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Technical and Insurance Risk Management - Tower Cranes (GP32)

Martin Banasik MSc CEng FIMechE

Allianz

Risk Management

Risk Consideration

The probability of the harm occurring

RISK = HAZARD x PROBABILITY

If it can happen, it will happen

Risk Management

Legal Compliance

European Legislative Structure

- **Supply Legislation – Goal setting directives, stipulating the minimum build requirements for equipment (i.e. Machinery Directive).**
- **User Legislation – Goal setting directives, stipulating the minimum safety requirements for the use of equipment in the workplace (including construction sites).**

European States

- **National interpretation of European directives.**

Indian Legislative Structure (Similar)

Parliamentary statutes

- **National Building Code of India – Guidelines for regulating building construction**

State Legislatures

Union Territory Legislatures

Risk Management

International Standards

International Standards Organisation (ISO)

ISO 12480-1 Cranes – Safe Use – Part 1: General

The standard aims to establish the required practices for the safe use of cranes, which include:

- **The suitable and sufficient planning of the operation**
- **The selection, provision and use of suitable cranes and equipment**
- **Maintenance, periodic checks and inspections of cranes and equipment**
- **The provision of properly trained and competent personnel**
- **Coordination with other parties to guard against hazards**
- **Establishing mutually understandable communication methods**

The crane operation shall include any necessary preparation of a site, erection, maintenance and dismantling of the cranes

Risk Management

International Standards

ISO 9927-1:2009 Cranes – Inspections – Part 1: General

ISO 9927-3:2005 Cranes – Inspections – Part 3: Tower cranes

The standards specify the regular inspections to be carried out on tower cranes including daily inspections, periodic inspections and thorough inspections. They are aimed at making sure a crane's proper working and operational conditions are maintained

ISO 23814:2009 Cranes - Competency requirements for crane inspectors

Developed in order to "achieve a uniformly high competency of crane inspectors worldwide"

The standards were developed by ISO's technical committee ISO/TC 96 Cranes subcommittee SC 5, with input from international and national manufacturers, users, inspection bodies, higher education institutes, insurance companies and government health and safety organisations from around the world

"The progressive introduction of new international standards and the regular review of existing ones will have a direct and positive effect on general safety by reducing potential hazards, as well as helping to remove technical barriers to the international trade in cranes." ISO states.

Risk Management

Risk Assessment

Suitable and sufficient

- Erection (Dismantling) stage (Installer)
- Climbing stage (Installer/End User)
- Use stage (End User)

Risk to employees at work

Risk to others at work location

Risk to others in the vicinity of the work location

The risk assessment should identify the risks arising from or in connection with the work activity

The level of detail in a risk assessment should be proportionate to the risk

Risk Management

Risk Assessment and Method Statement

Site access (obstructions, services, traffic management, work area, etc)

Persons in the vicinity of lifting equipment (control of hazard zone)

Confirmation of ground condition suitability (sub-surface ground composition)

Preparation of anchorage/crane base

Capacity and marking of lifting equipment (duty charts, ballast, etc)

Planning of reconfiguration operations (erection sequence and working configuration)

Management of the lifting operations

- Duties of the lift supervisor
- Control of lifting operations
- Safe system of work
- Communication lines

Risk Management

Control Measures

Relevant data should be available relating to components of any given Tower Crane build, which would include:

Crane erection method statement

What is the configuration of the crane(s) in question and how will this alter?

Test documentation for the configured state

The crane build and safety devices?

Adequate equipment maintenance/repair and records

What maintenance and repair has been carried out and by whom?

User checks

Daily and Weekly

Training for the work function

Provision of suitable and sufficient information and instruction

Risk Management

Storage of Crane Components at Depot

Important that storage conditions do not damage structural elements

Lowest sections to be raised so as not to rest in water pools avoiding corrosion build up

Strut on strut location fine as that rests strong section on strong section

Problems exist when sections are not neatly stacked and upper sections rest on the diagonal braces of lower sections

Should also consider auxiliary sections such as stairwells and their protection

Risk Management

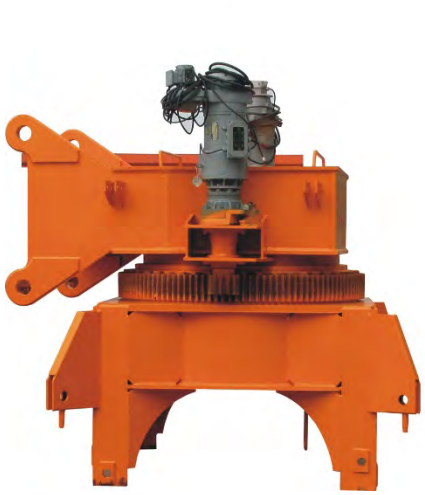
Storage of Crane Components at Depot

Important that storage conditions protect mechanical assemblies

Mechanical assemblies such as those for hoist and slew should be stored in a manner which minimises the adverse affects of the environment

