

Construction Industry Council

CIC Guidelines on Safety of Tower Cranes, Working in Hot Weather and Site Vehicles and Mobile Plant

1

(I) Purpose

- This paper seeks Members' endorsement for promulgation of the following CIC guidelines –
 - Publication No. 1 - Guidelines on Safety of Tower Cranes (at Annex I)
 - Publication No. 2 – Guidelines on Site Safety Measures for Working in Hot Weather (at Annex II)
 - Publication No. 3 – Guidelines on Safety of Site Vehicles and Mobile Plant (at Annex III)

2

(II) Introduction

- Since its formation in early 2007, the Committee on Construction Site Safety (Com CSS) has established informal task forces to tackle specific site safety issues.
- These include the following informal task forces formed in mid-2007 –
 - Informal Task Force on Safety of Tower Cranes (TF-TC);
 - Informal Task Force on Working in Hot Weather (TF-HW); and
 - Informal Task Force on Site Vehicles and Mobile Plant (TF-SV)

3

- TF-TC was formed in response to the concern arising from the serious accidents associated with tower cranes that occurred in mid-2007. TF-HW was formed to formulate measures for working in hot weather following the unusually hot summer in 2007.

4

(III) Guidelines

- TF-TC and TF-SV have completed their deliberations and consolidated their recommendations as sets of guidelines for adoption by the industry.
- TF-HW has completed the first stage of its deliberations and delivered an initial set of guidelines on measures that could be readily implemented in the coming summer.
- A study on the relationship between safety measures and thermal stress on workers measured by established parameters will be conducted in due course to facilitate the development of a more scientific set of guidelines for promulgation before summer 2009.
- The three sets of guidelines have been endorsed at the 5th meeting of Com CSS held on 2 April 2008.

5

(IV) Way Forward

(A) Website

- Subject to Members' endorsement, the three sets of guidelines will be published on CIC's website.

(B) Circulation of printed copies

- Printed copies will be circulated to the following types of industry organizations -
 - concerned government departments;
 - employers;
 - professional institutions and associations;
 - associations of contractors, subcontractors and suppliers;
 - trade unions; and
 - subcontractors registered on the Voluntary Subcontractor Registration Scheme operated by CIC.

6

- Appropriate industry organizations will be requested to further circulate the pamphlets to their members. For example, HKCA may help in circulating the pamphlet to contractors while the Hong Kong Construction Sub-contractors Association may help in relation to subcontractors.

(C) Seminars and talks

- Consideration may also be given to organizing talks to introduce the guidelines to industry organizations.

7

ADVICE PLEASE

8

Construction Industry Council

Publication No. 1
Guidelines on Safety of Tower Cranes

Disclaimer

This publication is prepared by the Construction Industry Council (CIC) to report findings or set out the recommended practices on specific subjects for reference by the industry but is NOT intended to constitute any professional advice on these or any other subjects. The parties using this publication should therefore seek appropriate advice from their professional advisers. CIC (including its members and employees) will NOT accept responsibilities for any consequences resulting from the use of or failure to use this publication.

Enquiries

Questions on these guidelines may be made to the CIC Secretariat at –

Rm 2001, 20/F, Alliance Building
130-136 Connaught Road Central
Hong Kong.

Tel. no. - 3571 8716
Fax no. - 3571 9848
E-mail - enquiry@hkcic.org
Construction Industry Council

Publication No. 1
Guidelines on Safety of Tower Cranes

A. Purpose

This publication sets out the good practices recommended by the Construction Industry Council (CIC) for enhancing the safety of tower crane operation.

B. Definitions

2. In this document, unless the context otherwise requires –
- (a) “Competent Person” means a person who is appointed by a Specialist Contractor to supervise the erection, dismantling and height alteration operation of a tower crane;
 - (b) “Competent Mechanical Engineer” (CME) means a Registered Professional Engineer registered under the Engineers Registration Ordinance (Cap 409) in the Mechanical Engineering or Naval Architecture & Marine discipline;
 - (c) “Competent Structural Engineer” (CSE) means a Registered Professional Engineer registered under the Engineer Registration Ordinance, Cap 409 in the Structural Engineering discipline;
 - (d) “height alteration” means the addition or removal of mast section to or from the main tower of a tower crane;
 - (e) “Operation” means the erection, dismantling and height alteration operations on a tower crane;
 - (f) “Owner” means person or company owning a tower crane;
 - (g) “Principal Contractor” means any person who enters into a contract with a client organization to perform construction work;

- (h) “Registered Safety Officer” means a person registered under regulation 7 of the Factories and Industrial Undertakings (Safety Officers and Safety Supervisors) Regulations;
- (i) “Specialist Contractor” means any person who enters into a contract with a Principal Contractor, or a subcontractor of a Principal Contractor to perform the erection, dismantling and height alteration of tower crane;
- (j) “Technically Competent Person Grade T5” (TCP T5) means a person whose academic or professional qualifications or experience of building works or street works satisfy the requirements set out in the Code of Practice for Site Supervision issued by Buildings Department for a particular type of site supervision or management tasks.

C. Introduction

3. Tower cranes are widely used for conveying of building materials on construction sites. Given that collapse of tower crane could result in serious threats to the safety of site personnel and members of the public, organizations and individual responsible for safety of tower cranes should take appropriate measures to assure their safety.

4. The Factories and Industrial Undertakings Ordinance (“FIUO”), the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations (“LALGR”) and the Occupational Safety and Health Ordinance (“OSHO”) impose duties on stake holders to assure the safety of tower cranes. These are complemented by the Code of Practice on the Safe Use Tower Crane published by the Commissioner for Labour under Section 7A of the FIUO providing practical guidance on selection, operation, erection and dismantling, maintenance, inspection, examination and testing of tower cranes.

5. This publication make recommendations on the measures for further enhancing the safety of tower cranes based on the good practices suggested by the concerned industry stakeholders including tower crane owners, specialist contractors and professionals. The Hong Kong Construction Association (HKCA) and the Construction Industry Council Training Academy (CICTA) also contributed on technical and administrative aspects.

6. While this publication does not have a special legal status, Labour Department has indicated that it shall take non-compliances of the recommended practices listed at Annex A into account in considering serving suspension notices under section 10 of the Occupational Safety and Health Ordinance (Cap 509) to the concerned Principal Contractors or Specialist Contractors. *For the avoidance of doubt, notwithstanding such intention, this publication is issued by CIC for reference by industry stakeholders only and will not constitute professional advice on tower crane operations or any other issues. The parties using this publication should therefore seek appropriate advice from their professional advisers. CIC (including its members and employees) will NOT accept responsibilities for any consequences resulting from the use of or failure to use this publication.*

D. Measures for Enhancing Safety of Tower Cranes

7. The following groups of measures described in the ensuing paragraphs are recommended for enhancing the safety of tower crane operations –

- (a) checking before erection of tower cranes;
- (b) improvements of site supervision;
- (c) qualifications and experience of Specialist Contractors;
and
- (d) qualification and experience of Competent Persons and workmen.

E. Checking before Erection of Tower Crane

(i) Pre-delivery checking

8. The owner of a tower crane should engage a CME to conduct pre-delivery checking in accordance with the procedures at Annex B before the tower crane is delivered onto the site.

9. As stipulated at Annex B, the CME should issue the following documents for the checking –

- (a) Report on Pre-Delivery Verification of Components with sample at Appendix B.1 to Annex B; and
- (b) Report on Pre-Delivery Inspection with sample at Appendix B.2 to Annex B.

(ii) *Checking of anchorage*

10. The anchorage of the tower crane should also be certified by an CME using Form 2 prescribed in LALGR before the tower crane may be erected.

(iii) *Checking of supporting structure*

11. Before a tower crane is erected, the principal contractor should engage a CSE or a TCP T5, with five years of relevant working experience to assess the structural integrity of the building structure for supporting and anchoring of the crane. The CSE or TCP should obtain all necessary information and specifications from the owner of the tower crane for conducting a comprehensive structural analysis including assessment of the adequacy of the foundation set-up and wall ties in resisting the anticipated loading including wind load.

12. The assessment report should be submitted to the Principal Contractor before concreting of the foundation and supporting structures.

(iv) *Derrick crane*

13. Where a derrick crane is used to dismantle a tower crane, the procedures in paragraphs 8 to 12 above should apply to the derrick crane. In particular, where a derrick crane supported on the roof is used, the adequacy of the roof for supporting the derrick crane should be assessed in the manner set out in paragraph 11 above.

F. Improvements of Site Supervision

(i) *Appointment of supervising engineer*

14. The principal contractors should appoint in writing a supervising engineer with the following qualifications, experience and competences to control, monitor and supervise operations on tower cranes –

- (a) an engineering degree of relevant discipline;

- (b) not less than four years of related working experience;
- (c) capability in administering the “Hold Points” on critical parts;
- (d) capability in communicating with the competent person throughout the operation; and
- (e) capability to conduct a visual inspection on the parts of a tower crane to ensure that they are in good working order before commencement of any operations.

(ii) Risk Assessment

15. The Principal Contractor should arrange to conduct a risk assessment in good time before the commencement of any operation on tower cranes to identify the hazards inherent in the operation and the hazards which could result from adjacent activities. The assessment should be conducted by safety professional (e.g. registered safety officers) and Registered Professional Engineer with suitable qualification and experience in appropriate discipline should be consulted on issues related to structural and mechanical stability. The assessment should be updated immediately before the start of the operations to take into account any changes in circumstances.

16. Principal contractors should formulate measures for avoiding the hazards identified in risk assessment, or where this is not possible, devise measures for minimizing their likelihood of occurrence or mitigating their consequences. These measures include –

- (a) installation of fall protection system for workers working at height;
- (b) suspension of work activities within an exclusion zone around the tower crane until an operation is completed;
- (c) provision of personal protective equipment such as protective gloves, ear protectors and reflective vests;
- (d) sufficient rest breaks;

- (e) provision of proper safety training for competent person and workmen engaged in tower crane operations;
- (f) provision of adequate lighting at inter-floors; and
- (g) employment of qualified workmen and competent person.

17. Chinese version of the risk assessment report should be made available on site for reference by specialist contractors engaged in tower crane operations.

18. The principal contractor and the specialist contractor should jointly prepare a method statement in Chinese to define the procedures of tower crane operations covering –

- (a) all measures for avoiding or mitigating the hazards identified in the risk assessment;
- (b) step-by-step procedures with diagrammatic illustration for conducting the operations with critical hazards and safety precautions highlighted by words such as “Danger”, “Caution” and “Hold Points”;
- (c) procedure and instruction on hold points of critical parts;
- (d) detailed procedures for avoiding hazards to site personnel working adjacent to the tower crane;
- (e) clear statements on the role and tasks of members of the working crew; and
- (f) arrangements for effective communication.

19. The guidelines for preparing the report for risk assessment are at Annex C.

(iii) *Pre-installation checking*

20. The Principal Contractor should check the availability of the following documents before proceeding with the erection of a tower crane or a derrick crane for dismantling a tower crane –

- (a) report on verification of components referred to in paragraph 9(a) above;
- (b) report on pre-delivery inspection referred to in paragraph 9(b) above;
- (c) Form 2 on checking of anchorage referred to in paragraph 10 above;
- (d) report on assessment of supporting structure referred to in paragraph 11 above; and
- (e) maintenance logbook recording the maintenance and inspection history of the crane.

(iv) *Pre-operation checking*

21. The principal contractor should make the following documents available before conducting any operation on a tower crane –

- (a) report of the risk assessment for the operation including the method statement;
- (b) records of the qualification and experience of the supervising engineer and the competent person responsible for the operation; and
- (c) all relevant certificates of test and examination of mobile cranes and derrick cranes used in the operation.

22. Copies of risk assessment report (including the method statement) should be distributed to the Specialist Contractor who should be advised of the estimated duration of the operation and the boundaries of the exclusion zone.

(v) *Pre-use Verification*

23. After the completion of each operation, the principal contractor should engage a CME to conduct a thorough examination and a load test to verify that the tower crane is fit for use. The use of the tower crane should resume only after satisfactory completion of the verification process.

G. Qualification and Experience of Specialist Contractors

24. Principal contractors should only engage competent Specialist Contractors registered on the specialty of “Erection, dismantling and climbing¹” of the Tower Crane trade of the Voluntary Subcontractor Registration Scheme administered by CIC for tower crane operations. Specialist contractors should possess the relevant experience, sufficient technical capability and engage competent person and workmen with appropriate skills and experience.

25. A Specialist Contractor should be able to understand the method statement for tower crane operations and to explain the details to his working crew including a full explanation on the risks associated with improper working procedures and those safety hints and precautions as outlined in the warning/attention sections normally marked “Cautions”, “Danger” or “Hold Points”.

H. Qualification and Experience of Competent Persons and Workmen

26. Specialist Contractors should employ Competent Persons and workmen with appropriate qualifications, training and experience for performing all operations on tower cranes taking into account the requirements set out at Annex D.

27. The manufacturer or his local agent should organize and provide familiarization training on tower cranes to competent persons.

I. Summary of Recommendations

28. The improvement measures recommended in the foregoing paragraphs are summarized at Annex E together with the implementing parties and timeframe.

