

# Tower Crane Safety



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**T**he upgrading of city liveability and urbanisation draw people to live in the city. Apart from that, government initiative in the affordable home market has raised the demand for high rise residential buildings.



The construction of high rises is not possible without hoisting machineries such as the tower crane, a piece of iconic engineering machine in the industry. This vital tool is very important for ease of construction activity and productivity, especially in the vertical transportation of construction material.

The safety aspects of tower cranes have voluntary and mandatory requirements. The voluntary requirement stipulated in standards and codes, should be adhered to by the industry to make sure that any fabrication of the tower crane, from design stage to operations at site, is integrated with safety elements that have been recommended as best practice.

The mandatory requirement, such as laws imposed by government authorities (Acts, Regulations and Code of Practice) must be complied with to protect the safety of the public as well as the workers.

In Malaysia, tower crane handling and management demand both voluntary and mandatory requirements to be practiced by the stakeholders. Through SIRIM, the Department of Standard Malaysia has provided some pointers in standards (*MS 1803:2008 - Cranes - Safety - Tower Crane and MS ISO 4310:2014 Cranes-Test Code and Procedures*) on tower crane safe handling that the construction industry can follow.

As for legal obligation, the Department of Occupational Safety and Health (DOSH), is the government agency enforcing mandatory requirements on tower crane safety framework in Acts such as Factory and Machinery Act 1967 (FMA), Occupational Safety and Health Act 1994 (OSHA) and other related regulations. To ensure the safety of workers and the public, DOSH also provides additional guidelines and an Industrial Code of Practice,

such as Public OSH in Construction Site Guidelines, 2007, and Risk Assessment Guidelines, HIRARC, 2008. We will go through some safety requirements related to the safe handling of tower cranes, including that specified in FMA, some OSHA needs and to highlight a new directive, the Chief Inspector Special Order 2017.

## APPROVAL & AUTHORISATION

To operate a tower crane in Malaysia, one needs approval and authorisation from DOSH. A tower crane is classified as hoisting machinery in category D (hoisting machinery come in 4 categories: A, B, C and D). The tower crane design must be submitted to the Chief Inspector of Factory & Machinery for approval via SKUD online system ([skud.dosh.gov.my:88](http://skud.dosh.gov.my:88)). The application will be reviewed by the DOSH Hoisting Machinery Unit, under the Industrial Safety Division,

prior to fabrication, installation and operation.

The local fabricator of hoisting machinery such as a tower crane must be registered with DOSH as a Competent Firm. The applicant must submit a design approval request in a formal application letter to the department along with related documents such as technical specifications (crane design, technical design drawings, design calculations, catalogue or technical specifications, load charts and operating manuals and maintenance), certifications and test report, safety devices and details of safety features as well as additional supporting documents such as Import Licence according to the respectively code or standard.

## REGISTRATION & CERTIFICATE OF FITNESS

*Section 19 of FMA and Regulation 10 of Factory and Machinery (Notification, Certificate of Fitness and Inspection) Regulations stipulates that the owner of every hoisting machinery shall hold a valid Certificate of Fitness in respect thereof so long as such machinery remains in service and that any illegal use of certified machinery will result in a penalty fine amounting to not more than RM150,000 or jail for a maximum period of three (3) years or both.*

Furthermore, hoisting machinery that needs a Certificate of Fitness (COF) must be registered with DOSH via its online system, MyKKP ([mykkp.dosh.gov.my](http://mykkp.dosh.gov.my)). At this stage, an applicant must apply through the DOSH regional office where the tower crane will be operated. When the machinery is successfully registered, the submission will be reviewed by the state DOSH officer.

If the information provided is satisfactory, DOSH will arrange for a first inspection of the tower crane to ensure that its foundation design is in accordance with the design document approved by the professional engineer and as submitted in the application. At the site inspection, DOSH inspectors may give approval for the owner/contractor to initiate the erection of the crane structure, provided everything

is in accordance with the document submissions. When the height reaches approximately 10m, the competent firm and DOSH will do a joint crane inspection to verify that machinery is in accordance with the approved design. At this point, the inspection of safety devices function tests and crane load tests should be carried out. If the inspection is successful, DOSH will issue a COF for the machinery, which is valid for up to 15 months. The COF should be renewed after that period and periodical inspection conducted in accordance to Section 40 of the FMA.

## ERECTION, MAINTENANCE & DISMANTLING

Risk activity such as erection, jacking up or dismantling of the tower crane must be conducted by a competent firm registered with DOSH. The owner/occupier of the tower crane must also ensure that it is periodically maintained (provision of section 21 of the FMA) by a registered Competent Firm.

