 3.4. Copies of the tie drawings must be retained on site with the crane. The crane must not be erected until a competent engineer or engineers has/have verified that the tie and tie attachment points on the structure have been constructed correctly.

2.2.2 Shielding

If the tower crane is sited behind a building of sufficiently robust construction to resist the collapse of the crane, this would have the same effect as being tied at the top of the building.

2.3 **Reduction of the Risk of Collapse by Configuration, including Down Rating**

If the crane tower cannot be positioned as specified in Clause 2.1 nor restrained as specified in Clause 2.2, Network Rail Asset Protection may consider allowing the tower crane to be installed if it is configured as follows:

2.3.1 Tower height requirements

The freestanding height of the tower is limited to the manufacturer's specified maximum freestanding height for the crane configuration chosen, calculated to the requirements of Clause 5.2 of EN14439:2006. The effect of out of service wind must be calculated using the appropriate wind region for the crane's location with a minimum of Region C, a minimum 25 year recurrence interval and the roughness factors for "flat open country".

Further details can be found in **CPA TIN 027** (free download from www.cpa.uk.net).

NOTE: "Freestanding height" is the maximum height specified by the manufacturer for a specific configuration of tower crane which is not tied to an adjacent structure

2.3.2 Down rating of rated capacity

The rated capacity of the crane is reduced to 75% of the manufacturer's specified rated capacity for the crane configuration chosen. The Rated Capacity Indicator/Limiter **MUST** be programmed with the reduced duty and recalibrated.

A 280 metre-tonne saddle jib crane with a 50m long jib erected on 2.3m tower sections in a C wind region with a 25 year return wind period, has a maximum rated capacity of 12000kg and a maximum capacity at the end of the jib of 5600kg. When erected close to the railway these values must be reduced to 75% i.e. 9000kg and 4200kg.

NOTE: The counter ballast must not be reduced from that required for the manufacturer's specified rated capacity for the crane configuration chosen.

2.3.3 Up-rating the base design

The tower crane base foundation must be designed using the in-service, erection and out of service foundation loads for the crane before down rating the rated capacity. The moment and horizontal loads due to the out-of-service condition must be up rated by a factor of 1.33 before being used in the base design. Loads due to erection or in-service conditions do not have to be uprated as there have already been downrated (See 2.3.2).

NOTE: The out of service vertical load is not up-rated as it is not possible to increase the crane's mass by this amount and to do so would reduce the tension loads in piled foundations.

NOTE: The effect of this is to increase the factor of safety of the base design.

NOTE: The foundation anchors are not subjected to up-rating as they are part of the cranes structure and fall under the requirements of 2.3.1

A 280 metre-tonne saddle jib crane with a 50m long jib erected on 2.3m tower sections in a C wind region with a 25 year return wind period has a maximum freestanding height on a cast-in foundation of 52m. The maximum base loads are due to the out-of-service condition and are Moment 5023 kNm, Horizontal 137 kN and Vertical 925 kN. Consequently when erected close to the railway the base design is carried out using the moment and horizontal loads multiplied by a factor of 1.33 (i.e Moment 6681 kNm, Horizontal 182 kN whilst Vertical remains at 925 kN).

Where the crane is to be mounted on a travelling (rail going) base or on a static cruciform base with base ballast, the ballast must be increased by a factor of 1.33 and the resulting loads used for design of the rail track or cruciform foundation.

The base design must be completed in accordance with guidance provided in CIRIA RP707 (C654) *Tower Crane Stability*. The design must then be subject to an independent design check, in accordance with Category 3 of Table 1 of BS 5975, to ensure that the concept, overall design and details of the foundation proposed are adequate and that the foundation designer's intentions (including the requirements of this guidance note) have been properly reflected in the drawings to be supplied to site. The check is not intended to take the place of any checking carried out by the foundation designer, who will retain full responsibility for the adequacy of the foundation design.

Pre erection checks of the base/foundation are to be carried out in accordance with **3.4**. Copies of the foundation drawings must be retained on site with the crane. Photographs of foundations under construction must be taken and retained on site. Cube tests must be taken of each batch of concrete used. Results of the tests must be retained on site. The crane must not be erected until a competent engineer had verified that the foundation has been constructed correctly and the concrete has achieved the necessary strength.

3.0 Other Planning Requirements

The following requirements apply to all tower cranes erected within the vicinity of the railway.

3.1 *Elimination of Oversailing*

No part of any crane jib shall over-sail the Network Rail operational boundaries under any circumstances, even in out-of-service conditions, unless specific permission is given by Network Rail. This may require the selection of a luffing jib crane.

If a luffing jib crane is used, the standard out-of-service radius will be significantly greater than the minimum radius. The crane manufacturer may allow a reduced out of service radius under certain circumstances, but this will increase the maximum base loads which will need to be taken into account in the base design.

In certain circumstances the tower crane manufacturer may permit the crane to be prevented from free slewing in the out of service condition. This must only be undertaken with the express written permission of the crane manufacturer, who will provide special base and/or tie loads for this situation.

3.2 *Where Oversailing is unavoidable*

Where avoidance of oversailing is proven to be not possible; entry into a formal “oversailing agreement” might be considered by Network Rail. Any such “oversailing agreement” will permit (subject to conditions) tower cranes to oversail Network Rail property with their jibs only either for weather vaning purposes only or exceptionally, when in service. Such conditions include, but are not limited to; the load, associated lifting tackle, lifting beams etc not being permitted to oversail. Control of operations where there is a risk of encroachment occurring, will need to be undertaken under strictly controlled conditions (suitable risk assessment and method statement (RAMS) and/or screening measures) or periods of track possession/ overhead line isolation.