¹ Code 4.1.1

List of Non-compliances with Possibility of Leading to Issue of Suspension Notices by Labour Department (LD)

1. Critical components and key members have not been inspected by a CME before delivery of a tower crane to the site for erection.
2. Report on Pre-delivery Inspection on critical components and key members by a CME is not available for on-site inspection.
3. Structural integrity of the building structure for supporting and anchoring of a tower crane or a derrick crane has not been assessed by a CSE or TCP T5.
4. Assessment report issued by a CSE or TCP T5 on the structural integrity of the building structure is not made available for on-site inspection by LD.
5. Maintenance logbook and Report on Pre-delivery Verification of Components are not kept available for on-site inspection by LD.
6. Competent person is not employed for the erection, dismantling and height alteration of a tower crane.
7. The competent person does not possess experience satisfying the requirements stipulated at Annex D.
8. The competent person does not possess adequate qualification and training to supervise his working crew for the operation.
9. The operation is not carried out by workmen with qualification, experience and training stipulated at Annex D.
10. Specific site risk assessment prior to the operation has not been conducted.
11. Specific site risk assessment report in Chinese has not been prepared.
12. Method statement in Chinese for the operation has not been prepared.
13. The operation is not supervised by a supervising engineer.

14. The supervising engineer does not possess qualification, experience and competences stipulated in paragraph 14 of the main text.

Implementation

- LD is taking items 6–8 and 10–12 into account in issuing suspension notices.
- The remaining items will take effect for this purpose within **three months** of the issue of this publication.

Procedures for Pre-Delivery Checking

Purpose

This Annex sets out procedures for pre-erection examination of tower cranes.

Engagement of CME

2. The owner of a tower crane should engage a CME to conduct a pre-erection examination of the tower crane before its erection on site.

Provision of Documents by the Owner

3. The owner should provide the following information to the CME –

- (a) origins of parts and components - written confirmation that all parts and components are identical or equivalent to the tower crane manufacturer's original equipment parts and components;
- (b) unique identification of parts and components - unique identification to all main structural parts, motors, gearboxes and braking systems of tower cranes to be used when referring to components in reports for inspection and testing, and certifications for repairs and modifications. (A sample list is included at Appendix B.1.)

(Unique identification will not be required for pins and bolts used containing main structural parts if systems are in place for separating those that have passed non-destructive tests from the others. However, if the crane manufacturer specifies any limitations on the usage of the pins and bolts (e.g., with useful life dictated by the number of times that have been in use, etc.), unique identifiers should be provided.)

- (c) verification checklist – listing the main components making up the tower crane to help in verifying that these main components conform to the manufacturer's

specifications;

- (d) relevant sections from the user manual - to demonstrate conformance of parts and components with the manufacturer's specifications;
- (e) maintenance logbook - details of the most recent repair and maintenance work performed on the critical parts as listed below –
 - (i) Main structural parts
 - (ii) Motors
 - (iii) Gearboxes
 - (iv) Braking systems
 - (v) Slewing ring mounting bolts

(Further details should be provided if requested by the CME.)

Examination by CME

4. The CME should conduct thorough examination of the critical parts of a tower crane before it is delivered to the construction site making appropriate reference to the information provided by the owner. A checklist illustrating the possible scope of the examination is at Appendix B.2. As the checklist is for illustration only and is by not meant to be exhaustive, the CME should examine its applicability and validity by making reference to manufacturer's specifications and manual of the specific tower crane and other relevant information.

Non-destructive Tests

5. The non-destructive tests on the critical components including bolts and pins and welded connections should be conducted by qualified personnel. All bolts and pins (i.e., 100%) used for connection of main structural parts should be tested. Items with cracks should be replaced.

6. The CME should prescribe the non-destructive tests to be conducted on welded connection based on the result of visual inspection of critical parts. For critical parts over fifteen years old or of unconfirmed age, the minimum amount of welded connections to be tested shall be 10%. A higher percentage may be specified by the CME

where deemed necessary (e.g., due to a history of cracking).

7. If cracks are detected on any component, then all remaining welded connections on that component must be tested. Components with cracks must be replaced or repaired in accordance with the manufacturer's specifications, then further thoroughly examined by the CME.

8. All non-destructive test reports shall be forwarded to the CME for review.

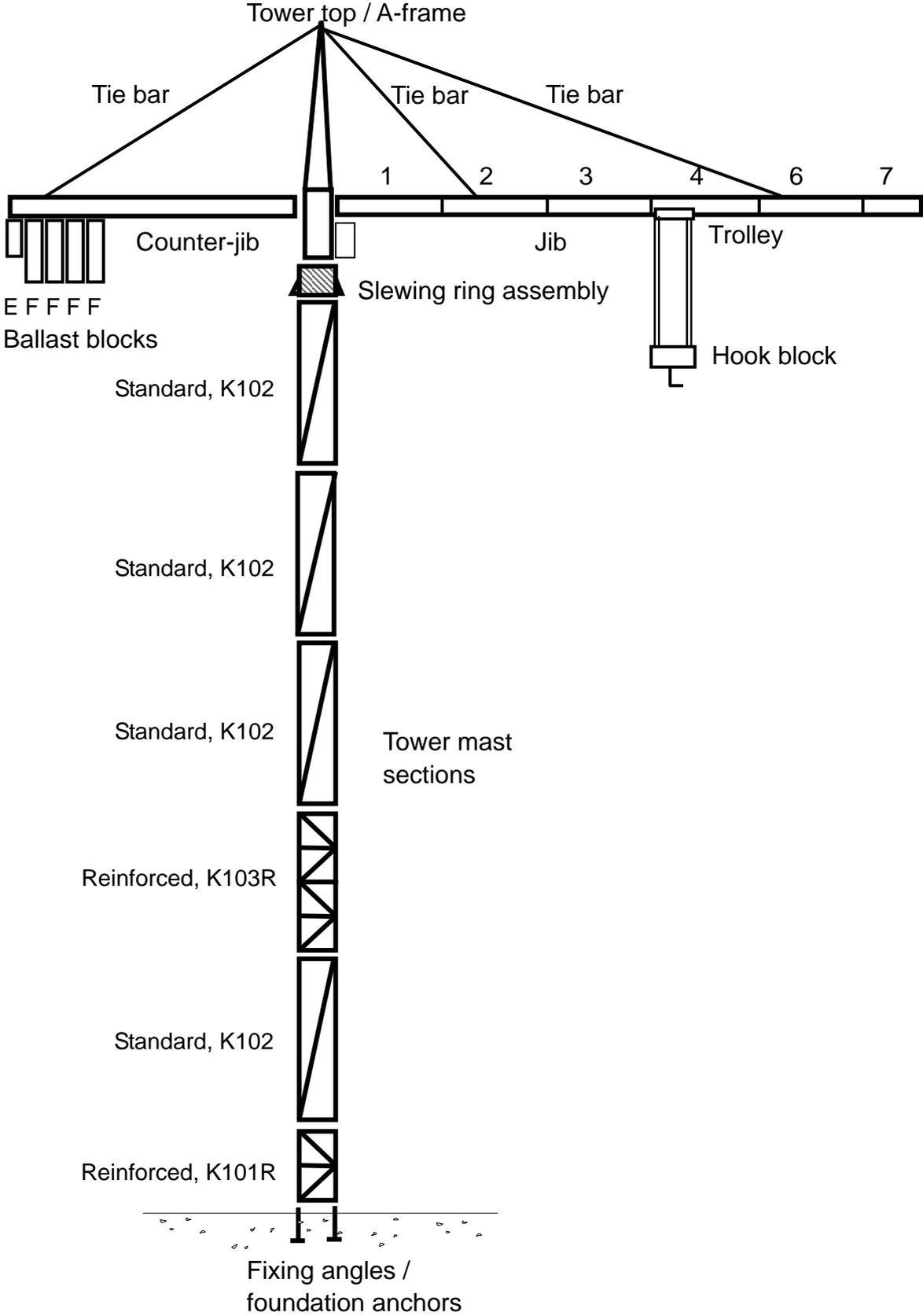
Sample Verification Checklist

1. Particulars of Tower Crane

Site details : Block 1, 88 ABC road, Kowloon Tong
Site identification : TC1
Make : ABC
Model : TX100
Jib length : 55m
Mast height : 28.2m
Hook height : 30.7m
Serial No. : 123456
Year : 2007

(Note : The checklist is by no means exhaustive. Owners should examine its applicability and validity by making reference to manufacturer's specifications and manual of the specific tower crane.)

2. Manufacturer Specification



I have verified that the following main components (critical parts) making up the tower crane conform to the manufacturer's specifications as follows:

Item	Main components	Qty	Owner's identification	Manufacturer's code	Main dimensions	Year	Remarks
1	Fixing angles / anchors	4	F1, F2, F3, F4	Q200	200mm high	2007	Non-reusable
2	Tower base undercarriage / chassis	Nil					
3	Tower mast sections	1	M1	K103R	1.6m x 1.6m x 5m high	2007	Reinforced
		4	M2, M3, M4, M5	K102	1.6m x 1.6m x 5m high	2007	Standard
		1	M6	K101R	1.6m x 1.6m x 3m high	2007	Base section, reinforced
4	Slewing ring assembly	1	M1	S300		2007	Reinforced
5	Tower top / A-frame	1	T1	A202	5m high	2007	
6	Counter-jib	1	C1	C204	12m	2007	
7	Jib	5	J1,J2,J3,J4 J6	1,2,3,4,6	10m long	2007	
		1	J7	7	5m long	2007	
8	Ballast blocks	4	B1,B2,B3,B4	Type F	4mx2mx0.3 m thk	2007	4 tonnes each
		1	B5	Type E	2mx2mx0.3 m thk	2007	2 tonnes each
9	Wire drum	1	WD1		φ500mm drum	2007	Hoisting
		1	WD2		φ200mm drum	2007	Trolley
10	Hook block	1	H1			2007	4-fall
11	Trolley	1	T1			2007	4-fall
12	Telescopic cage	1	TC1			2007	

Date of Verification: _____

Signature: _____

Date of This Report: _____

Name of CME: _____

Reg. No. : _____

Scope of the Thorough Examination

Report reference :

Report date :

**THOROUGH EXAMINATION OF CRITICAL PARTS
FOR TOWER CRANE**

(Note: The checklist shown in this report is by no means exhaustive. RPE should examine its applicability and validity by making reference to manufacturer's specifications and manual of the specific tower crane.)

Thoroughly examined by

Name of Competent Mechanical Engineer :

Registration No. :

Date of Examination :

Date of This Report :

CONTENTS

<u>Section</u>	<u>Description</u>	<u>Page</u>
1.	Introduction	
2.	Particulars of tower crane	
3.	Visual examination	
4.	Dimensional examination	
5.	Review of maintenance logbook	
6.	Summary of findings	

1. INTRODUCTION

This report presents details of the thorough examination carried out on the critical parts of the tower crane before they are delivered to a construction site.

2. PARTICULARS OF TOWER CRANE

Tower crane owner :

Inspection location :

Site address :

Site identification :

Make :

Model :

Jib length :

Mast / hook height :

Serial No. :

Year :

3. VISUAL EXAMINATION

Visual examination was carried out to check and examine the state of the critical parts listed in Sections 3.1 and 3.2.

(Note: Visible damage includes cracking, deformation, corrosion, wear and abrasion)

<u>Critical parts</u>	<u>Acceptance criteria</u>	<u>Condition acceptable</u>		
		Yes	No	Remarks
3.1 Main structural parts				
(a) Fixing angles / foundation anchors	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(b) Tower base undercarriage / chassis				
Structural members	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Welded connections	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Connection pins / bolts	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(c) Tower mast sections				
Structural members	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Welded connections	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Connection pins / bolts	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(d) Slewing ring assembly				
Structural frame	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Welded connections	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Slewing ring mounting bolts	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(e) Tower top / A-frame				
Structural members	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Welded connections	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Connection pins / bolts	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(f) Counter-jib				
Structural members	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Welded connections	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Tie bars	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Connection pins	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(g) Jib				
Structural members	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Welded connections	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Tie bars	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Connection pins	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____

<u>Critical parts</u>	<u>Acceptance criteria</u>	<u>Condition acceptable</u>		
		Yes	No	Remarks
3.2 Accessories				
(a) Ballast blocks				
Undercarriage / chassis	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Counter-jib	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(b) Pulleys	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(c) Wire drums				
Hoisting	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Trolley	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Luffing	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(d) Wire ropes				
Hoisting	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Trolley	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Luffing	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(Note: Acceptance criteria shall include any special recommendations from the manufacturer)				
(e) Hook block	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(f) Trolley	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(g) Collars				
Climbing collars for floor climbing	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Climbing ladders for floor climbing	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Wall tie collars for telescoping	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Hydraulic assembly	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
(h) Telescopic cage				
Structural members	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Welded connections	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Connection pins / bolts	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____
Hydraulic assembly	No visible damage affecting safety	<input type="checkbox"/>	<input type="checkbox"/>	_____

4. DIMENSIONAL EXAMINATION

Measurement of the pin and hole diameter for pinned connections was carried out to check for out-of-tolerance against the manufacturer's recommendations.

<u>Critical parts</u>	<u>Acceptance criteria</u>	<u>Dimension acceptable</u>		
		Yes	No	Remarks
(a) Mast section connections				
Pin diameter	As per manufacturer's recommendations	<input type="checkbox"/>	<input type="checkbox"/>	_____
Hole diameter	As per manufacturer's recommendations	<input type="checkbox"/>	<input type="checkbox"/>	_____
(Note: Connections with fixing angles / foundation anchors, between adjoining mast sections, and with slewing ring support)				
(b) Jib section connections				
Pin diameter	As per manufacturer's recommendations	<input type="checkbox"/>	<input type="checkbox"/>	_____
Hole diameter	As per manufacturer's recommendations	<input type="checkbox"/>	<input type="checkbox"/>	_____
(Note: Connections between adjoining jib sections)				
(c) Tie bar connections				
Pin diameter	As per manufacturer's recommendations	<input type="checkbox"/>	<input type="checkbox"/>	_____
Hole diameter	As per manufacturer's recommendations	<input type="checkbox"/>	<input type="checkbox"/>	_____
(Note: Connections between adjoining tie bars, and with fixing plate)				

5. REVIEW OF MAINTENANCE LOGBOOK

The repair and maintenance record prepared by the tower crane owner shall include details of work performed on the following critical parts.