Competence in the context of tower cranes is a legal obligation. As stipulated in Section 29A of the FMA, "no person shall manufacture, fabricate, test, install, maintain, dismantle or repair any machinery which is prescribed unless a written authority has been issued by the chief inspector". Competent firms in tower crane management need to be recognised as those with the skills, knowledge, experience and understanding of technical requirements related to tower crane operations. The recognition of competence in a firm is determined by DOSH, based on certain requirements.

## ALTERATION OF STRUCTURE, RE-ENGINEERING, MODIFICATION & REPAIR

When it comes to the cost and process of getting a new tower crane, the owner has the option to repair/refurbish rather than replace. Occasionally, replacement parts are not available, so a crane owner has no choice but to do necessary repair work. Severe damage can usually be fixed but there are cases which

are beyond repair and required modifications.

Before or during its life cycle, a tower crane may require changes or modifications in structure/components and the resubmission of modified designs must get the appraisal of DOSH. The previously approved COF will be automatically revoked.

A registered competent firm or the crane manufacturer will be required to do the modification works. DOSH must be notified of major modifications such as re-engineering the hoisting machine, in order to get approval for the work. The crane must be re-evaluated, a new design drawing required and the new design calculations done by a registered competent tower crane firm.

This requirement does not apply to part replacement (Original Equipment Manufacturer, OEM) which does not involve structure or capacity change but it must be recorded.

## OPERATIONS & HANDLING

Most cases of tower crane accidents occur during operation and handling. Crane movements increase the probability of an accident. To ensure safety during use, consider the following:

**1. Safe System of Works** – Section 15 (1) of Occupational Safety and Health Act (OSHA) 1994, outlines the general duties of employers and self-employed persons to their employees against risks to safety or health in relation with the activity of a workplace.

In a construction site, lifting works is usually a daily activity and this includes use of hoisting machinery. There are risks that need to be addressed in operating tower cranes and it is compulsory to conduct a risk assessment before work can be carried out. Any relevant risk must be properly managed and control measures implemented to ensure that work to be performed is safe.

**2. Lifting Plan** – Lifting works require a lifting plan which must be provided by those with the necessary knowledge and experience. The lifting plan shall be documented and communicated effectively

to all the workers involved in the operation of the tower cranes. It is important that the lifting plan be clearly understood and implemented by all those involved.

A lifting plan should contain safety and control elements, lifting procedures to be implemented, lifting layouts, material positions, crane operation radius, position and the number of signalman and riggers. It should also state the means of protection for those not involved with the tower crane operation.

The supervision of lifting works should also be included in lifting plans, such as requirements for supervisors to ensure that the plan is adhered to. The supervisor should have sufficient knowledge, experience and the authority to control operations, including stopping operations in case of unsafe conditions.

The lifting plan should also clearly state the communication method used between the crane operator and the signalman and the safe working load (SWL) to be lifted by the crane to avoid overloading which may cause an accident. Also to be included is the main reference for operating cranes such as load chart, boom angle, load radius and lifting capacity. Requirements for competent operators should be clearly stated to avoid illegal operators handling the crane.

**3. Permit to Work & Daily Inspection Checklist** – It is important to ensure that important requirements are in place before the lifting operation starts. The construction management team can ensure that all the essential elements are checked completely by practising a work permit system. First, the involved parties need to check and fill out the checklist pertaining to the safe lifting and approvals by those authorised before work starts. Prior to the operation, a permit will be issued.

Such a system will ensure that crane operators are legitimate, the lifting equipment

is in good condition, all safety devices are functioning properly and the cranes are in good condition.

Lifting equipment is a main component of a tower crane. The condition of the wire rope, hook block and safety latch must be checked daily and any damage rectified immediately. Those who fail to stop operations if there is any defect that may cause bodily injury to any person or damage to properties (Section 40 of the FMA), can be fined a maximum of RM250,000 or jail of not more than five (5) years or both.

**4. Personnel Involved With Tower Crane Operation** – Tower crane operators require a sufficient level of competency to ensure that lifting work can be carried out safely. To ensure that qualifications, experience, knowledge and expertise in tower cranes operations are as required by Acts and regulations, DOSH issues a certificate of competence to eligible individuals and firms. Crane operators need to have this competence certificate but before they can obtain this, they must attend training conducted at a centre approved by DOSH. A valid Crane Operator Licence will only be issued to those who have passed the tower crane assessment examination. Signalmen, riggers and lifting supervisors are also required to attend lifting operation training although they are not required to obtain the certificate of competency.

## SAFETY DEVICES & FEATURES

All tower cranes must have safety features to avoid accidents or failures that may occur due to human error or negligence, weather, material durability or any circumstance that may increase accident risk. These safety devices are extremely important and tower cranes should be properly equipped with Safety Limit Switch, Operator Warning and Guided Device, Weather and Aircraft Safety Device, Safety Features when the operator is outside the cabin, Fail-Safe

Features and Anti-Collision Devices. Daily inspections and scheduled maintenance on all tower crane safety features can help prevent catastrophic crane failure.