3.3 *Tower Crane, Base and Foundation : Design & Check Certification*

The tower crane, its base and foundations shall be subject to design submission in accordance with the requirements of Network Rail Civil Engineering Assurance standard NR/L3/CIV/003 including the presentation of F002 “*Design Intent*” and F003 “*Certificate of Design and Check*”, well in advance of the proposed installation date.

3.4 *Pre Erection Checks for Ties and Bases*

Before the tower crane is erected the necessary checks must be completed on both ties (where applicable) and bases/foundations and a *Tower Crane Tie Approval/Completion Certificate* (See **Annex B**) completed, together with a *Tower Crane Foundation Approval/Completion Certificate*. Copies of both certificates must be given to the Network Rail Asset Protection Engineer, together with the tie and foundation designs.

Further details can be found in **CPA TIN 031** (free download from www.cpa.uk.net).

NOTE: *TIN 031 requires a Category 2 design check. This must be increased to Category 3 for tower cranes alongside Network Rail lines.*

3.5 *Planning for Dismantling*

Before the tower crane is erected the dismantling operation should be planned, at least in outline, to ensure that changes to the site between erection and dismantle do not impede the dismantling operation. For example - building on the area required to stand the mobile crane on for dismantling.

In addition, if a possession and, if appropriate, isolation is needed for the dismantling operation, the lead time for these will be considerable.

3.6 Zoning and Anti-collision Systems

To prevent the tower crane oversailing the operational boundaries during use it must be fitted with a zoning system to limit the slewing, luffing or trolley motions. Zoning systems will also assist in the avoidance of obstructions such as tall chimneys.

Where more than one tower crane is erected on a site, an anti-collision system must be fitted if there is a risk of a clash between the hoist rope and load of one crane and the jib or counter jib of another crane.

The lift plan (method statement) should include a drawing of the site showing the extent and position of the pre-warning and exclusions zones.

Further details can be found in **CPA TIN 010** (free download from www.cpa.uk.net).

3.7 Base Collision Protection

The tower crane base must be protected against impact from vehicles and mobile equipment travelling on site.

3.8 Tower Cranes in the Vicinity of Aerodromes, Notification and En-route Obstacle Lighting

Tower cranes which are to be erected in the vicinity of aerodromes require notification to the aerodrome manager and may be required to be fitted with aviation warning lighting. In addition to any aerodrome-related requirement, any structure (temporary or otherwise and regardless of location) of a height of 300ft or more needs to be notified for aviation purposes.

Further detailed requirements are given in:-

- Technical Information Note TIN 039 - *Operating Tower Cranes in the Vicinity of Aerodromes, Notification and En-route Obstacle Lighting*, Construction Plant Hire Association (free download from www.cpa.uk.net)
- Civil Aviation Authority CAP 1096 *Guidance to crane operators on aviation lighting and notification* (free download from www.caa.co.uk)

3.9 Erection Crane Requirements

Wheeled mobile cranes are commonly used to erect tower cranes and it should therefore be noted that whilst utilising such plant, standard Network Rail Asset Protection control/safety measures will apply. Whilst the tracks & overhead lines are “live” the oversailing of road mobile crane jibs etc will not be permitted. The crane superstructure must also be prevented from approaching the railway by the use of limiting devices set to limits specified by Network Rail.

3.10 Lifting Loads over the Railway

The lifting of loads over the railway will only be permitted in exceptional circumstances following detailed discussions with Network Rail and will involve specific requirements such as track possessions and overhead line isolation.

4.0 Crane Preparation

Before a tower crane is delivered to site, prior to each erection or alteration, it is essential that it is inspected thoroughly to identify any worn or faulty components and that these are replaced. It is considerably easier and less costly to replace components and carry out lubrication and adjustments in a depot, than when the crane has been erected on site. Work on an erected tower crane always involves work at height and presents difficulty in handling heavy components.

Pre-delivery maintenance provides a good opportunity for the completion of supplementary tests before the crane is erected. It is also strongly recommended that the tower crane's drive and control systems are powered up and checked for correct functioning during pre-delivery maintenance.

The direct transfer of cranes between sites should be approached with extreme caution as it often leads to both delays in erection and time lost through the correction of faults. Direct transfers are not to be undertaken for cranes which are to be erected alongside the railway.

Records of the pre-delivery inspection must be retained in a file for the crane held on site.

Further details are given in the Construction Plant-hire Association's, *Best Practice Guide on the Maintenance, Inspection and Thorough Examination of Tower Cranes* (free download from www.cpa.uk.net)

5.0 Erection, Alteration and Dismantling

The erection of tower cranes must be planned and carried out by trained and competent personnel. A risk assessment must be carried out for each erection and a job specific method statement prepared. The method statement must address potential problems, such as equipment failure and rising wind speed, with appropriate contingency measures. All members of the erection team must be briefed on the method to be used and confirm that they are aware of their specific duties. The erection operation will be controlled by the erection supervisor who must have the authority to suspend operations at any time that he/she judges that it would be unsafe to continue.

The dismantling of tower cranes is not just the reversal of the erection process. Before dismantling is carried out a risk assessment must be undertaken to identify any changes to the site or the surrounding area, which may impinge on the operation. These may include adjacent structures, access for transport and mobile cranes, and mobile crane set up areas.