<u>Critical parts</u>	<u>Acceptance criteria</u>	<u>Details available</u>		
		Yes	No	Remarks
(a) Main structural parts	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
(b) Motors				
Hoisting	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
Slewing	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
Trolley	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
Luffing	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
(c) Gearboxes				
Hoisting	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
Slewing	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
Trolley	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
Luffing	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
(d) Braking systems				
Hoisting	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
Slewing	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
Trolley	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
Luffing	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____
(e) Slewing gear mounting bolts				
Tightening torque	As per manufacturer's instructions	<input type="checkbox"/>	<input type="checkbox"/>	_____

6. SUMMARY OF FINDINGS

6.1 Critical parts thoroughly examined

- All critical parts thoroughly examined are in acceptable condition, and are considered suitable for site installation.

- The critical parts listed below are **not** in acceptable condition, and are required to be replaced or repaired in accordance with the manufacturer’s specifications. The replaced or repaired parts are required to be further thoroughly examined by a RPE when they become available.

	<u>Critical part</u>	<u>Details of non-conformance</u>
(a)	_____	_____
(b)	_____	_____
(c)	_____	_____

6.2 Maintenance logbook

- Record of repair and maintenance work performed on the critical parts is available.

- Record of repair and maintenance work performed on the critical parts is **not** available for the items listed below. The record is required to be updated and further reviewed by a RPE when all the outstanding repair and maintenance work have been performed.

	<u>Critical part</u>
(a)	_____
(b)	_____
(c)	_____

6.3 Non-destructive test reports

(a) Bolts and pins

Non-destructive test report for bolts and pins (used for connection of main structural parts) is available to confirm acceptable condition.

Yes

No

Remarks: _____

(b) Welded connections

Non-destructive test report for welded connections is available to confirm acceptable condition.

Yes

No

Remarks: _____

Report for Risk Assessment

Purpose

This Annex sets out the guidelines for reporting on risk assessment for tower crane operations.

Overview

2. A report for risk assessment should consist of the following sections –

- (a) introduction
- (b) hazard assessment
- (c) method statement
- (d) record of key personnel
- (e) manufacturer's manual for tower crane.

(A) *Introduction*

3. This section should cover –

- (a) purpose of the risk assessment report;
- (b) scope and detailed description of the project; and
- (c) operations covered by the report.

(B) *Hazard assessment*

4. This section should cover the hazards identified taking into account all relevant matters including -

- (a) preparation work;
 - deployment of crew for work supervision;
 - checks on the suspension points of various accessories (with specification);
 - checks on the lifting appliances and lifting gears (with specification);
 - operating frequencies of walkie-talkies;
 - checks on hand tools and fall arresting stripes;

- checks on full body harness;
 - location of the enclosure;
 - checks on personal protective equipment;
 - storage of material;
 - safety training;
 - wind speed monitoring and the maximum allowable wind speed;
 - arrangement of the control ropes;
- (b) work commencement procedures specifying the potential risk and mitigation measures of all procedures;
- (c) work completion procedures including tests, examination and certification; and
- (d) contingency plan for emergencies.
5. A sample hazard analysis is included at Appendix C.1 for reference.

(C) Method statement

6. The section should clearly define the procedures for every step in the operations and should be drawn up in consultation with the competent person, the safety officer and other people concerned and should be issued to the working crew for effective compliance.

7. The method statement should include –

- (a) details of the construction site and construction works which should include a site layout plan;
- (b) notes on the general safety measures for the works;
- (c) pre-construction plan;
- (d) operating procedures with key points highlighted by diagrammatic illustrations;
- (e) personal safety equipment; and
- (f) safety measures for the operation.

8. Example of a site layout plan is included at Appendix C.2 while a sample method statement for dismantling of tower crane is at Appendix C.3.

(D) Personal particulars of crew members

9. This section should list the personal particulars of –

- (a) staff responsible for drawing up the method statement;
 - (b) members of the working crew –
 - (i) competent person;
 - (ii) senior workmen;
 - (iii) junior workmen.
10. Personal particulars should include the following –
- (a) name of the person;
 - (b) position held;
 - (c) qualifications held (including certificates issued in accordance with statutory provisions); and
 - (d) year of experience.
11. A sample of personal particulars is at Appendix C.4.
- (E) *Manufacturer's Manual***
12. Contractor should enclose a copy of the manufacturer's manual in the risk assessment report.

ABC Construction Company

Safety : xxxxxx
 Revision : 3
 Date :

Findings of Analysis into Works Hazards

Description of work	:	Addition of mast to heighten a tower crane				Location of	:	
Post of operator	:	Tower Crane Operator of XX				Operation	:	
Members of Hazard Analysis Group	:	xxx (Site In-charge), xxx (Respresentative of XX), xxx (Quality Control Manager) xxx (Chief Mechanic) and xxx (Safety Officer)				Date of Analysis	:	
Reviewed by	:	xxx Site In-charge (Vetting)	Recorded by xxx (Safety Officer)			Date of Review	:	
Personal Protective Equipment Required	:	Safety Harness NH60/Sala / P+P, Fall Arrestor FUJII DENKO, Mask 3M 8210 N95, Ear Plug 3M EP1250, Eye Goggles UVEX 9161-014, Safety Helmet Centurion 1100, Safety Boots						
Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
(1) Preparation Work:								
Item 1.1	Item 1.1					Item 1.1		
Formulation of safe working procedure on the addition of mast to tower crane	Danger caused by non-specific working procedure (potential danger: Danger triggered because of no works statement was prepared or works statement being inappropriate)	W,A	4	3	12	Representative of XX draws up works hazard analysis, risk control measures and works programme together with QCM, Chief Mechanic, Site In-charge and Safety Officer	9(3X3)	QCM/SO Site In-charge/Chief Mechanic
Item 1.2	Item 1.2					Item 1.2		
Staffing arrangement for dedicated personnel to monitor the addition of mast to tower crane	Unclear or inadequate definition by monitoring officer triggers danger (potential danger: Danger triggered because monitoring officers are not at site to monitor the addition of chassis to mast)	W,A	4	3	12	XX appoints experienced works supervisor to monitor all procedures of the addition of mast to tower crane (the supervising officer is XXX/XXX/XXX)	9(3X3)	

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
Item 1.3	Item 1.3					Item 1.3		
Examination of every hanging point (such as ballasts etc.)	There is the danger that an accessory may fall during the process of hoisting.	W,A	4	3	12	Works Supervisor to check all hanging points are fit	9(3X3)	
(It is necessary to specify which hanging points are included)	(Potential danger: defects of hanging points may lead to falling.)					before assigning workers to carry out proper hoisting.		
Item 1.4	Item 1.4					Item 1.4		
Inspect all lifting appliances and lifting gears.(It is necessary to specify which lifting appliances and lifting gears are included.)	Hoisting may lead to the falling of materials. (Potential danger: hoisting danger occurs because lifting gears have not been inspected by public surveyor or they are in poor conditions.)	W,A	4	3	12	Works Supervisor to check that lifting gears and cranes have been issued with certificates of inspection and are in good condition before proceeding to works procedures.	9(3X3)	
Item 1.5	Item 1.5					Item 1.5		
Frequency channel of walkie-talkie	Danger occurs during hoisting of material and communication. (potential danger: poor reception leads to danger.)	W,A	4	3	12	Works Supervisors are responsible for ensuring the proper reception of walkie-talkie.	9(3X3)	
Item 1.6	Item 1.6					Item 1.6		
Inspection of hand tools and fall arrest strips	Hand tools may fall down. (Potential danger: such as tools slipping from hand when in use may fall down.)	W,A	4	3	12	Works Supervisors are responsible for ensuring all hand tools are tied to fall arrest strips and they should instruct and supervise workers to...	9(3X3)	

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
Item 1.7	Item 1.7					Item 1.7		
Inspection of full body harness.	Potential danger of fall of person.	W,A	4	3	12	Works Supervisors are responsible	9(3X3)	
	(Potential danger: irregularity of					for a pre-works procedure inspection		
	full body harness or failure to use					to ensure full body harnesses are		
	full body harness may lead to fall of					proper and to supervise workers to		
	person.)					use them during the works		
						procedure. Also to instruct workers to		
						use the harnesses properly before any		
						works procedure.		
Item 1.8	Item 1.8					Item 1.8		
Fencing-off of site	Affect workers at lower working area.	W,A	4	3	12	Foremen, Chief Mechanic and	9(3X3)	
(It is necessary to specify the	(Potential danger: danger occurs					Works Supervisor are jointly		
location.)	because of improper fencing-off of					responsible for determining the area		Foreman
	site or there are workers working at					to be fenced off. Works Supervisor		
	lower working area.)					is to send someone to guard against		
						workers of other trades getting		
						into the crane erection area.		
Item 1.9	Item 1.9					Item 1.9		
Inspection of personal protective	PPP cannot fully perform its protection	W,A	4	3	12	Works Supervisor to inspect PPE	9(3X3)	
equipment (PPE)	function. (Potential danger: improper					before assigning work and to instruct		
	PPE can not perform its protective					workers of the proper use of it.		
	function or improper use of PPE by							
	worker may lead to danger.)							

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
Item 1.10	Item 1.10					Item 1.10		
Placing of materials	Improper placing of materials triggers danger (Potential danger: such as material obstructing passage, tall stacking and insecure placing, etc.)	W,A	3	3	9	Works Supervisor and Foreman to jointly work out the arrangement for placing of materials and to choose a suitable and secure place for the placing of materials. To instruct and supervise workers to place materials suitably and less than 2 metres high.	6(2X3)	Foreman
Item 1.11	Item 1.11					Item 1.11		
Safety training	Inadequate training of workers leads to danger (Potential danger: Inadequate hazard awareness of worker leads to danger.)	W	4	3	12	Works Supervisor to arrange training for workers before works procedures commence, including manual handling work.	9(3X3)	
Item 1.12	Item 1.12					Item 1.12		
Monitoring of wind speed (It is necessary to specify the greatest wind allowable.)	Wind speed exceeding 62 km per hour will result in danger (Potential danger: The turning of chassis and insecure hoisting may result in danger.)	W,A	4	3	12	Works Supervisor and Chief Mechanic are responsible for monitoring. (Receiving weather report) when wind speed exceeds 62 km per hour, operation of tower crane should be stopped immediately.	9(3X3)	
Item 1.13	Item 1.13					Item 1.13		
Arrangement for control rope	Collision of objects endangers workers (Potential danger: Inadequate and improper control rope may lead to danger in hoisting.)	W,A	4	3	12	Works Supervisor to arrange adequate and suitable control rope and monitor the use of it.	9(3X3)	

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
(2) Commencing works procedure								
(Erection of telescopic cage)								
Item 2.1	Item 2.1.1					Item 2.1.1		
Use the tower crane and two long chain slings and two short chain slings to hoist the telescopic cage to the mast at the bottom of chassis and then open the door of the telescopic cage. After fixing it to the mast at the bottom of chassis, use lifting gear to adjust the door of the telescopic cage and fix it properly, and then hammer the pins until they are firm, so that the telescopic cage is firmly fixed on the mast. Jack up the telescopic cage to the position of the chassis and then secure the 4 pins of the telescopic cage to the bottom of the chassis. After that remove the hook and connection wire.	Potential danger of fall of person ~1 (Potential danger: As workers work on the mast of the tower crane, there is the danger of fall of person.)	W,A	4	3	12	Works Supervisor to instruct workers to fix the full body harness firmly with fall arrestor before starting the works procedure. Works Supervisor to check if the access leading up and down is secure and suitable.	9(3X3)	
	Item 2.1.2					Item 2.1.2		
	Potential danger of load falling down~1 (Potential danger: Inappropriate hanging point of telescopic cage or unsuitable hoisting device may lead to the danger of load falling down.)	W,A	4	3	12	Works Supervisor to ensure the hanging point is proper before assigning workers with rigging certificate and experience to carry out rigging and lifting operation. Works Supervisor to fence off the lower working area before works procedures commence. Works Supervisor to check the valid certificates of all lifting devices and to ensure all lifting devices are in good condition by visual inspection.	9(3X3)	

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
Item 2.1 (cont'd)	Item 2.1.3					Item 2.1.3		
	Potential danger of falling of tools~1 (Potential danger: hand tools slipping from hand may fall down.)	W,A	4	3	12	Works Supervisor to instruct and monitor workers to use fall arrest strips to prevent hand tools from falling.	9(3X3)	
Item 2.2	Item 2.2.1					Item 2.2.1		
To install two mono-rails at the bottom of chassis and use the tower crane to fix the trolley on the mono-rail. When the telescopic cage is installed at the bottom of chassis, lift counter-jib to balance the tower crane.	Potential danger of fall of person~1 (Potential danger: As workers work on the mast of the tower crane, there is the danger of fall of person.)	W,A	4	3	12	Works Supervisor to instruct workers to fix the full body harness firmly with fall arrestor before starting the works procedure.	9(3X3)	
	Item 2.2.2					Item 2.2.2		
	Potential danger of load falling out~1 (Potential danger: Inappropriate rigging method of mono-rail or unsuitable hoisting device may lead to danger of load falling down.)	W,A	4	3	12	Works Supervisor to ensure the rigging method of mono-rail is appropriate before assigning workers with rigging certificate and experience to carry out rigging and lifting operation.	9(3X3)	
						Works Supervisor to fence off the lower working area before works procedures commence.		
						Works Supervisor to check the valid certificates of all lifting devices and to ensure all lifting devices are in good condition by visual inspection.		