### TOWER CRANE ACCIDENTS

Any accident or dangerous occurrence related to the workplace should be reported immediately to the nearest DOSH office. This is outlined under Section 31 of the FMA, Section 32(1) of the OSHA, Regulation 8 of *Factory and Machinery (Notification, Certificate of Fitness and Inspection) Regulations 1970*, and Regulation 5(1) of *Occupational Safety and Health (Notification of Accident, Dangerous Occurrence, Occupational Poisonous and Occupational Disease) Regulations 2004*.

There have been many cases of crane accidents reported in the local media. Some involve fatalities and even the public. In one extremely shocking case in 2016, a woman who was driving past the site of a hotel construction in Jalan Raja Chulan, Kuala Lumpur, was crushed by a one-tonne hook block that fell from a tower crane at approximately 20-storeys high. She died at the scene due to the impact.

This is an example of a case with several factors that should not be allowed by the management in charge of the crane. According to media reports, the tower crane safety device had been tampered with, allowing the crane operating radius to go beyond the boundary of the construction site and construction hoarding onto public road. Even worse, the crane operator was reported to have disappeared immediately after the accident and the authorities had to seek help from Interpol because he had fled the country.

The absence of a proper, safe working system such as Permit-to-Work by the contractor involved and an effective supervisory system allowed the tower crane boom to be operated beyond the construction site perimeter. Punitive action was taken against the contractors involved and a fine of RM40,000.00 was

imposed. The accused was convicted under Section 17 of OSHA (maximum fine of up to RM50,000.00 or jail of not more than two (2) years or both).

### CHIEF INSPECTOR SPECIAL ORDER 2017

DOSH has been carrying out enforcement and promotional activities at construction sites on revisions to the Act and Regulations, the enhancement of enforcement policies to promote and ensure compliance at construction sites, the promoting of preventive measures through Hazard, Risk and OSH management system but still, there are reports of tower crane related accidents.

After OSHA was introduced in 1994, employers were supposed to take a voluntary proactive approach to ensure effective accident preventive action rather than wait for the government to take legal action. A high level of compliance will reduce the number of accidents at construction sites. The aim of self-regulation is far better than compliance to descriptive FMA.

However, the lack of awareness in the industry with regards to self-regulation and an increase in tower crane accidents have forced DOSH to regulate more firm directives to individuals rather than take traditional approaches or punitive action against the organisations.

To ensure that worksites adhere to all necessary requirements, DOSH has ordered all Construction Project Managers (PM) to hold responsibility for safe handling and operation of tower cranes. In any construction site, the PM is the one with overall responsibility for all activities, project progress, control and who can halt a project.

The Chief Inspector of Factory & Machinery is given the power to direct special orders, spelt out under sub-section 27(1) of FMA, for factory and machinery. The directive, made on 5 June, 2017, to all Construction PMs, can be found on the DOSH webpage ([www.dosh.gov.my](http://www.dosh.gov.my)). The order is split into 3 parts and includes the penalty.

The first part requires the PM to ensure that the tower crane has all the approvals necessary, including a permit to install and that it complies with DOSH requirements to install and has the COF. The second part states that the PM's duty includes handling and the maintenance of the tower crane during operations, appointing a valid crane operator registered with DOSH, appointing a trained lifting supervisor, signalman and riggers, the implementation of Permit-to-Work system, daily inspection of lifting gear and safety device functionality as well as keeping a record of usage, inspection and maintenance.

The third part states that PMs should ensure that any crane service provider should have a contract with the occupier to manage the erection, jacking, maintenance, repair and dismantling of the tower crane in accordance with the law requirement. The PM should also pay serious attention to the penalty that may apply upon conviction. The maximum amount of the fine imposed is RM200,000.00 or jail not exceeding 5 years or both. Violation

of any provision in the order and the accused may be punished individually.

## CONCLUSION

The operation of machinery such as tower cranes involves broad aspects of safety, from design and built-in security features to operations and ensure that safety requirements as described are fully complied with. Failure to identify the shortcomings of tower crane operations will hurt the users and may jeopardise the safety of construction workers. The Chief Inspector Special Order to Project Manager (2017) is intended to ensure that parties dealing with the tower cranes comply with safety and related laws. The penalty sentences show that DOSH is very serious about ensuring that stakeholders pay serious attention to worker safety and health of construction industry especially tower crane operation. It is hoped that such a requirement will reduce the number of occupational accidents involving tower cranes. All Construction PMs must be aware of current rules and play a vital role in tower crane safety and operations. ■

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