It is essential that both erection and dismantling are carried out by competent and authorised personnel who are familiar with the make and model of tower crane and have adequate information to undertake their tasks effectively.

The method statement for erection, alteration and dismantling must consider the risk to railway from the process including the use of mobile cranes.

It is essential that Network Rail are notified in advance of any erection alteration or dismantling operations.

Further information on the erection and dismantling of tower cranes is given in:

- BS 7121-5:2006, *Code of practice for safe use of cranes – Part 5: Tower cranes.*
- Strategic Forum for Construction *Guidance on The Planning & Liaison Process for the Erection, Climbing & Dismantling of Tower Cranes* (free download from www.cpa.uk.net)

6.0 Climbing

Climbing is the process by which the height of a tower crane may be increased or reduced without the aid of another crane and requires a significant degree of forethought and skill if it is to be accomplished successfully.

It is essential that all climbing operations are carried out by competent and authorised personnel who are familiar with the make and model of tower crane to be climbed and have adequate information to undertake their tasks effectively.

The limiting windspeed for climbing operations must be set at 75% of the manufacturer's maximum for climbing, to allow time for the crane to be safely secured in a rising wind.

It is essential that Network Rail are notified in advance of any climbing operations.

Detailed guidance on the climbing of tower cranes is given in:

- *Best Practice Guide on the Climbing of Tower Cranes*, Construction Plant-hire Association (free download from www.cpa.uk.net)
- BS 7121-5:2006, *Code of practice for safe use of cranes – Part 5: Tower cranes*.

7.0 Use of Tower Cranes

The use of tower cranes alongside railways requires particular care to ensure that neither the crane, nor the load it is lifting or moving, fall onto the track. This is best accomplished by strict adherence to the planning, supervision and use requirements of BS 7121-1 and BS 7121-5 and in particular the assessment of both the complexity of the load and lifting operation, and the environment in which it is being carried out.

A copy of the lift plan (method statement) prepared by the appointed person shall be retained on site.

Detailed guidance is given in:-

- BS 7121-1:2006, *Code of practice for safe use of cranes – Part 1: General.*
- BS 7121-1:2006, *Code of practice for safe use of cranes – Part 5: Tower Cranes.*
- *Best Practice Guide on the Safe Use of Top Slew Tower Cranes*, Construction Plant-hire Association (free download from www.cpa.uk.net)
- *Best Practice Guide on the Safe Use of Self Erecting Tower Cranes*, Construction Plant-hire Association (free download from www.cpa.uk.net)

8.0 Maintenance, Inspection and Thorough Examination

The effective maintenance of tower cranes is vital in ensuring that cranes remain safe and free from defects whilst on site. Maintenance activities include inspection, preventive maintenance and repair of breakdowns. Adequate time must be allowed in the construction programme to ensure that these activities can be carried out as and when required.

Thorough examination is a separate activity from maintenance, but again sufficient time must be allowed for thorough examination to be carried out after erection or alteration and before taking into service, periodically at intervals not exceeding six months and after the occurrence of exceptional circumstances.

It is essential that both maintenance and thorough examination are carried out by competent and authorised personnel who are familiar with the make and model of tower crane and have adequate information to undertake their tasks effectively. It is essential that thorough examination is undertaken by a competent person who is sufficiently independent from the erection and maintenance activities. The competent person should require overload testing to be carried out to supplement thorough examination after each erection, and after every reconfiguration (alteration of jib length, alteration of tower height, addition or removal of ties, etc.). The magnitude of the test load should be as specified by the tower crane manufacturer based on the full rated capacity.

The following supplementary tests are compulsory:

- Independent verification of zoning and anti-collision systems by the competent person;
- Independent witnessing of hoist brake tests by the competent person (See **Table 2**);
- Independent witnessing of luffing brakes tests on a luffing jib tower crane by the competent person (See **Table 2**);
- Independent witnessing of trolley brakes tests on a saddle jib tower crane by the competent person (See **Table 2**);
- Earth continuity test for lightning protection (See **CPA TIN 036** free download from www.cpa.uk.net);

NOTE: Test loads should be kept as near to the ground as possible to minimise the effect of failure.

NOTE: Tests should be carried out with the jib parallel to or away from the railway.

NOTE: Details on Minimising the Effects of Winch Failure During Load Testing can be found in **CPA TIN 037** (free download from www.cpa.uk.net).

Brake	Test Load	Procedure	Performance Requirement
Hoist Brake	100% of rated SWL	Lower test load and actuate emergency stop	Brake should arrest load
Luffing Brake	75% of derated SWL at 50% of max radius	Lower jib and actuate emergency stop	Brake should arrest load
Trolley Brake	100% of derated SWL at 75% of max radius	Trolley out and actuate emergency stop	Brake should arrest load
Table 2 – Requirements for Dynamic Supplementary Brake Testing			

Records of thorough examination, supplementary testing and maintenance following erection must be held on site.

It is essential that Network Rail are notified in advance of any maintenance operations.

Detailed guidance on both maintenance and thorough examination is given in:-

- *Best Practice Guide on the Maintenance, Inspection and Thorough Examination of Tower Cranes*, Construction Plant-hire Association, (free download from www.cpa.uk.net)
- BS 7121-2-1:2012, *Code of practice for the safe use of cranes, Part 2-1: Inspection, maintenance and thorough examination – General*
- BS 7121-2-5:2012, *Code of practice for the safe use of cranes, Part 2-5: Inspection, maintenance and thorough examination – Tower cranes*

9.0 Records

It is essential that the records listed in **Annex A** are available on site for inspection by Network Rail. The site must also complete and retain on site a *Management of Tower Cranes Leading Indicator Audit* (See **Annex C**) at intervals not exceeding 3 months during the period that the tower crane is erected on site.