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
Item 2.2 (Cont'd)	Item 2.2.3					Item 2.2.3		
	Potential danger of falling of tools~1 (Potential danger: hand tools slipping from hand when in use may fall down.)	W,A	4	3	12	Works Supervisor to instruct and monitor workers to use fall arrest strips to prevent tools from falling.	9(3X3)	
	Item 2.2.4					Item 2.2.4		
	Potential danger of fall of ballasts~1 (Potential danger: Inappropriate rigging point may lead to falling during hoisting)	W,A	4	3	12	Works Supervisor to assign workers with rigging certificate to carry out hoisting procedures.	9(3X3)	
						To instruct worker of the proper rigging method before works procedures commence.		
						To ensure rigging operator possesses relevant crane operation certificates and all lifting devices are in good condition and to check that they can be used.		
	Potential danger of fall of ballasts~2 (Potential danger: inappropriate hanging point may lead to fall during hoisting.)	W,A	4	3	12	Ganger to check that the hanging points of ballasts are proper before hoisting them.	9(3X3)	
						Works Supervisor to ensure chain slings are checked and are issued with valid certificate and are suitably locked before assigning experienced workers with rigging certificate to carry out rigging procedure.		

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
Item 2.3	Item 2.3.1					Item 2.3.1		
When the tower crane is balanced, hammer out the 8 pins at the bottom of the chassis and jack up the part of tower crane above the chassis until the two temporary supporting wedges can be laid on the shackle of the mast, and then slightly lower the tower crane so that it is firmly supported.	Potential danger of fall of person~1 (Potential danger: As workers work on the mast of the tower crane there is the danger of fall of person.)	W,A	4	3	12	Works Supervisor to instruct workers to fix the full body harness firmly with fall arrestor before starting the works procedure.	9(3X3)	
Use hydraulic jack to jack up the tower crane. Use tower crane to hoist mono-rail to the position of the mast and put the mast into the telescopic gear. Hammer the 8 groups of pins at the bottom of chassis until they are firm enough and then hammer the 4 groups of pins joining the mast until they are firm enough. The telescoping procedure of tower crane is completed.	Item 2.3.2 Potential danger of pin falling out~1 (Potential danger: Inappropriate hammering of pin or unsuitable hoisting device may lead to fall down of pin.)	W,A	4	3	12	Works Supervisor to instruct and monitor worker to hold pins firmly before putting them in the correct position and to start the procedure of hammering when they are firm.	9(3X3)	
						Works Supervisor to fence off the lower working area before works procedures commences.		
	Item 2.3.3 Danger of tower crane falling~1 (Potential danger: Inappropriate installation of shackle may lead to the fall of tower crane.)	W,A	4	3	12	Item 2.3.3 Works Supervisor to check shackle is properly installed before assigning workers to commence the tower crane telescoping procedure.		
	Danger of tower crane falling~2 (Potential danger: Inappropriate installation of temporary support wedges may lead to the fall of tower crane.)	W,A	4	3	12	Item 2.3.3 Works Supervisor to check the wedges are properly installed before assigning workers to commence the tower crane telescoping procedure.	9(3X3)	

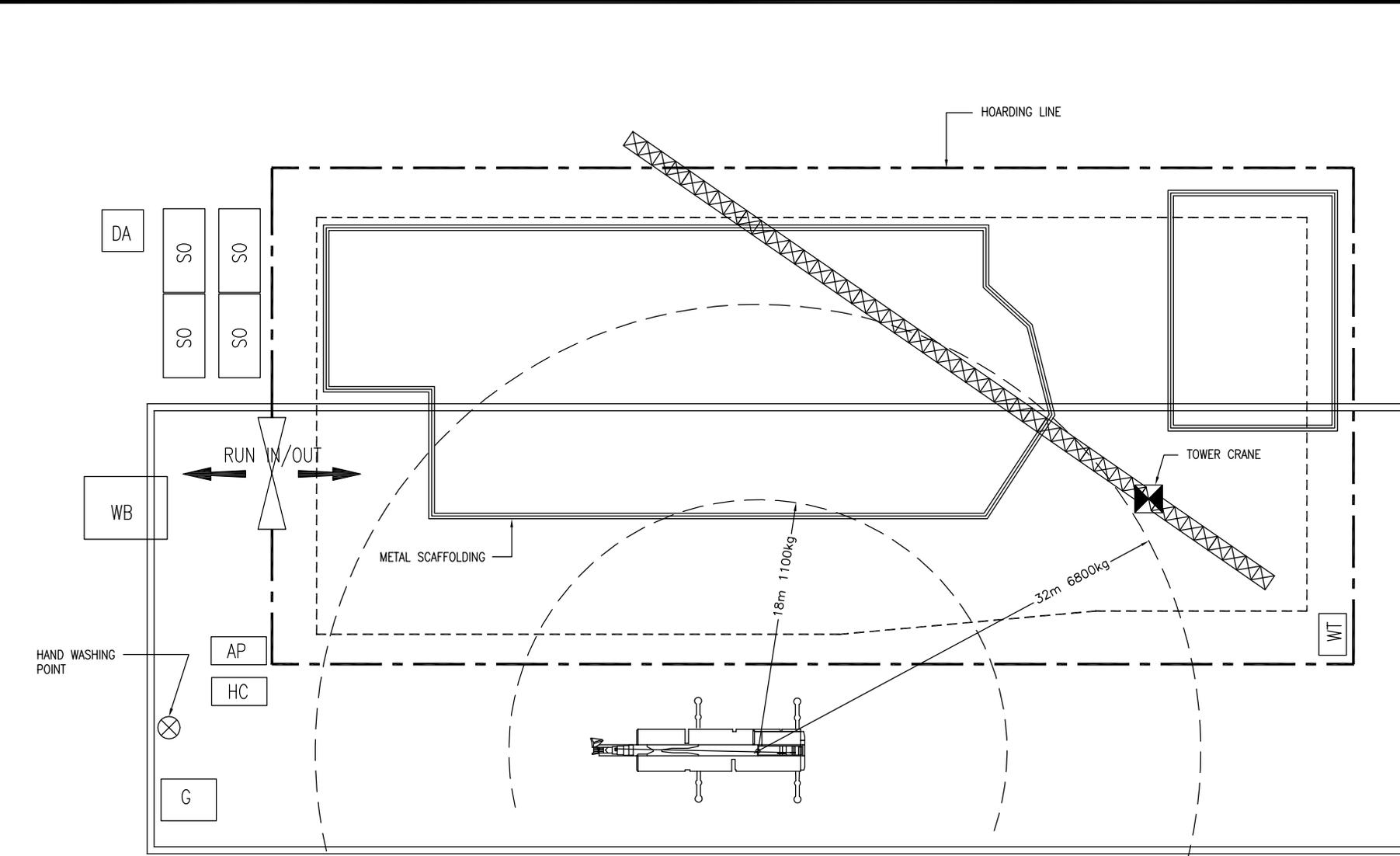
Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
(Dismantling of telescopic cage.)								
Item 2.4	Item 2.4.1					Item 2.4.1		
When the tower crane has climbed to the appropriate height, lower the telescopic cage until it sits firmly on the mast, and then hammer out the 8 groups of pins at the bottom of chassis and dismantle the telescopic cage with the following procedure:	Potential danger of fall of person~1 (Potential danger: As workers work on the mast of tower crane there is the danger of fall of person.)	W,A	4	3	12	Works Supervisor to instruct workers to fix the full body harness firmly with fall arrestor before starting the works procedure.	9(3X3)	
1. Use wires to secure the gate of the telescopic cage and dismantle the gate.	Item 2.4.2 Potential danger of pin falling down~1 (Potential danger: Inappropriate hammering of pins or unsuitable hoisting devices may lead to danger of pins falling down.)	W,A	4	3	12	Works Supervisor to instruct and monitor worker to hold pins firmly before putting them in the correct position and to start the procedure of hammering when they are firm.	9(3X3)	
2. Secure two groups of two long and two short chain slings to four appropriate positions and hammer out the four groups of pins each at the chassis and the four corners of the mast.						Works Supervisor to fence off the lower working area before works procedures commence .	9(3X3)	
3. Use wires to secure the telescopic cage	Item 2.4.3 Potential Danger of telescope cage falling ~1	W,A	4	3	12	Item 2.4.3 Works supervisor to check the mono-rail is secure before proceeding.		
4. Retrieve the shackle and loosen the hydraulic jack.	(Potential danger: Inappropriate installation of mono-rail may lead to falling of the mast.)					Works Supervisor to fence off the lower working area before works procedures commence.		
5. Use chain slings to pull out the telescopic cage along the mono-rail and hoist the telescopic cage back to the ground.								
(Remark: Other method of dismantling the telescopic cage can also be used.)								

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
Item 2.4 (continuation)						Works Supervisor to check the valid certificates of all lifting devices and to ensure all lifting devices are in good condition by visual inspection.		
						Works Supervisor to ensure the telescopic cage has been secured with wires.		
	Item 2.4.4					Item 2.4.4		
	Potential danger of falling of hand tools~3 (Potential danger: when tightening bolts, there is the danger of hand tools or bolts falling.)	W,A	4	3	12	Works Supervisor to instruct and monitor worker to use hand tool and control rope.	9(3X3)	
						Works Supervisor to fence off the lower working area before works procedures commence.		
	Item 2.4.5					Item 2.4.5	9(3X3)	
	Danger of tower crane falling. (Potential danger: Inappropriate installation of pins may lead to falling of the tower crane.)	W,A	4	3	12	Works Supervisor to check pins are properly installed before assigning workers to start the tower crane dismantling procedure.		

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
			Impossible(1)					
Item 2.5	Item 2.5.1					Item 2.5.1		
Transport the hydraulic jack and tools etc. back to the ground	Potential danger of load falling down~2 (Potential danger: Inappropriate hanging points for the hoisting of hydraulic jack and telescopic cage may lead falling.)	W,A	4	3	12	Works Supervisor to ensure the hanging points for the hoisting of hydraulic jack and telescopic cage are proper before assigning workers with rigging certificate and experience to carry out rigging operation.		
						Works Supervisor to check the valid certificates of all lifting devices and to ensure all lifting devices are in good condition by visual inspection.		
						Works Supervisor to instruct and monitor workers to use skip that have been checked for bulk handling.		
						Works Supervisor to fence off the lower working area before works procedures commence.		

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
Item 2.6	Item 2.6.1					Item 2.6.1		
Assign competent examiner to the site to carry out the tests and examine the tower crane.	Potential danger of fall of testing block~1 (Potential danger: Inappropriate rigging may leads to falling down during hoisting.)	W,A	4	3	12	Works Supervisor to assign workers with rigging certificate to carry out hoisting procedure.	9(3X3)	
The tower crane can only be used after electrician has adjusted the safe device and RPE has issued a valid certificate.						Works Supervisor to assign workers with rigging certificate to carry out hoisting of mast.		
						Before the works procedure is carried out, instruct workers of the proper rigging procedure.		
						To ensure crane operators possess relevant crane operation certificate and all lifting devices are in good condition and are checked suitable for use.		
	Potential danger of fall of testing block ~2 (Potential danger: Inappropriate hanging point may lead to falling during hoisting.)	W,A	4	3	12	Ganger to check that hanging point of the testing block is proper before hoisting them.	9(3X3)	
						Works Supervisor to ensure chain slings are checked and are issued with valid certificate and are suitably locked before assigning experienced workers with rigging certificate to carry out rigging procedure.		

Basic Operation Procedure	Existing and Potential Hazard	Conditon being Affected	Possibility(P)	Hazard Level(C)	Risk Level	Rectification Measures Resolved to be taken	Residual Risk Level	Action
		Workers(W)	Very Possible(5)	Mild(1)	*PC=RP			
		Public(P)	Possible(4)	Affected(2)				
		Environ-ment(E)	May be Possible(3)	Serious(3)				
		Asset(A)	Slimly Possible(2)	Disastrous				
	Impossible(1)							
(3) Completion of works procedure	Item3.1 Fall of object (Potential danger: If tools are not properly put away, when a tower crane is in operation, there is the danger of falling of object.)	W,A	4	3	12	Item3.1 When the works procedures are completed, Works Supervisor to check that all tools are put away properly.	9(3X3)	
(4) Emergency	Item4.1 Fire breaks out and workers can not get away and get injured.	W,P,E,A	4	3	12	Item4.1 Works Supervisor to inform Chief Mechanic and head of Emergency Action Team (Site In-charge) immediately and to take action accordingly.	9(3X3)	Site-In-charge
						Site In-charge to inform first aider to stand-by for rescue.		Site-In-charge & first aider
						After receiving the message, the Site In-charge immediately appoints someone to have a vehicle ready in case there is the need to send casualties to hospital.		Site-In-charge
						After the fire, the Site In-charge shall convene a meeting to review the causes of the fire and the accident and draw up precautionary measures to prevent the same from happening.		Site-In-charge



- LEGEND:**
- SO - SITE OFFICE
 - DA - DANGEROUS STORAGE CABINET
 - WB - WHEEL WASHING BAY
 - AP - ASSEMBLE POINT
 - HC - HELMET CAGE
 - G - GENERATOR WITH EMERGENCY STOP
 - WT - WATER TREATMENT PLANT

SITE LAYOUT PLAN
(N.T.S.)