This would extend to ancillary items including:

- Ropes
- Electrical control systems



Environmental affects could cause deterioration, malfunction and/or premature failure

Risk Management

Transportation of Crane Components to Site

Important that means of loading and transportation do not damage components and assemblies

The depot yard crane or sited tower crane would be used to load components on to suitable transport

At site the components would often be unloaded by the erection mobile crane or an adjacent tower crane which may be on site

Risk Management

Storage of Crane Components on Site

Important that the components are stored on site in a manner which minimises the potential for damage

Components should be stored away from site traffic, where possible

Road access and site area restrictions can result in a sequential scheduling of the crane components to site. These are then unloaded from the transportation and immediately hoisted into position.

Risk Management

Preparation of Tower Crane Base

Important that the base is correctly designed, constructed and is compatible with the crane to be erected

Any alterations to the crane or the base must be suitably addressed to ensure integrity of the assembled crane

Prior to the erection, it is essential that the crane base is certified by a structural engineer as having been designed and constructed correctly

Risk Management

Sequence and Method of Tower Crane Erection

Important that the method statement clearly deals with site conditions and limitations and is adhered to

Site restrictions can cause variations in tower crane build sequence and the method statement should address this

Once the base has been verified the mast sections are sequentially connected

The slew gear is then located at the top of the build

The counter-jib can be raised in one section

The main jib can be raised in one or a number of assembled sections

Counterweights are then located

Risk Management

Thorough Examination/Inspection

Inspection post installation and prior to first use at a new site

Regular inspection when in-service

Inspection post, repair, alteration or incident and prior to placing back into service

Place inspection in context

- Operational environment
  - Demolition
  - Construction
- Duty
- Utilisation

Consider defects and weaknesses

Recommend actions to rectify

Advise on Health & Safety improvements

Risk Management

Thorough Examination/Inspection

Detailed visual scrutiny of critical load path items:

- Structure
- Mechanical components

Functional testing of safety devices:

- Rated Capacity Indicator
- Rated Capacity Limiter
- Hoist Limits (Upper and Lower)
- Slack Rope
- Slewing Limits
- Travel Limits
- Derricking Limits
- Anti-collision
- Wind Speed Indicator

Exposure of critical hidden parts.

Supplementary Testing (at discretion of Competent Person)

Competent Person

Person with appropriate practical and theoretical knowledge and experience of the lifting equipment which will enable them to detect defects and weaknesses and to understand their significance with regard to the continued safe use of the lifting equipment

Risk Management

Maintenance

Cranes should be maintained in:

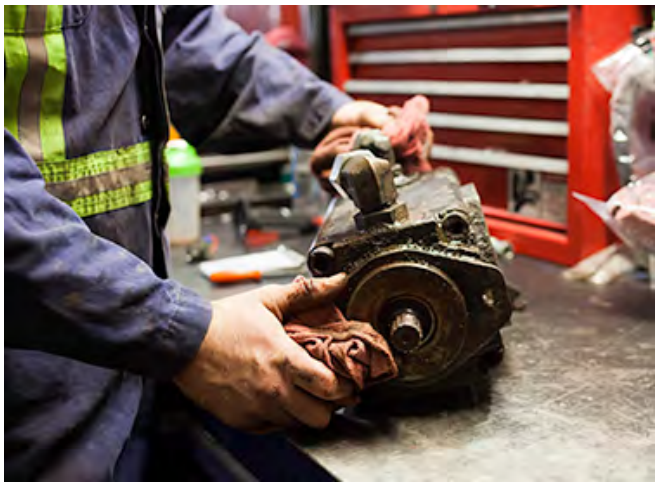
- An efficient state
- Efficient working order
- Good repair

It is advised that maintenance is documented to prove it is being completed and to enable the monitoring of deterioration

This would extend to:

- Replacement of components
- Repair details

Maintenance to be carried out as per manufacturers specification



Risk Management

Supervisors and Operators

It is important that those who supervise, erect and operate tower cranes are competent for their duties

The burden of proof lies with the employer and would normally be shown via training records for the individuals, in conjunction with their own working history/experience

Local regulation and/or national industry sectors may very well place a requirement for additional verification, via certification and/or registration

Risk Management

Tower Crane Climbing

As any construction rises there may be a requirement to raise the associated Tower Crane

A sequential process of:

- ‘Balancing’ the crane
- Securing the climbing frame
- Disengaging mast sections
- Hydraulically raising upper section of crane
- Inserting new mast section

Extremely hazardous activity to be undertaken by suitably trained personnel

Risk Management

Underwriting Considerations

How to insure?