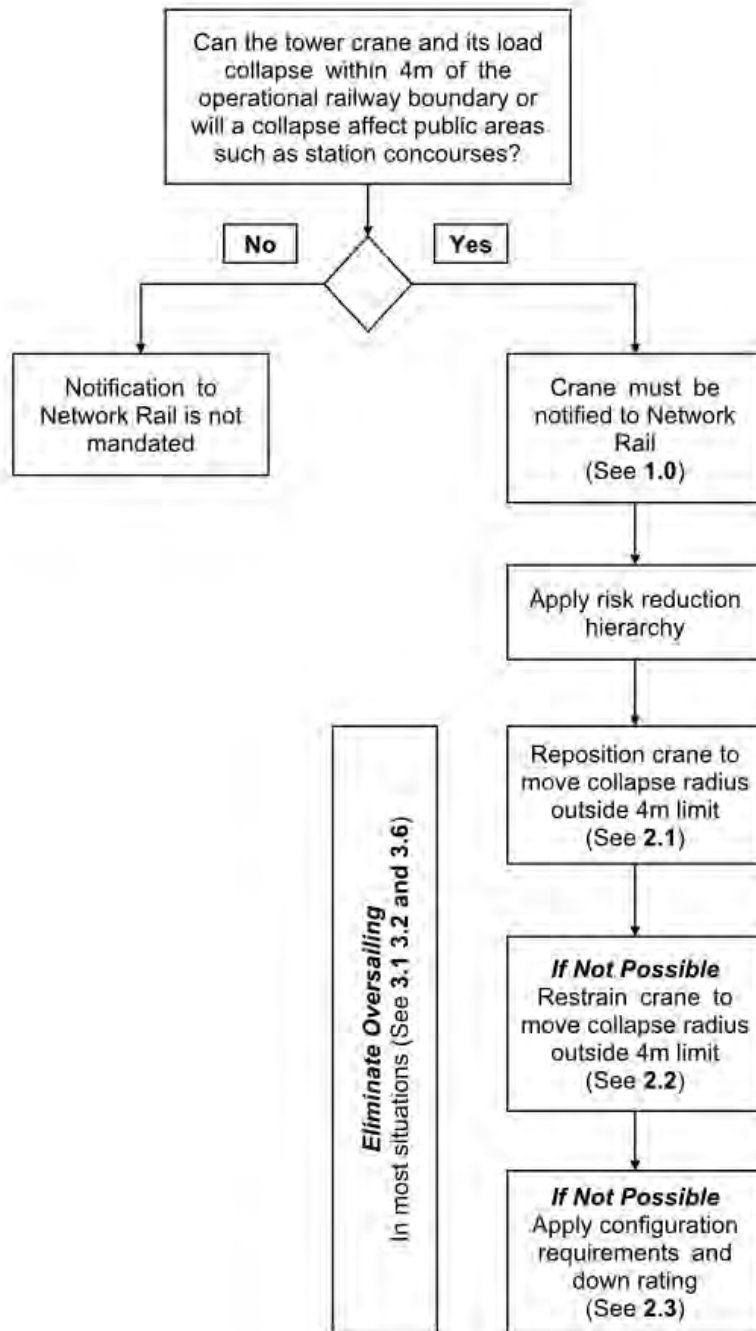


Figure 1 - Initial Hierarchy of Risk Elimination and Reduction

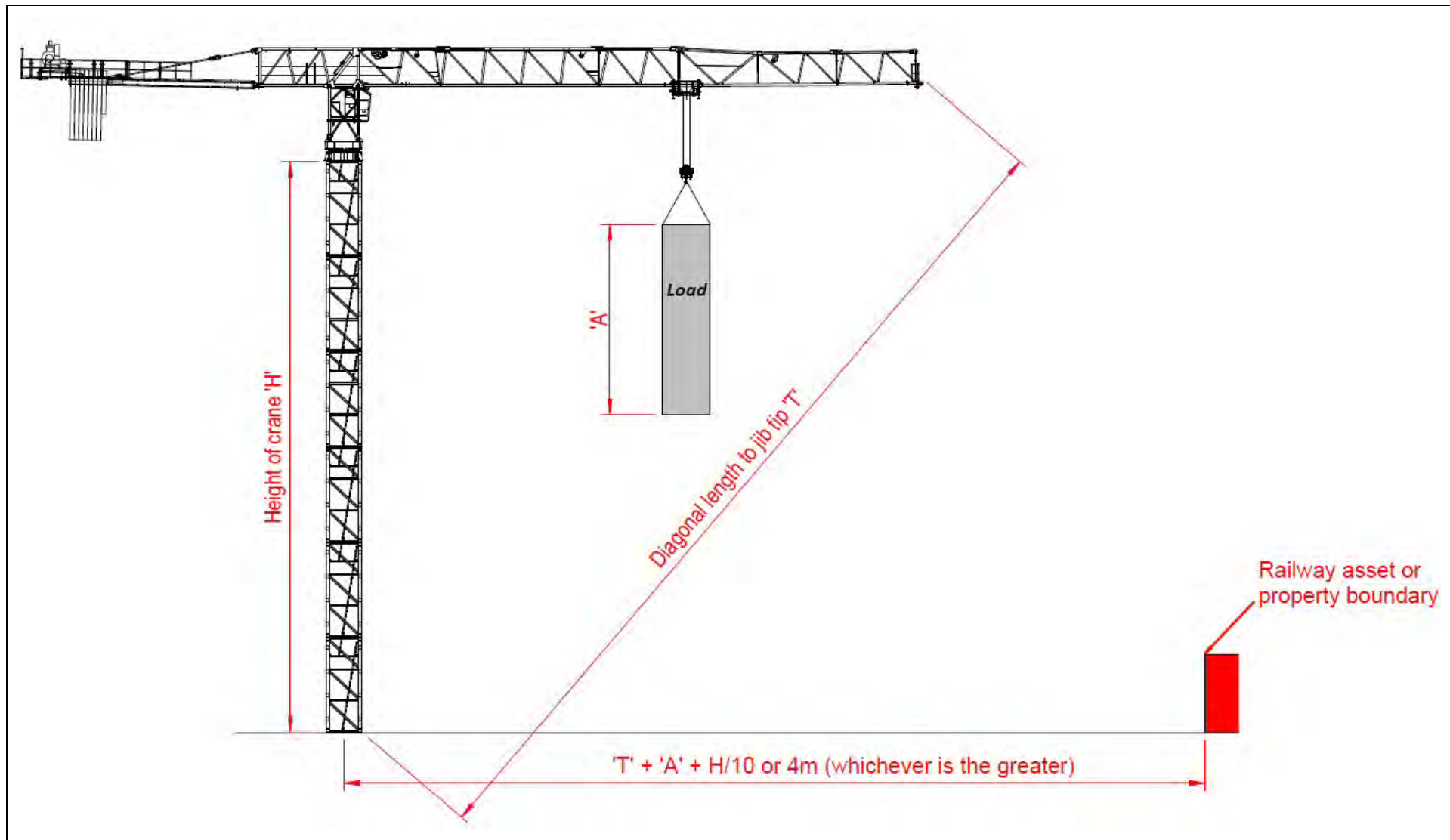


Figure 2 – Collapse Distance - Saddle Jib (vertically slung load)