REV.	DESCRIPTION	DATE
MAIN CONTRACTOR :		
 協興建築有限公司 HIP HING CONSTRUCTION CO LTD 新加坡建築師公會 Member of NWS Holdings		
PROJECT :		
TITLE :		
SITE LAYOUT PLAN		
DRAWN BY:	CHECKED BY:	APPROVED BY:
-	-	-
JOB NO :	SCALE :	DATE :
-	N.T.S.	23-1-2008
DRAWING NUMBER :		REV.
SO/001		

SAMPLE

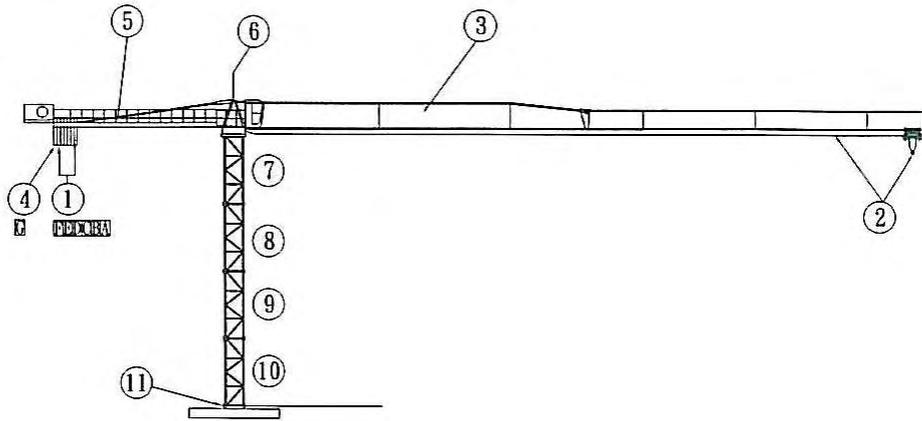
Appendix C.3

Requirement of tower crane erection/dismantling procedures as expressed in the method statement

Site Name : _____

Project Item : _____

Scale : 1:700



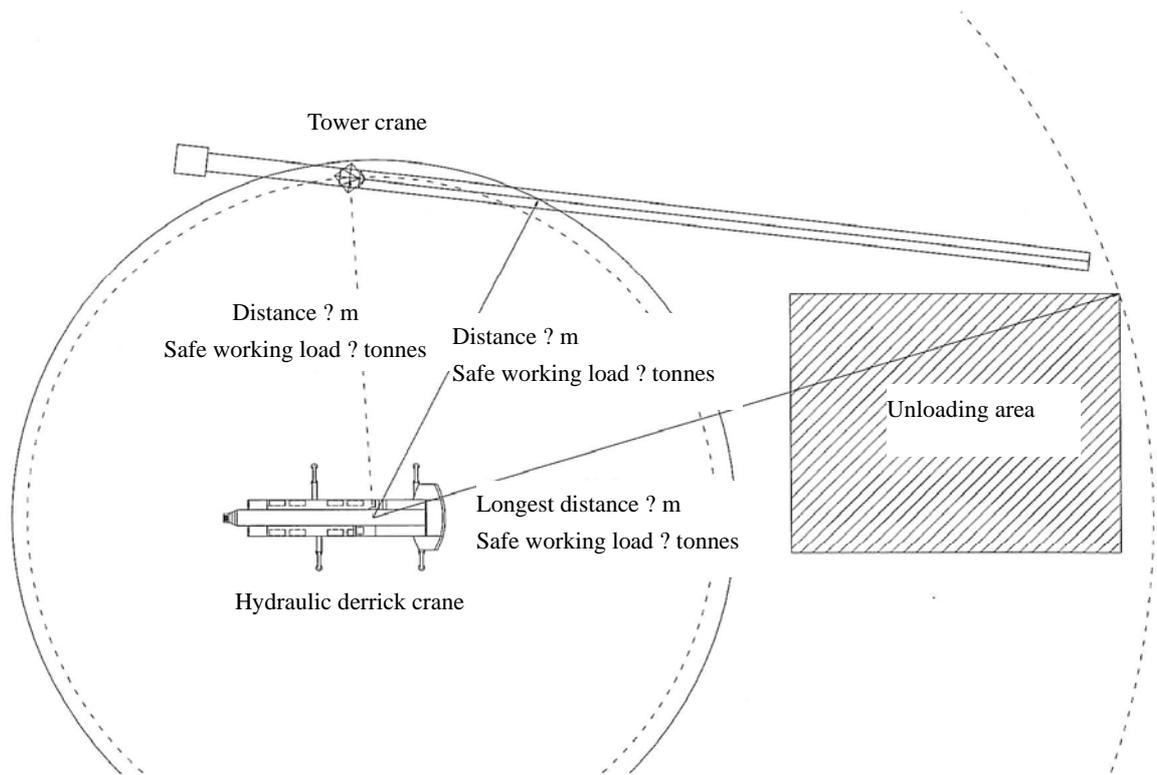
Dismantling steps as well as weight and length of various parts

Dismantling steps	Name of parts	Weight	Length
1A	counter-jib ballast	2.1 tonnes	1940 mm
1B	counter-jib ballast	2.1 tonnes	1940 mm
1C	counter-jib ballast	3.15 tonnes	2840 mm
1D	counter-jib ballast	3.15 tonnes	2840 mm
1E	counter-jib ballast	3.15 tonnes	2840 mm
1F	counter-jib ballast	3.15 tonnes	2840 mm
2	hook	0.53 tonnes	1710 mm
3	jib + trolley	9.3 tonnes	60000 mm
4G	counter-jib block	3.15 tonnes	2130 mm
5	counter jib + hoisting drum	9.2 tonnes	15840 mm
6	A-frame + slewing ring + cabin	7.3 tonnes	4720 mm
7	mast	1.86 tonnes	6000 mm
8	mast	1.86 tonnes	6000 mm
9	mast	1.86 tonnes	6000 mm
10	mast	1.86 tonnes	6000 mm
11	concrete footing		

SAMPLE

Layout plan to be attached to building plans (please refer to Annexes 1 to 3)

Distance between hydraulic derrick crane and the centre of tower crane



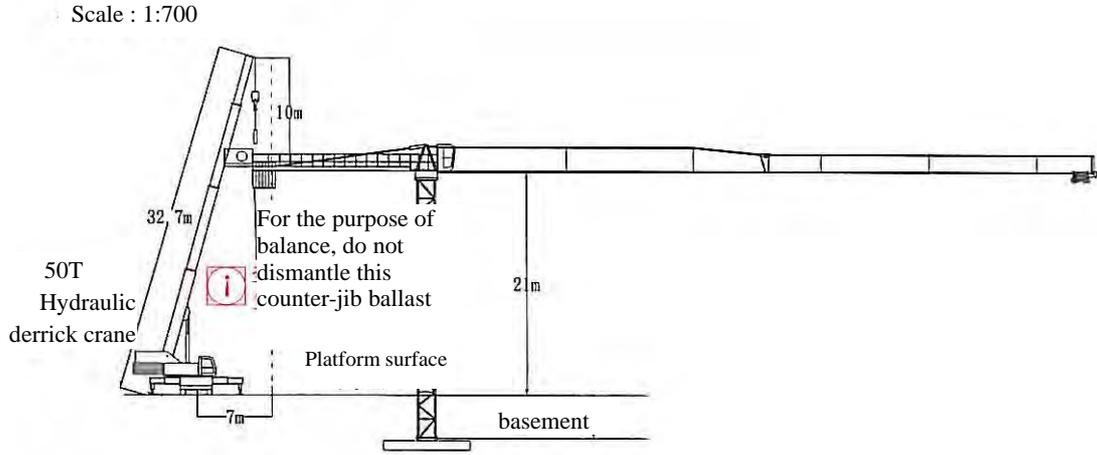
Information required:

- 1) name of facilities for dismantling a tower crane
- 2) brand name of hoisting facilities
- 3) model number of hoisting facilities
- 4) show the distance between storage area for hoisting facilities and centre of the tower crane
- 5) show the hoisting area of the hoisting facilities
- 6) show in the diagram the radius of the relevant work of the hoisting facilities and their greatest safe working load
- 7) show the enclosed area of the dismantling work
- 8) show the storage area of the parts of the tower crane
- 9) show the storage area of jib and counter-jib
- 10) describe the type of ground and way of cushioning and the material used of the crane if hydraulic derrick crane is used
- 11) show the weight to be carried by ballast of hydraulic derrick crane

SAMPLE

Tower Crane Dismantling Procedures

Step 1: Dismantle the counter-jib block



Works Procedures:

1. Dismantle 1A to 1F counter-jib ballast with a derrick crane!

 Important Points	 Hazard Identification
Distance between the tower crane and the derrick crane is 7 m, the safe working load is 13 tonnes	Fall of person: 1. Technicians must use safety belts
Reserve one counter-jib ballast for balance when dismantling the jib	Fall of object: 1. Enclose the affected area, no access except for tower crane dismantling workers 2. Hand tools must be tied to the appropriate position with a rope

SAMPLE

Tower Crane Dismantling Procedures

Step 2: Dismantle the hook and retrieve the hoisting wire rope

Works Procedures:

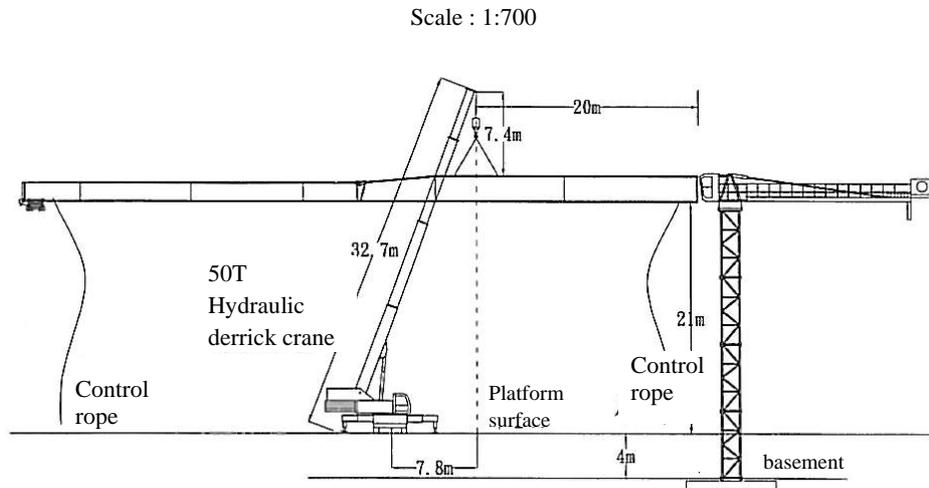
1. Use wires and shackles to secure the hook on the jib.
2. Use the tower crane to coil hoisting wire back to hoisting drum.

 Important Points	 Hazard Identification
Good communication must be maintained with the tower crane operator when retrieving the hoisting wire rope	Fall of person: 1. Technicians working at the jib must use “double shackle” safety belts
Only tower crane operators with a certificate will be allowed to operate the tower crane	Fall of object: 1. Enclose the affected area, no access except for tower crane dismantling workers 2. Hand tools must be tied to the appropriate position with a rope

SAMPLE

Tower Crane Dismantling Procedures

Step 3: Dismantling the jib



Works procedure :

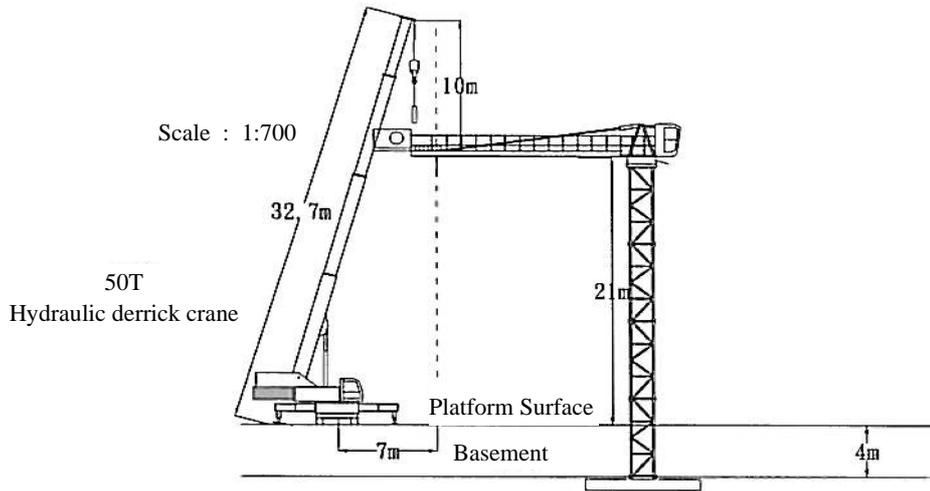
1. Use 4 chain slings of 2.4 m long and 2 wires to hoist the centre of the jib according to the manual.
2. Tie the trolley properly with rope and retrieve the cable.
3. Hammer out the square-shaped pins and the steel plate which are connected to A-frame.
4. Afterwards, hammer out the small pins joining the wedge lock and the slewing ring.
5. Slightly hoist up the jib to a 5 degree angle with the ground level and hammer out the pins of the oval core within the wedge lock.
6. Use the derrick crane to dismantle the whole jib and lay it on the ground before continuing with the dismantling process.