- Principal project client
- Main contractor
- Crane owner

Separate Contractors Plant and Equipment

- Ensure that insurance provider is supplied with sufficient detail of cranes and there use (climbing)

Indemnity on Actual Value

- Difficult to clearly ascertain, due to the modular nature of Tower Cranes

Standard Covers

- Machinery Breakdown
- Sudden and Unforeseen Damage
- All Risks Cover
- Hired in Plant

Possible Cover Extensions

- Lifted Goods
- Own Surrounding Property
- Third Party Liability
- Wind-off Cover

Risk Management

Underwriting Considerations

Recommended Clauses

Erection, use and dismantling of a tower crane are to be undertaken in compliance with applicable regulation and standards

Inspection is to be undertaken periodically in compliance with applicable regulation and standards, to identify defect and assess deterioration

Suitable and sufficient maintenance is to be undertaken periodically and appropriate repair, as per manufacturer's specification and in compliance with applicable regulation and standards

Suitable and sufficient non-destructive examination and testing of critical structural components of a tower crane is to be undertaken after 10 years of life

Case Study

Incidents – Crane Collapses

Applied overload should be avoided by the activation of limiting devices such as the rated capacity limiters (RCL)

Erection crane instability can be caused by ground subsidence and/or excessive wind loading

For tandem or multiple lifting configurations then it is essential that the operation is controlled and coordinated. Clear lines of communication must be ensured between crane operators and supervisors

Case Study

Incidents – Crane Collapses

Investigations into the crane collapse revealed that the four anchors located at the base of the crane had failed structurally. This resulted in the entire structure toppling over. It was also suggested that the crane was not lifting any load at the time of collapse

Three workers were killed and two others were injured

The crane had been load tested and certified that the crane's critical parts had been checked for flaws and were found to be sound

Apparently a lack of detailed scrutiny of the mast anchors before the structure was installed had prevented defects in the mast anchors from being readily identified and these defects had resulted in the crane's collapse

Case Study

Incidents – Crane Collapses

Tower crane climbing operations present inherent dangers

When correctly planned and executed then risks should be minimised to levels as low as are reasonably practicable

During the climbing operation the tower is effectively guided and not absolutely restrained as it would be in a fully assembled state

The jib arrangement should be as balanced as possible so that the secondary effects of wind and crane movement are minimised

Secondary effects need not be great to place significant strain on the climbing frame

Case Study

Incidents – Crane Collapses

Where tower cranes are operating in close proximity then the working heights should be varied to prevent the jib structures from coming into contact

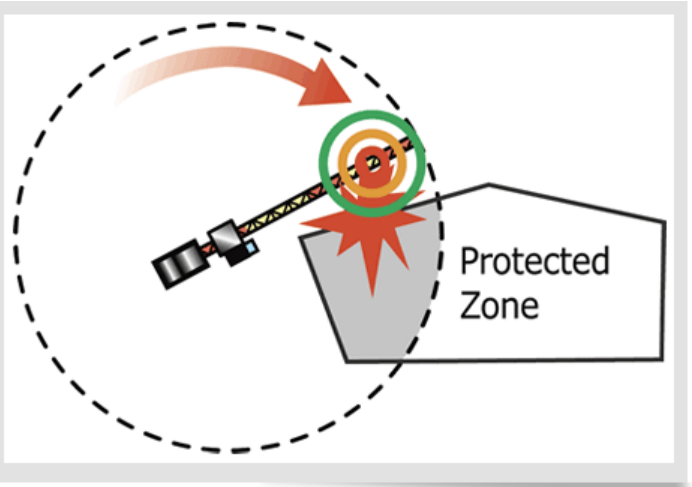
Anti-collision devices and zoning systems can be fitted which are designed to prevent cranes from transgressing defined operational radii or colliding

Tower cranes should be sited where there is clear space available for erection, operation and dismantling

Consideration should be given to proximity hazards such as:

- Overhead electric lines
- Radio frequency wave transmission towers
- Nearby structures and buildings
- Stored materials
- Other construction works
- Airport flight paths
- Public access areas including highways and railways

Where site hazards/restrictions exist then zoning systems designed to prevent cranes from flying over forbidden areas can be fitted



Risk Reduction

How do we maximise potential for project success!

Accidents do happen

Ensure that no-one gets hurt

Accidents avoided by:

Comprehensive planning

Attention to detail

Competent/Trained staff

Provision of relevant data

Good communication

Partnership!