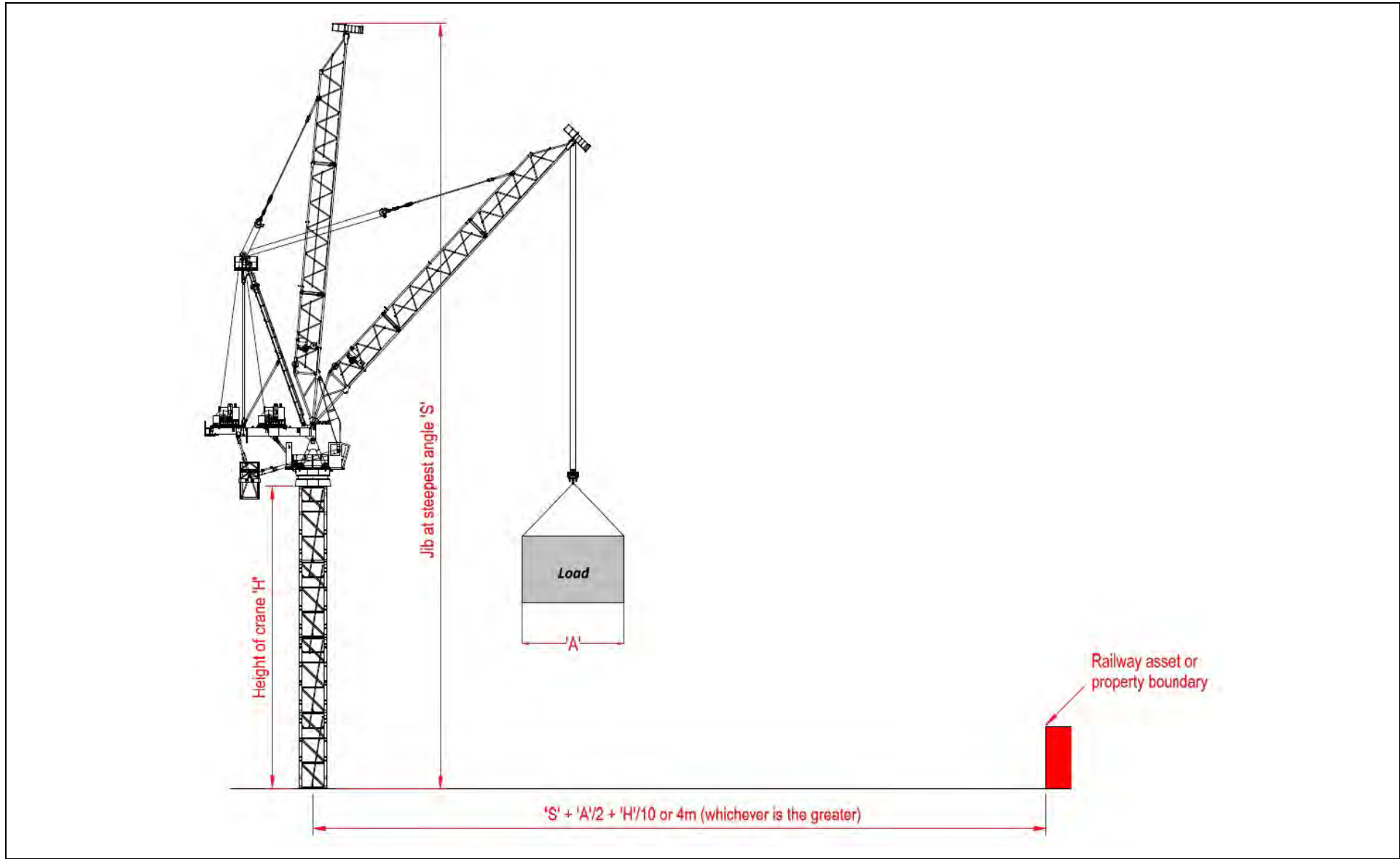
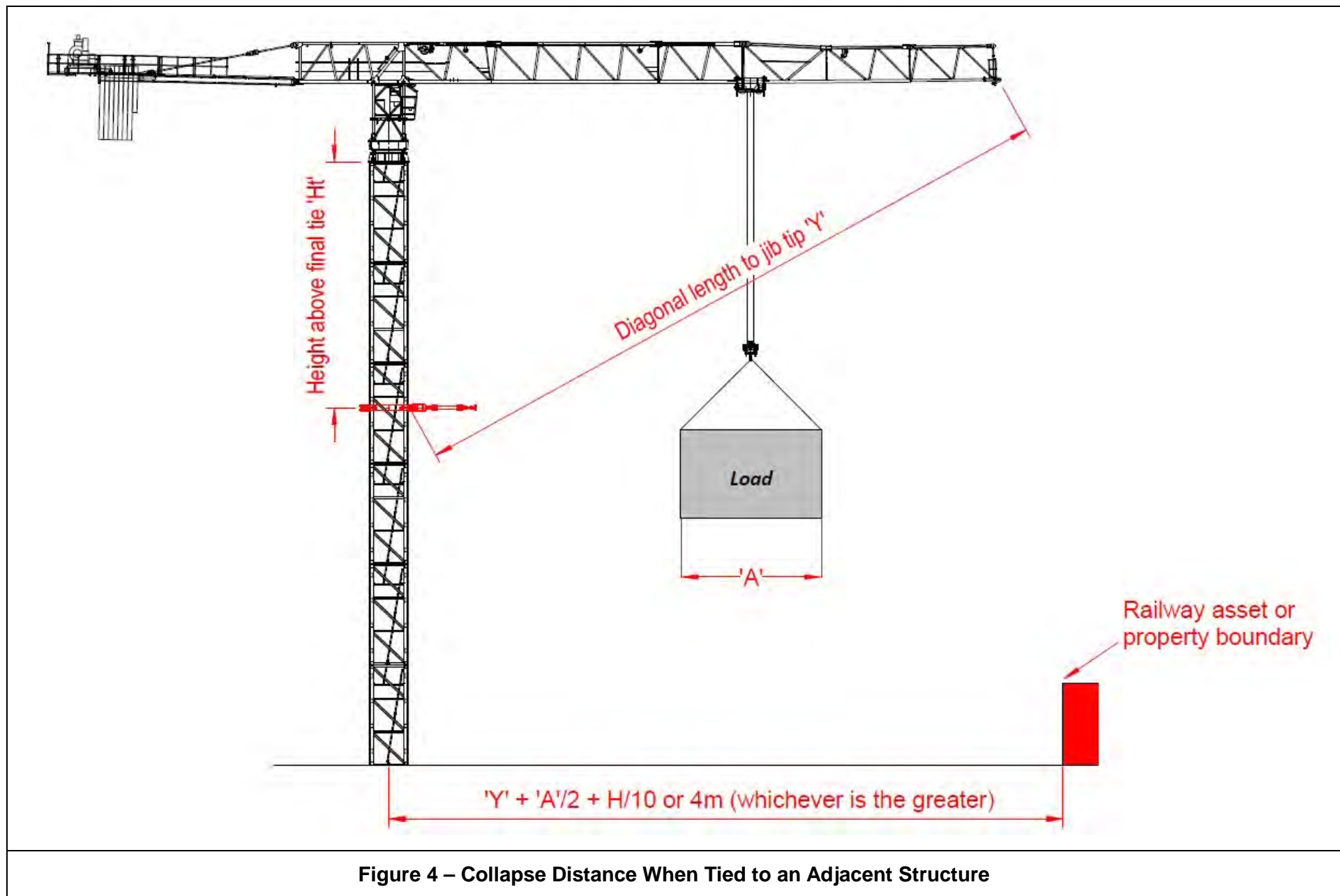


Figure 3 Minimum Collapse Distance – Luffing Jib (horizontally slung load)



Annex A – Documents held on site for Network Rail inspection

- Approved Network Rail F002/F003 for temporary works covering tower crane base(s) (Category 3), foundations (Category 3) crane (Category 2), erection crane pad (Category 3) and ties (if used) (Category 3);
- Non-objections to method statements/lift plans;
- Base and pile drawings and construction photographs;
- Tie drawings and construction photographs;
- Cube and pile test results (continuity);
- Base and tie design and construction records (inc check certificates);
- Notification to airfields (if required);
- Notification to CAA (if required);
- Build configuration of crane and load charts;
- Power supply requirements and generator size (if any);
- Wind zone assessment record (Region D or above);
- Erection Method Statement;
- Outline dismantle plan;
- In-service lift plan;
- Drawings for anti-collision and zoning systems;
- Certificate of setting of anti-collision and zoning systems;
- Records of checking of anti-collision and zoning systems settings;
- Lifting team training and competence assessment;
- Confirmation of resetting of rated capacity;
- Records of near miss investigations;
- Results of thorough examinations (including overload test results);
- Results of supplementary tests;
- Test certificates;
- Maintenance schedule and records.