 Important Points	 Hazard Identification
Distance between the tower crane and the derrick crane is 7.8 m, the safe working load is 12.3 tonnes	Fall of person: 1. Technicians working at the jib must use “double shackle” safety belts
Before dismantling the jib, the trolley must be tied to the jib with a coarse string	Fall of object: 1. Enclose the affected area, no access except for tower crane dismantling workers 2. Hand tools must be tied to the appropriate position with a rope
Must use a control rope to keep the jib within the radius of safe hoisting of the derrick crane	Overloading of derrick crane: 1. The derrick crane operator and signaller must ensure the object for hoisting must not exceed the safe working load.
Must use a block to secure the jib so as to maintain a correct central position and prevent the release of too much energy during the dismantling process	
Adequate space must be reserved on the ground level for placing the jib of 60 m long	

SAMPLE

Tower Crane Dismantling Procedures

Step 4: Dismantle the last ballast



Works Procedures:

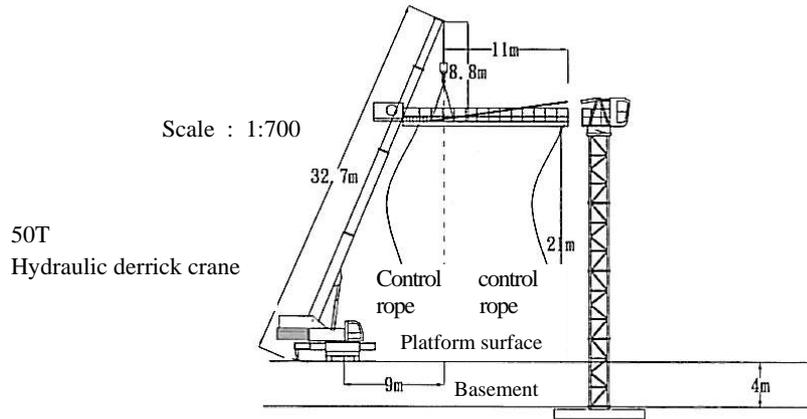
1. Dismantle the 4G ballast with a derrick crane

 Important Points	 Hazard Identification
Distance between the tower crane and the derrick crane is 7 m, the safe working load is 13 tonnes	Fall of person: 1. Technicians must use safety belts
	Fall of object: 1. Enclose the affected area, no access except for tower crane dismantling workers 2. Hand tools must be tied to the appropriate position with a rope

SAMPLE

Tower Crane Dismantling Procedures

Step 5: Dismantle the counter jib (with hoisting drum)



Works Procedures:

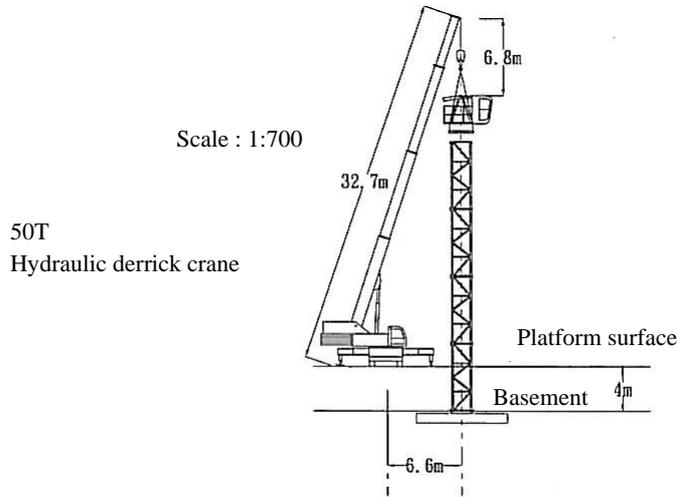
1. Use 4 chain slings of 2.4 m long to lift up the centre of the counter jib according to the manual.
2. Hammer out the small pins joining the wedge lock and the slewing ring.
3. Slightly lift up the counter jib to a 5° angle, hammer out the connecting pins on the tie bar of the counter jib. Then, hammer out the small pins of the oval core within the wedge lock.
4. Use the derrick crane to dismantle the whole counter jib and lay it on the ground before continuing with the dismantling process.

 Important Points	 Hazard Identification
Distance between the tower crane and the derrick crane is 9 m, the safe working load is 11 tonnes	Fall of person: 1. Technicians must use safety belts
Must use a control rope to keep the dismantled counter jib within the radius of the safe hoisting of the derrick crane.	Fall of object: 1. Enclose the affected area, no access except for tower crane dismantling workers 2. Hand tools must be tied to the appropriate position with a rope
Must use a block to secure the counter jib so as to maintain a correct central position and prevent the release of too much energy during the dismantling process	Overloading of derrick crane: 1. The derrick crane operator and signaller must ensure the object for hoisting must not exceed the safe working load.
Adequate space must be reserved for placing the whole piece of counter jib	

SAMPLE

Tower Crane Dismantling Procedures

Step 6: Dismantle the A-frame + slewing ring + cabin



Works Procedures:

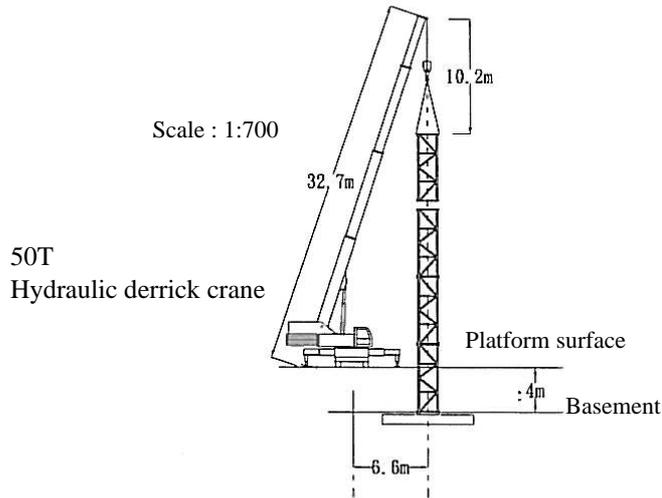
1. Use 4 chain slings of suitable length to lift up the A-frame + slewing ring+cabin according to the instruction manual.
2. Loosen the screws connecting the slewing ring and the mast with a hydraulic block.
3. Use a derrick crane to dismantle the A-frame+slewing ring+cabin and lay them on the ground.

 Important Points	 Hazard Identification
Distance between the tower crane and the derrick crane is 6.6 m, the safe working load is 13 tonnes	Fall of person: 1. Technicians must use safety belts
	Fall of object: 1. Enclose the affected area, no access except for tower crane dismantling workers 2. Hand tools must be tied to the appropriate position with a rope
	Derrick crane overloading: 1. The derrick crane operator and signaller must ensure the object for hoisting must not exceed the safe working load.

SAMPLE

Tower Crane Dismantling Procedures

Steps 7 to 10: Dismantle the four masts



Works Procedures:

1. Use 4 chain slings of suitable length to lift up one mast.
2. Loosen the screws connecting the masts with a hydraulic block.
3. Use a derrick crane to dismantle the masts and lay them down to the ground one by one.

 Important Points	 Hazard Identification
Distance between the tower crane and the derrick crane is 6.6 m, the safe working load is 13 tonnes	Fall of person: 1. Technicians must use safety belts
	Fall of object: 1. Enclose the affected area, no access except for tower crane dismantling workers 2. Hand tools must be tied to the appropriate position with a rope

SAMPLE

Tower Crane Dismantling Procedures

Step 11: Dismantle the concrete footing

Works Procedures:

1. Cut away the outcrop of the concrete footing with oxy-acetylene torch.
2. Use a derrick crane to dismantle the cut-off outcrop down on the ground.

 Important Points	 Hazard Identification
Only oxy-acetylene torch operators with a certificate will be allowed to operate the oxy-acetylene torch	Fire/explosion 1. Hot works must be carried out in accordance with the requirements of the hot works safe working procedures. 2. Prepare a fire extinguisher 3. Technicians must use appropriate safety personal protective equipment

End

SAMPLE

Appendix C.4

[Specialist Contractor's name]

Appointment Letter of Competent Persons of Tower Crane Dismantling

To: ABC construction company

Site Name :

Attention: Safety Officer

As tower crane MD-175 at site xxxx under your company is to be dismantled, the following personnel are appointed Competent Persons for the dismantling works (both of them have **10** years' relevant experience on the model of tower crane of the same series) until completion of the works.

Name	Post	Green Card	Crane Operation Certificate	Contact Telephone	Site Position
	Competent Person				Up on the tower crane

[Specialist Contractor's name]

Date

SAMPLE

[Specialist Contractor's name]

Appointment Letter of Senior/Junior Workmen

To: ABC construction company

Site Name :

Attention: Safety Officer

As tower crane MD-175 at site xxxx under your company is to be dismantled, the following personnel are appointed senior/junior workmen until completion of the works.

Name	Post	Types of Certificate Held and their Serial Numbers				
		Green Card	Crane Operation Certificate	Certificate of Rigger Safety Operation	Certificate of Gas Safety Training	Years of Experience
	Senior Workman					
	Senior Workman					
	Junior Workman					
	Junior Workman					

[Specialist Contractor's name]

Date

SAMPLE

[Specialist Contractor's name]

Workers Engaged in the Dismantling of Tower Crane

To: ABC construction company

Site Name :

Attention: Safety Officer

The following personnel will attend the works safety meeting before the implementation of works.

Name	Post	Types of Certificate Held and their Serial Numbers				
		Green Card	Crane Operation Certificate	Certificate of Rigger Safety Operation	Years of Service	Site Position
	Senior Workman					
	Senior Workman					
	Senior Workman					
	Junior Workman					

[Specialist Contractor's name]

Date

**Qualification and Experience
of Site Personnel Engaged in Tower Crane Operations**

Competent Person

(A) Role

- A competent person supervises the working crew of the operation.
- In height alteration, the competent person operates the hydraulic jack of the climbing gear or telescopic cage of the tower crane.

(B) Qualification

- Registered Skilled Worker of the trade “To carry out erection, dismantling, telescoping/climbing of tower crane, and the hoisting of materials, tools and equipment related to the aforesaid work” under the Construction Workers Registration Ordinance (CWRO).

(C) Experience

- At least 10 years of relevant experience; and
- Possesses experience in handling a similar tower crane of the same model line to be operated upon, or attendance of course on familiarization training on a similar tower crane of the same model line.

(D) Training

- Competent persons should have completed the following courses –
 - Safety Training Course For Construction Workers of Specified Trade (Silver Card Course) – Tower Crane Worker (Erecting, Dismantling, Telescoping & Climbing) (“EDTC Course”) offered by CICTA; and
 - Training for Tower Crane Competent Person (Erecting, Dismantling, Telescoping & Climbing) offered by CICTA.

- *Competent Person in charge of dismantling of a tower crane using derrick crane* should also have completed the Certification Course with Imbedded Certification Test for Derrick Crane Operator offered by CICTA

(E) *Competencies*

- A Competent Person should be able to –
 - brief and instruct his crew to execute the operation in accordance with the method statement;
 - draw the attention of his crew to important safety warnings and precautions stipulated in the manufacturer’s manual, method statement, critical parts checklist and risk assessment in particular the parts marked as “Danger”, “Cautions” and “Hold Points”;
 - response to questions raised by his crew members and provide appropriate directives to them;
 - conduct visual inspection to ascertain the integrity of key components of the tower crane prior to commencement of the operation.

Senior workman

(A) *Qualification*

- Registered Skilled Worker of the trade “To carry out erection, dismantling, telescoping/climbing of tower crane, and the hoisting of materials, tools and equipment related to the aforesaid work” under CWRO

(B) *Experience*

- At least four years of related work experience

(C) *Training*

- A senior workman should have completed the following courses organized by CICTA –

- Safety Training Course for Construction Workers of Specified Trade (Silver Card Course) – Construction Materials Rigger (“Rigger Course”); and
- EDTC Course

Junior Workman

(A) *Qualification*

- Registered General Worker under CWRO

(B) *Training*

- A junior workman should have completed the following courses organized by CICTA –
 - Rigger Course; and
 - EDTC Course

(C) *Supervision*

- A junior workman with less than four years of experience should work only under the direct one-to-one supervision of a senior workman.

Summary of Recommended Improvement Measures

Section and subsection¹	Improvement Measures	Implementing parties	Implementation timeframe
E	Checking before Erection of Tower Crane		
(i)	Pre-delivery checking	Tower crane owners	Upon issue of publication
(ii)	Checking of anchorage	Tower crane owners Principal Contractors	Upon issue of publication
(iii)	Checking of supporting structure	Tower crane owners Principal Contractors	Upon issue of publication
F	Improvement of site supervision		
(i)	Appointment of supervising engineer	Principal Contractors	Upon issue of publication
(ii)	Risk assessment and method statement	Principal Contractors Specialist Contractors	Already implemented
(iii)	Pre-installation checking	Principal contractors	Upon issue of publication
(iv)	Pre-operation checking	Principal contractors Specialist Contractors	Upon issue of publication
(v)	Pre-use verification	Principal contractors	Already implemented
G	Qualification and experience of specialist contractors	Principal contractors Specialist contractors	Upon issue of publication
H	Training and experience of competent persons and workmen	Principal contractors Specialist contractors	Already implemented ²

¹ Of the main text

² Except for (i) Registration as Skilled Worker of the trade “To carry out erection, dismantling, telescoping/climbing of tower crane, and the hoisting of materials, tools and equipment related to the aforesaid work” under the Construction Workers Registration Ordinance (CWRO), which will be implemented in six months after the trade is available for registration; and (ii) Completion of training for Tower Crane Competent Person (Erecting, Dismantling, Telescoping & Climbing), which will be implemented in six months after its launching

Publication No. 2
Guidelines on Site Safety Measures
for Working in Hot Weather

Disclaimer

This publication is prepared by the Construction Industry Council (CIC) to report findings or set out the recommended practices on specific subjects for reference by the industry but is NOT intended to constitute any professional advice on these or any other subjects. The parties using this publication should therefore seek appropriate advice from their professional advisers. CIC (including its members and employees) will NOT accept responsibilities for any consequences resulting from the use of or failure to use this publication.