Annex B - Tower Crane Base and Tie Forms

Additional information on arrangements for the design of tower crane bases and ties, checking of designs and conformation of correct installation and/or construction is given in CPA Technical Information Note TIN 031 - Tower Crane Bases and Ties.

Tower Crane Foundation Pre-erection Inspection Report					
Site Details :					
Tower Crane No/Location:		Make:		Model:	
Height under Hook:		Jib Length:			
Base Type:					
Items Checked (delete where not applicable)		As Specified?		Inspected By	Date
		Yes	No		
All Foundations	Compliance with design drawings/specification	<input type="checkbox"/>	<input type="checkbox"/>		
Cast-in Items	Supplied by tower crane manufacture or approved source	<input type="checkbox"/>	<input type="checkbox"/>		
	Level check	<input type="checkbox"/>	<input type="checkbox"/>		
	Verticality check	<input type="checkbox"/>	<input type="checkbox"/>		
	Within tolerance	<input type="checkbox"/>	<input type="checkbox"/>		
Concrete	Correct grade	<input type="checkbox"/>	<input type="checkbox"/>		
	Sufficient maturity	<input type="checkbox"/>	<input type="checkbox"/>		
	Rebar- grade, diameter, quantity and position prior to pour	<input type="checkbox"/>	<input type="checkbox"/>		
Piles	Satisfactory pile tests	<input type="checkbox"/>	<input type="checkbox"/>		
	Reinforcement bond length	<input type="checkbox"/>	<input type="checkbox"/>		
Steelwork	Steel grade	<input type="checkbox"/>	<input type="checkbox"/>		
	Weld quality	<input type="checkbox"/>	<input type="checkbox"/>		
	Bolts – grade, torque, tightness, quantity	<input type="checkbox"/>	<input type="checkbox"/>		
Rail Tracks	Bedding properly compacted	<input type="checkbox"/>	<input type="checkbox"/>		
	Rail and sleeper quality	<input type="checkbox"/>	<input type="checkbox"/>		
	Levels and gauge to tolerance	<input type="checkbox"/>	<input type="checkbox"/>		
	Limit ramps and end stops correctly positioned and firmly fixed	<input type="checkbox"/>	<input type="checkbox"/>		
	Rails correctly fixed and earthed	<input type="checkbox"/>	<input type="checkbox"/>		
Documents against which foundation has been checked (drawing nos./document references):					
Notes and Observations:					
<i>I confirm the tower crane foundation has been constructed to the specifications and that a satisfactory post construction inspection has been carried out.</i>					
Name:		Signed:		Date:	
Position:			Company:		

Tower Crane Foundation Approval/Completion Certificate

Site Details :

Tower Crane No/Location:		Make:		Model:	
Height under Hook:		Jib Length:			

Base Type:

Foundation/Grillage Design	
-----------------------------------	--

Design Criteria and References:

Drawings and Documents Issued:

Limitations or Restrictions:

NOTE: If the foundation design relies on the use of permanent works, the designer should state whether the permanent works have been analysed

I certify that reasonable professional skill and care has been used in the preparation of this design, that the details have been checked for compliance with the relevant standards listed above and that the design has been accurately translated into drawings and other documents issued to site.

Name:		Signed:		Date:	
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Position:		Company:	
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Foundation/Grillage Design Check*	
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I certify that reasonable professional skill and care has been used in the preparation of this design, that the details have been checked for compliance with the relevant standards listed above and that the design has been accurately translated into drawings and other documents issued to site.

Name:		Signed:		Date:	
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Position:		Company:	
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*NOTE: A separate approval/completion certificate is required for each tower crane * Category 3 check , Table 2 of BS 5975*

Permit To Erect	
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I confirm the tower crane foundation has been constructed to the specifications detailed above and a post construction inspection has been carried out (recorded on the attached report), and that the tower crane may be erected.

Name:		Signed:		Date:	
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Position:		Company:	
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NOTE: The tower crane cannot be erected until the completed form is returned to the Operations Department

Tower Crane Tie Fabrication and Installation Inspection Report

Site Details :

Tower Crane No/Location:		Make:		Model:	
Height under Hook:		Jib Length:			
Tie Type:	Tie Position (from base):				

Items Checked (delete where not applicable)		As Specified?		Inspected By	Date
		Yes	No		
All Ties	Compliance with design drawings/specification	<input type="checkbox"/>	<input type="checkbox"/>		
Steelwork	Steel grade	<input type="checkbox"/>	<input type="checkbox"/>		
	Dimensional check	<input type="checkbox"/>	<input type="checkbox"/>		
	Weld quality	<input type="checkbox"/>	<input type="checkbox"/>		
	Bolts – grade, torque, tightness, quantity	<input type="checkbox"/>	<input type="checkbox"/>		
Structure Attachment Points	Confirmation that the tie attachment points on the supporting structure will take the design tie loads	<input type="checkbox"/>	<input type="checkbox"/>		
Tower Crane Mast	Verticality within tolerance	<input type="checkbox"/>	<input type="checkbox"/>		

Documents against which tie has been checked (drawing nos./document references):

Notes and Observations:

I confirm the tower crane tie has been manufactured to the design specifications and that a satisfactory pre-installation construction inspection has been carried out.

Name:		Signed:		Date:	
Position:			Company:		

Tower Crane Tie Approval/Completion Certificate

Site Details :

Tower Crane No/Location:		Make:		Model:	
Height under Hook:		Jib Length:			
Tie Type:	Tie Position (from base):				

Tie Design

Design Criteria and References:

Drawings and Documents Issued:

Limitations or Restrictions:

NOTE: Where the tie design relies on the use of permanent works for support, the designer should state whether the permanent works have been analysed

I certify that reasonable professional skill and care has been used in the preparation of this design, that the details have been checked for compliance with the relevant standards listed above and that the design has been accurately translated into drawings and other documents issued to site.

Name:		Signed:		Date:	
Position:			Company:		

Tie Design Check*

I certify that reasonable professional skill and care has been used in the preparation of this design, that the details have been checked for compliance with the relevant standards listed above and that the design has been accurately translated into drawings and other documents issued to site.

Name:		Signed:		Date:	
Position:			Company:		

*NOTE: A separate approval/completion certificate is required for each tower crane * Category 3 check , Table 2 of BS 5975*

Permit To Erect

I confirm the tower crane tie and tie attachment point to the supporting structure has been constructed to the specifications detailed above and a pre installation inspection has been carried out (recorded on the attached report), and that the tie may be installed.

Name:		Signed:		Date:	
Position:			Company:		

NOTE: The tower crane cannot be erected until the completed form is returned to the Operations Department

Annex C - Management of Tower Cranes Leading Indicator Audit Form

Management of Tower Cranes Leading Indicator Audit

Nature of construction project:

Date(s) of audit:

Tower crane number:

Proforma completed by:

1.0	Selection	
1.1	Is the tower crane selected the correct type for the application?	Y/N
1.2	Is the model and size of tower crane selected correct?	Y/N
2.0	Erection	
2.1	Does the location of the tower crane take account of location hazards?	Y/N
2.2	Has the competence of the Erection Team been demonstrated?	Y/N
2.3	Has a site and job specific risk assessment been carried out, a method statement been written and all personnel involved briefed?	Y/N
2.4	Have measures been put in place to avoid collisions with other tower cranes and high reach plant?	Y/N
2.5	Has the tower crane base been designed and installed correctly (see Temporary Works question set)?	Y/N
2.6	Have any ties been designed and installed correctly (see Temporary Works question set)?	Y/N
2.7	Has a post installation test and through examination been carried out before handover?	Y/N
2.8	Does method statement for climbing operation contain hold points and contingency plans for rising wind speed and equipment failure during climbing?	Y/N
3.0	Maintenance	
3.1	Is daily, weekly and periodic preventive maintenance being carried out and are records available?	Y/N
3.2	Are defects being reported, investigated and rectified in a timely manner?	Y/N
4.0	Thorough Examination	
4.1	Are statutory periodic thorough examinations being carried out?	Y/N
4.2	Does the competent person have adequate independence?	Y/N
4.3	Are defects being reported, investigated and rectified in a timely manner?	Y/N
5.0	Operation	
5.1	Has the competence and medical fitness of the operators been demonstrated?	Y/N
5.2	Are there sufficient operators to allow for regular breaks and shift patterns?	Y/N
5.3	Are wind speed restrictions followed?	Y/N
5.3	Are communications between operator and slinger/signallers adequate?	Y/N
5.4	Are all lifts adequately planned and supervised?	Y/N
5.5	Is the operation of multiple cranes co-ordinated effectively?	Y/N
5.6	Are all cranes left out of service in the correct condition?	Y/N

Annex D - Additional Information

Legislation

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.

Standards

BS 5975:2008 + A1:2011, *Code of practice for temporary works procedures and the permissible stress design of falsework*

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

BS 7121-2-1:2012, *Code of practice for the safe use of cranes, Part 2-1: Inspection, maintenance and thorough examination – General*

BS 7121-2-5:2012, *Code of practice for the safe use of cranes, Part 2-5: Inspection, maintenance and thorough examination – Tower cranes*

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

Other Publications

Best Practice Guide on the Climbing of Tower Cranes, Construction Plant-hire Association (free download from www.cpa.uk.net)

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

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

Best Practice Guide on the Safe Use of Top Slew Tower Cranes, Construction Plant-hire Association (free download from www.cpa.uk.net)

Best Practice Guide on the Safe Use of Self Erecting Tower Cranes, Construction Plant-hire Association (free download from www.cpa.uk.net).

Good Practice Guide on Medical Fitness to Operate Construction Plant, SFfC Plant Safety Group (free download from www.cpa.uk.net).

Tower Crane Technical Information Note series, Construction Plant-hire Association (free download from www.cpa.uk.net).

TIN 031 - *Tower Crane Bases and Ties*, Construction Plant-hire Association (free download from www.cpa.uk.net).

TIN 036 - *Tower Crane Power Supplies, Earthing Arrangements and Lightning Protection*, Construction Plant-hire Association (free download from www.cpa.uk.net).

Tower crane stability, 2006. CIRIA RP707 (C654). Construction Industry Research and Information Association.

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

Guidance on The Planning & Liaison Process for the Erection, Climbing & Dismantling of Tower Cranes, Strategic Forum For Construction.

The Safe External Climbing of Tower Cranes” DVD Lend Lease and Select Tower Cranes.

Tower Crane Installation Training Programme, TWR 01. Construction Skills.