Enquiries

Questions on these guidelines may be made to the CIC Secretariat at –

Rm 2001, 20/F, Alliance Building
130-136 Connaught Road Central
Hong Kong.

Tel. no. - 3571 8716

Fax no. - 3571 9848

E-mail - enquiry@hkcic.org

Publication No. 2

Guidelines on Site Safety Measures for Working in Hot Weather

Purpose

This publication provides guidance to contractors on the measure that may be taken to protect the safety of site personnel working under hot weather.

Introduction

2. The hot and humid summers in Hong Kong may lead to working under high temperatures on construction sites. It will therefore be crucial to take appropriate safety measures to protect site personnel from hot weather. Ideally, these measures should be linked to heat stress on workers (i.e. the physical and physiological reactions of the worker to temperatures that fall outside normal comfort zone) measured by parameters such as Wet Bulb Globe Temperature (WBGT). As further development works are required for adopting such system in Hong Kong, this publication is introduced in the interim to set out some of the good practices that may be readily implemented by contractors during the summer months to enhance the safety of site personnel. CIC will conduct further research on assessment of heat stress and may refine the guidelines in future.

(A) *Role of client organizations*

3. Client organizations should render supports to their contractors for implementing these guidelines and are encouraged to mandate their adoption by incorporation into contractual provisions. Client organizations should consider taking an equitable approach in incorporating appropriate contractual provisions for granting extension of time for delays resulting from unusual hot weather and in assessing requests for extensions of time made for such delays.

(B) *Role of contractors*

4. Contractors should establish safe systems of working in hot weather (making reference to the good practices in this publication where appropriate) and provide adequate training, information, instruction and supervision to workers and site supervisors to facilitate

and ensure its adoption. Furthermore, as the guidelines are not intended to be exhaustive, contractors should determine the safety measures to be implemented for working in hot weather through the risk assessment procedures outlined at Annex A.

(C) *Role of workers and site supervisors*

5. Workers and site supervisors should take note and observe the provisions of the guidelines which are relevant to them (for example wearing light-coloured clothing).

Risks of Working in Hot Weather

6. The common heat-related disorders are –

- heat syncope (fainting)
- heat exhaustion
- heat stroke

7. Heat syncope occurs when blood pools in the lower parts of the body causing a temporary reduction in blood supply to the brain and hence a transient loss of consciousness.

8. Heat exhaustion results from high body temperature caused by reduction of blood flow and could drive up core body temperature to 39°C. The reduction of blood flow may result from dehydration under hot conditions or extremely fast heartbeat caused by high temperature and intense physical labour.

9. The symptoms of heat exhaustion are –

- tiredness, thirst, dizziness
- numbness or tingling in fingers and toes
- breathlessness, palpitations and low blood pressure
- blurred vision, headache, nausea and fainting
- clammy skin that may be either pale or flushed
- lowering of mental alertness

10. Heat stroke occurs when the core body temperature approaches 41°C thus affecting the co-ordination of the nervous system and thermal regulation mechanism. Heat stroke carries a high risk of fatality from cardiac or respiratory arrest and must be treated as a medical emergency.

11. Symptoms of heat stroke includes –

- thirst, fatigue and lethargy
- nausea and headache
- fainting and transient loss of consciousness
- clammy skin and paleness
- weak and rapid pulse, and uncontrolled muscular contractions even muscle cramps

12. While the symptoms of heat stroke may be similar to other less severe heat-related disorders, its onset may be sudden and dramatic.

Safety Measures for Working in Hot Weather

13. Work arrangements

- (a) avoid working in hot environment for prolonged periods of time;
- (b) take heed of weather report (including very hot weather warning);
- (c) reschedule works to cooler periods (such as early morning) and cooler places (such as sheltered or shaded area) in so far as possible;
- (d) schedule works requiring use of personal protective equipment (PPE) such as breathing apparatus, apron, long sleeve gloves to cooler times of the day;
- (e) enable workers to adapt to the hot environment before taking on full workload;
- (f) reduce the physical demand on workers by minimizing manual work through use of mechanical aids (such as tractors, forklifts, electric saws, mechanical hoists);
- (g) avoid working under direct sunlight. Where this is not possible –
 - (i) provide shade/shelter where possible on ground level or each exposed floor; and

- (ii) ask workers to apply sunscreen of sun protection factor not less than 15 on any exposed skin;
- (h) avoid working in enclosed areas with poor ventilation. Where this is not possible –
 - (i) keep workers away from heat sources or, where this is not possible, insulate the heat sources to minimize heat emission;
 - (ii) remove hot air from the works area by exhaust pipes or other suitable means; and
 - (iii) ventilate the works area by using fans or blowers.

14. Work break cycle and cool down facilities

- (a) enable workers to cool down and reduce their exposure to hot environment through taking regular breaks and rotating duties and worksites;
- (b) make arrangements for workers to rest in cool and shady place during hot periods;
- (c) provide shower and washing facilities for washing and external cooling; and
- (d) provide cooling devices such as cooling fans with atomized water spray.

15. Drinks

- (a) provide sufficient cool (10-15°C) drinking water at easily accessible drinking points;
- (b) encourage workers to take plenty of water to replenish the body fluid and electrolytes lost through sweating. In general, a worker will need to drink at least half a litre of water each hour while working under hot weather. However, drinks designed to replace body fluids should be consumed only in moderation since excess can result in electrolytes imbalance;

- (c) prohibit consumption of alcoholic drinks which could dehydrate the body; and
- (d) avoid drinks containing caffeine (such as tea or coffee) which are a diuretic and may aggravate loss of body fluids.

16. Clothing and protective equipment

- (a) encourage workers to keep their shirt or other top on and to wear clothing that is –
 - (i) light-coloured (to minimize heat absorption and enhance heat dissipation);
 - (ii) loose-fitting (to enhance perspiration. However, clothing that is too loose are not suitable because of the risk of entangling in the moving parts of machines);
 - (iii) made of natural materials (to enhance heat dissipation); and
 - (iv) long-sleeved (to minimize exposure of the skin to sunlight when working outdoors);
- (b) encourage the use of naturally ventilated helmet to enhance perspiration; and
- (c) encourage the use of helmet with broad brim to provide better shade to the face, neck and back.

17. Health of workers

- (a) train supervisors and workers to recognize symptoms of heat-related disorders;
- (b) ask workers to inform their supervisors immediately upon sensing or observing any symptoms of heat-related disorders; and
- (c) avoid assigning workers who may have difficulties in coping with heat to work under hot environment taking advice of their attending doctors into account;

18. First aid procedures and facilities

- (a) develop first aid and emergency procedures and provide appropriate training on these to site supervisors and workers through talks and regular drills;
- (b) provide first aid immediately to any workers who show symptoms of heat-related disorders following the procedures at Annex B.

Guidelines for Risk Assessment for Heat Stress

Introduction

In planning and executing construction works, duty holders (i.e. the main contractor or its subcontractor in direct control of any construction works) should assess the risks resulting from hot weather and take appropriate measures to protect site personnel from heat stress through risk assessment procedures outlined below.

Risk Assessment Procedures

(A) *Assessment of Risks*

2. Duty holders should identify risks that may affect construction personnel, their likelihood of occurrence and their possible consequences taking into account all relevant factors, including –

- (a) the capability, skill, experience and age of people doing the work;
- (b) the nature and location of construction operations;
- (c) the work practices;
- (d) the anticipated durations of working;
- (e) the type of plant, machinery and equipment to be used;
- (f) findings of inspection of the workplace and direct observation of similar construction works;
- (g) discussion with workers;
- (h) records of accidents and “near misses”;
- (i) advice and literature provided by equipment and material suppliers;

- (j) relevant legislations and related codes of practice, international standards and guidelines issued by industry organizations; and
- (k) relevant research findings.

3. The following factors are particularly relevant to risk assessment for heat stress –

- (a) high temperature resulting from work in hot weather, or heat generated by plant and machinery;
- (b) exposure to direct sunlight;
- (c) high humidity resulting from humid weather or plant or processes generating moisture;
- (d) insufficient ventilation in enclosed areas;
- (e) heavy physical work; and
- (f) wearing of protective clothing which affect heat dissipation from the body.

4. The risks identified should be summarized in the form of list containing the following details to facilitate development of a safety plan –

- (a) the nature of the risks;
- (b) the locations where they will be encountered;
- (c) factors giving rise to the risks; and
- (d) personnel which will be affected.

(B) Mitigation of risks

5. Duty holders should mitigate the risks of heat stress by implementing appropriate control measures in the following hierarchy of control adopting measures in the higher tiers in so far as possible –

- (a) elimination of risks - for example by re-scheduling the construction works, using mechanical aid to replace manual work and providing adequate ventilation for enclosed environment;
- (b) reduction of risks – for example by using equipment that generate less heat to reduce the temperature of the works area;
- (c) administrative controls and safe work practices – for example by providing appropriate training and work instructions; and
- (d) personal protective equipment – for example provision of light clothing or face shields.

(C) Monitoring and Review

6. The findings of risk assessment process and the risk mitigations measures should be monitored and reviewed regularly to ensure their validity and effectiveness. Review should be conducted upon the occurrence of the following events –

- (a) an injury or illness occurs resulting from heat stress;
- (b) availability of evidence that the risk assessment is no longer valid; and
- (c) significant changes in location of works, work practices, or work procedures.

7. Changes should be made to the risk mitigation measures taking into account the findings of the review where appropriate.

First Aid to Workers
Showing Symptoms of Heat-Related Disorders

- Move the patient to a cooler place.
- Lower his body temperature by –
 - removing his clothes
 - wipe his body with a towel soaked in cold water
 - fan the patient.
- If the patient is unconscious, place him in a recovery position.
- DO NOT give the patient any food or drink whether he is conscious or not.
- Send the patient to hospital as soon as possible.

Construction Industry Council

Publication No. 3
Guidelines on Safety of Site Vehicles and Mobile Plant

Disclaimer

This publication is prepared by the Construction Industry Council (CIC) to report findings or set out the recommended practices on specific subjects for reference by the industry but is NOT intended to constitute any professional advice on these or any other subjects. The parties using this publication should therefore seek appropriate advice from their professional advisers. CIC (including its members and employees) will NOT accept responsibilities for any consequences resulting from the use of or failure to use this publication.

Enquiries

Questions on these guidelines may be made to the CIC Secretariat at –

Rm 2001, 20/F, Alliance Building
130-136 Connaught Road Central
Hong Kong.

Tel. no. - 3571 8716

Fax no. - 3571 9848

E-mail - enquiry@hkcic.org

Publication No. 3

Guidelines on Safety of Vehicles and Mobile Plant on Construction Site

Purpose

This publication provides guidelines to contractors and subcontractors in direct control of any construction works (*duty holder*) on measures for enhancing the safety of vehicles and mobile plant operating on construction sites.

Introduction

2. The increase of fatal accidents caused by site vehicles and mobile plant in recent years has given rise to concerns on striking/trapping hazards posed by site vehicles and mobile plant particularly during reversing.

3. Duty holders are encouraged to take a holistic approach in protecting site personnel from hazards resulting from site vehicles and mobile plant through proper planning, adoption of safe working procedures, providing proper training for construction personnel and installation of appropriate safety devices on site vehicles and mobile plant. This publication sets out the good practices on these aspects for reference by industry stakeholders. *For the avoidance of doubt, adoption of these practices alone may not necessarily be sufficient for complying with the relevant statutory provisions on site safety including any obligations to undertake risk assessment and provide safe systems of work.*

Safety Measures

4. The following measures may be adopted for enhancing the safety of operation of site vehicles and mobile plant –

- (a) risk assessment;
- (b) design of site layout;
- (c) reversing video device (RVD);

- (d) other reversing safety devices;
- (e) safe working procedures; and
- (f) training of construction personnel.

(A) Risk assessment

5. Duty holders are encouraged to conduct risk assessments to identify the risks resulting from site vehicles and mobile plant, assess their likelihood and possible consequences taking into account all relevant circumstances including –

- (a) locations of ingress and egress points for vehicles;
- (b) layout of traffic routes on the site;
- (c) movements of site vehicles and mobile plant in works areas and loading/unloading areas; and
- (d) movement of workers and other personnel within the site.

6. Appropriate measures should be taken to deal with the hazards identified in the above process giving due consideration to their likelihood and possible consequences. These measures include –

- (a) elimination of the risk (such as obviating the need for reversing by providing drive-through circulation routes); or
- (b) where the risks could not be eliminated, mitigate them at source with engineering controls or minimize the risks with designing suitable safe systems of work. For instance, where reversing cannot be avoided the reversing vehicle or plant should be guided by a banksman or equipped with RVD.

(B) Design of site layout

7. Duty holders should properly design site layout and traffic circulation routes so as to minimize the hazards resulting from site

vehicles and mobile plant following the guidelines in the following paragraphs and other relevant statutory provisions and practices.

8. Minimizing movements - Movements of vehicles and plant on construction sites should be minimized through appropriate measures including –

- (a) controlling entry of vehicles into site through gates and barriers;
- (b) providing parking spaces away from works areas; and
- (c) locating loading and unloading areas on the periphery of construction sites.

9. Safety of pedestrians – Appropriate facilities should be provided to facilitate safe movement of personnel within the site including –

- (a) pedestrian-only routes;
- (b) clear demarcation of pedestrian routes by barrier;
- (c) grade-separated pedestrian crossing points;
- (d) at-grade pedestrian crossing points with facilities (such as traffic light signals) for controlling pedestrian and traffic flows; and
- (e) wearing of high-visibility safety vests.

10. Reversing movements

- (a) reversing movements should be minimized by providing, where possible, drive-through circulation routes;
- (b) where reversing is unavoidable, turning heads should be provided and banksmen should be deployed to guide reversing vehicles and plant where necessary; and

- (c) steps should be taken to ensure that banksmen wear high-visibility safety vests and use walkie-talkie or similar equipment for effective communication.

11. Speed limits

- (a) speed limits should be imposed on traffic routes through erecting speed limit signs; and
- (b) road humps or other similar devices should be provided to prevent speeding.

(C) *Installation of RVD*

12. Duty holders are encouraged to install RVD to provide drivers and operators with rear-side views through closed circuit television (CCTV) system with camera mounted on the rear of vehicles and plant to capture the rear-side view for display on a monitor usually installed in front of the driver and operator.

13. Annex A sets out the findings on the assessment of the need and suitability for installation of RVD on site vehicles and mobile plant commonly used on local construction sites which may be summarized as follows –

- (a) 12 types of vehicles/plant for which installation is not recommended for various reasons such as vibration which could affect the functioning of RVD;
- (b) 27 types of vehicles/plant for which installation is recommended. Out of these –
 - (i) 16 types of vehicles/plant which are licensed to operate on public roads are covered by the guidelines published by Transport Department on RVD and are not therefore covered by this publication; and

- (ii) 11 types of vehicles/plant which are used on construction sites only and are therefore covered by this publication.

14. The guidelines for installation of RVD on the types of vehicles/plant referred to in paragraph 14(b)(ii) above are included at Annex B.

(D) Other reversing safety devices

15. RVD may be complemented by other reversing safety devices including –

- (a) cross view mirror;
- (b) parking sensor (reading / indicator or sound); and
- (c) reversing alarm and warning light.

(E) Safe working procedures

16. Duty holders should formulate safe working procedures in relation to the operation of site vehicles and mobile plant on the basis of the guidelines at Annex C.

(F) Training of site personnel

17. Apart from basic training, duty holders should also provide the following types of training specific to vehicles and plant –

- (a) job-specific induction and refresher training to drivers and operators for safe operation of vehicles and plant;
- (b) courses on safe operation for managers and supervisors;
- (c) briefing for drivers, operators and workers on the traffic routes and rules on site; and
- (d) job-specific training for banksmen covering safety rules and instructions on site traffic and communication system.

**Assessment of Need and Suitability for Installing RVD
on Common Site Vehicles and Mobile Plant**

Site Vehicle and Mobile Plant		Installation of CCTV	Remarks
1	Excavation, site formation and roadworks		
1.1	Bulldozer	Recommended	
1.2	Excavator, tracked		
1.3	Excavator, wheeled		
1.4	Loader, wheeled		
1.5	Loader, tracked		
1.6	Grader		
1.7	Scraper		
1.8	Tractor		
1.9	Road planer		
1.10	Road miller		
1.11	Dump truck, gross vehicle weight > 38 tonne	Recommended	The guidelines at Annex B do not apply to this type of vehicle/plant since they are also used on public roads and are therefore covered by the guidelines published by Transport Department for RVD.
1.12	Dump truck, 5.5 tonne < gross vehicle weight ≤ 38 tonne		
1.13	Breaker, excavator mounted (pneumatic)	Not recommended	Excessive vibration generated by rock/concrete breaking may cause frequent malfunctioning of RVD
1.14	Breaker, excavator mounted (hydraulic)		
1.15	Rock drill, crawler mounted (pneumatic)		
1.16	Rock drill, crawler mounted (hydraulic)		
1.17	Dump truck with grab, 5.5 tonne < gross vehicle weight ≤ 38 toone		
1.18	Asphalt paver	Not recommended	Install RVD is not practical to the plant function
1.19	Road roller	Not recommended	Without confined control cabin
1.20	Roller, vibratory	Not recommended	Without confined control cabin
1.21	Locomotive (run on track)	Not recommended	Its use on railway should have specific safety measures to prevent or abate hazard of workers

Site Vehicle and Mobile Plant		Installation of CCTV	Remarks
			getting into the railway line.
1.22	Ballast regulating machine (run on track)		Ditto
2 Piling Works			
2.1	Crane, mobile	Recommended	
3. Concreting			
3.1	Concrete lorry mixer	Recommended	The guidelines in the Annex B do not apply to this type of vehicle/plant since they are also used on public roads and are therefore covered by the guidelines published by Transport Department for RVD.
3.2	Concrete pump, lorry mounted		
4 Lifting / Transportation			
4.1	Lorry	Recommended	The guidelines in the Annex B do not apply to this type of vehicle/plant since they are also used on public roads and are therefore covered by the guidelines published by Transport Department for RVD.
4.2	Lorry, gross vehicle weight > 38 tonne		
4.3	Lorry, 5.5 tonne < gross vehicle weight \leq 38 tonne		
4.4	Crane, mobile (diesel)		
4.5	Light goods vehicle, gross vehicle weight \leq 5.5 tonne		
4.6	Lorry, with crane/ grab, gross vehicle weight > 38 tonne		
4.7	Lorry, with crane/ grab, 5.5 tonne < gross vehicle weight \leq 38 tonne		
4.8	Pick up truck		
5 Others			
5.1	Water truck	Recommended	The guidelines in the Annex B do not apply to this type of vehicle/plant since they are also used on public roads and are therefore covered by the guidelines published by Transport Department for RVD.
5.2	Road sweeper		
5.3	Pressure tanker		
5.4	Tipper		
5.5	Forklift truck	Not recommended	These are small machines without confined control cabin
5.6	Dumper		

Installation of RVD

Purpose

This Annex provides guidance on the installation of RVD on site vehicles and mobile plant.

Scope

18. The guidance given in this Annex applies to the following types of vehicles and mobile plant which –

- (a) Bulldozer
- (b) Excavator, tracked
- (c) Excavator, wheeled
- (d) Loader, wheeled
- (e) Loader, tracked
- (f) Grader
- (g) Scraper
- (h) Tractor
- (i) Road planer
- (j) Road miller
- (k) Crane, mobile, wheeled & tracked

Typical RVD

19. A typical RVD consist of –

- A wide angle camera lens of horizontal angle of vision about 120 effective angle or more and vertical angle of vision 70 effective angle or more.
- A monitor with diagonal size of 130 mm or more.

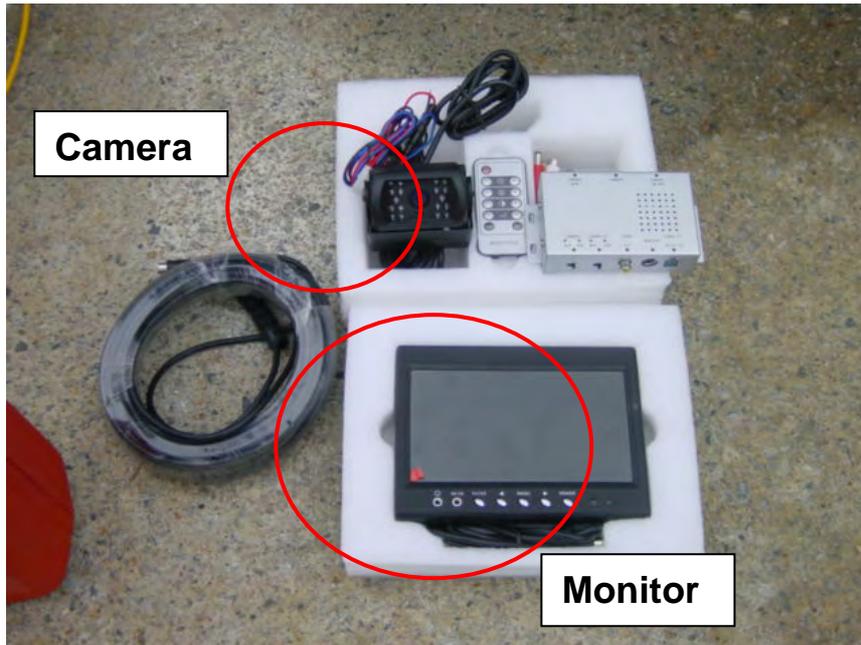


Figure 1 – Typical RVD



Figure 2 – Typical Image Displayed on Monitor

Requirements for RVD

20. RVD installation should provide drivers/operators with the following minimum visibility envelop –

- longitudinal coverage – 3.2 m from rearmost of the vehicle/plant;

- lateral coverage – overall width of plant plus 0.5 m on each side;
- height of object detected – any object 0.3 m above ground in the visibility envelop

21. The recommended visibility envelop is illustrated in the following figure.

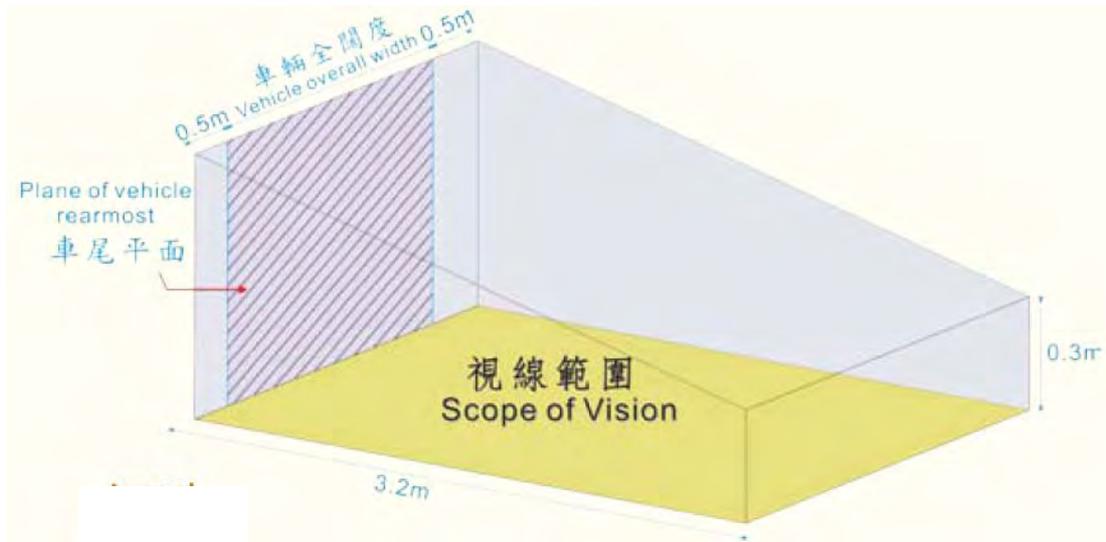


Figure 3 – Visibility Envelop

(Source: “A Guide for the installation of Devices to Assist Reversing of Good Vehicles” published by Transport Department)

22. Cameras should be water and dust proof. Infrared cameras should be used in order to detect rear images reliably when used in environment of low illumination or night vision.

23. The image captured by the camera should be displayed automatically on the monitor upon engaging the backward gear.

Guidance on Installation

(A) Camera

24. The camera should be installed at a height not less than 1.5 m as shown in Figure 4. Otherwise more than one camera may be required to achieve the required visibility.



Figure 4 – Single camera setup for excavator

25. Appropriate mounting frame shall be provided for installing and protecting the camera as shown on Figure 5.



Figure 5 – Mounting Frame for Camera

(B) Monitor

26. The monitor should be installed in operator's cabin at location easily visible to operator and shall not obstruct vision of normal operation as shown on Figure 6.



Figure 6 – Position for Monitor

(C) Wiring

27. All wiring and conduits should be adequately protected from chafing and short-circuit.

Safe Working Procedures

Purpose

This Annex sets out the safe working procedures for operating site vehicles and mobile plant.

Procedures

2. Authorization of drivers and operators

- (a) only authorized drivers and operators with proper training and qualification should be allowed to operate site vehicles and mobile plant; and
- (b) the list of authorized drivers and operators should be affixed to vehicles and plant where possible.

3. Preparation for starting work

- (a) drivers and operators should conduct pre-use check in accordance with prescribed procedures to ensure fitness of vehicles and plant for use; and
- (b) if RVD is installed, drivers and operators should also ascertain that it is in reasonably good working conditions, in particular the legibility of the image on the monitor.

4. Vehicles and plant in operation

- (a) drivers and operator should check around before starting to starting any vehicles and plant;
- (b) when vehicles and plant are traveling, drivers and operators should –
 - (i) look in the direction of travel particularly in reversing;
 - (ii) keep to designated vehicle routes;

- (iii) drive at safe speeds; and
 - (iv) follow directions indicated on traffic signs and made by signalers;
- (c) in performing loading/unloading operations, drivers and operators should –
- (i) load and unload on level ground with the parking brake applied and outriggers fully extended (where applicable); and
 - (ii) where this is not possible, choke the rear wheels and turn the front wheels towards the kerb (when facing downhill) or away from the kerb (when facing uphill) on parking, and engage the first gear and stay at the wheels.

5. End of working day – At the end of the working day, drivers and operators should –

- (a) park in designated parking space which is reasonably level and sufficiently remote from edges of excavations, pits, spoil heaps and sea fronts where possible; and
- (b) where appropriate retract the jib, or lower the arm or bucket onto the ground.