

By Occupation Safety and Health Division  
Ministry of Manpower

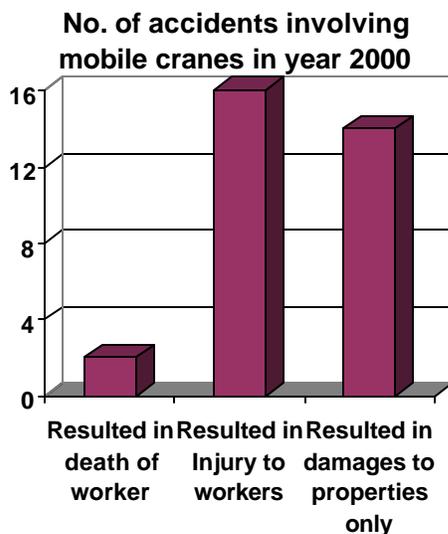
## Introduction

There are approximately 10,000 mobile cranes being used in Singapore. The majority of these cranes are used in the construction industry to increase the productivity of the building construction. However the misuse, failure to follow safe practices and procedures or complacency often led to accidents. Such accidents could have a catastrophic impact to the safety of workers and members of public.

This safety circular is meant to provide guidelines for the safe use of mobile cranes in construction sites.

## Accident Statistics

In year 2000, there were a total of 32 incidents involving mobile cranes, of which 2 cases resulted in fatalities and 16 cases resulted in varying degrees of injury. Another 14 cases involved damages to properties.



## Causes of Crane Accidents

The main causes of accidents that had been identified can be traced to the following:

- Lack of planning and supervision;
- Incorrect siting or setup of cranes;
- Failure to correctly calculate or estimate the load;
- Failure of personnel to carry out the correct procedures;
- Careless & Complacent;
- Use of wrong lifting gears;
- Faulty devices or machines;
- Lack of proper maintenance.

### Accident Case 1: August 2000



The boom of a crawler crane flipped backwards when the steel casing (for bore piling operation) it was lifting broke at the tip where it was shackled. The boom and the hook block landed on the expressway and hit a vehicle.

## Selecting the crane

Cranes should always be selected to handle the maximum anticipated load with capacity to spare. Other consideration for the selection of the cranes are the nature of lift, ground condition, site constraints, etc.

## The crane operator

The crane shall only be operated by a trained and competent operator. The operator must also be registered with the Chief Inspector of Factories.

## Documents for the crane

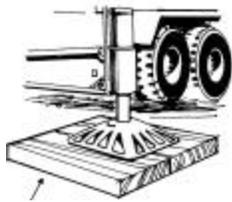
When the crane arrives on site, the following documents should come along with the crane for inspection and review when requested:

- a) A valid Certificate of Test / Thorough Visual Examination of Lifting Equipment for the **mobile crane** (LM Certificate);
- b) Valid Certificates of Test / Thorough Visual Examination of Lifting Equipment for all **lifting gears** that comes with the crane;
- c) The **log-book** or log sheet for the recording of the operational tests carried out by the operator before the start of every workshift;

If the operator is unable to produce the above documents, the crane supplier should be contacted and the documents obtained before the machine is put into use. It is advisable to state that the production of these documents will be required when the crane is hired.

## Siting of Crane

The stability of the crane depends heavily on the proper siting and setting of the crane. Unless stated by the manufacturer, the crane should have its outriggers fully extended with the wheels off the ground. The ground should be level and capable of supporting the full weight of the crane and its load. In addition, sufficient and suitable packing in the form of steel plates or



timber mats should be placed under the outriggers to evenly distribute the weight.

The crane should also be positioned so that:

- a) The operator has a clear view of the operation as far as practicable;
- b) There is sufficient operating space;
- c) It is well away from edges of excavation and fixed structures which people may be trapped by the moving parts such as counterweights, etc

## Planning and Supervision

All lifting operation should be properly planned by a competent person before the actual execution and **not left solely** to the crane operator.

Investigation into crane accidents revealed that one of the root causes of these accidents was due to lack of proper planning and supervision. This is particularly so for simple routine lifts. Hence, all contractors are advised not to be complacent during any lifting operation, and to plan and supervise the operation carefully.

Site constraints that would have an impact on the safe operation of the lifting should be considered before the execution of the lift. Examples of such constraints are:

- a) Lifting next to or over an excavation pit;
- b) Materials or machines placed along the access way thereby reducing the available space to extend the outriggers;
- c) Site is located nearby busy traffic, or existing building or structures.

Careful planning is especially critical for difficult lifts such as pick and carry operations, tandem lifting and tilt-up operation.

***“The change in radius caused by booming down and/or telescoping out shall be considered when determining the lifting capacity of the crane. The reduction in the boom angle, caused by the load when just lifted off the ground, and the consequential increase in the radius shall also be considered in determining the safety of a lift.”***

**– SS CP 37: Safe Use of Mobile Cranes**

Special consideration should be given when the load is required to be placed at a distant further away from the crane than when it is being picked up, i.e. an increase in the crane’s working radius.

### Personnel

The Factories (Operation of Cranes) Regulations 1998 requires the appointment of the following personnel for all mobile crane operation:

- Trained lifting supervisor;
- Trained riggers; and
- Trained signaller.

#### Fatal Accident Case 2: August 2000



The crane operator lifted and placed a pallet of bricks onto a work platform on the 5<sup>th</sup> storey without being instructed or signaled to do so. The platform collapsed together with a worker. The worker died subsequently

All contractors are advised to familiarise themselves with the duties of these appointees as spelt out in the regulation and ensure that the only trained and competent personnel are appointed.

In the case where the lifting operation is out of the view of the operator (such as lifting a load from the rooftop of a building), the occupier is obligated to appoint sufficient number of signaller for the operation.

### The Load

The weight of the load should always be **known** from specifications or through calculations. It is important to note that the safe working loads (SWL) indicated in most load capacity charts are gross SWL. This means that the weight of the hook block, and all lifting gears used must be deducted from this gross SWL to obtain the net SWL that the crane is able to lift at that configuration.

### Load Radius Indicator

The **mandatory** load radius indicator gives the safe working load at the configuration that the crane has been set, and gives a warning signal when the radius is unsafe. The indicator:

- must be calibrated regularly;
- must be configured for both main and auxiliary hooks (when both hooks are used)
- The operator must be trained to use / set the indicator correctly to tally with the actual configuration adopted;

It is important to note that the load radius indicator served primarily as an **operational aid**. Although the indicator can warn the operator of an impending overload, it should not be used as the only tool to test the stability limit of the crane during operations.

Supervisors and foreman are advised **not to rely** on the operator to use the indicator to determine the weight of the load. They should instead have prior knowledge of the weight of the load. This is especially critical when the lifting operation involves the dismantling of machinery or structure from heights.

**Singapore Standards Code of Practice 37: Safe Use of Mobile Cranes: 2000**

The Factories (Singapore Standards and Code of Practice) Order 2001 has gazetted the SS CP 37 as a mandatory code for compliance by any user. The code provides comprehensive requirements on the application, safe operation, maintenance and testing of mobile cranes.

The guidelines and requirement laid out in this circular are extracted from the code.

The crane's safe working load is always indicated for freely suspended loads. It is expressly forbidden to use the crane to drag any load, or any operation that may cause the hoist line to be out of plumb.

Slewing should be done slowly to maintain control of the load.

Tag lines should be used where applicable to minimise swing

The operator should stay at the controls at all time when the loads are suspended.

Interpolation of the safe working load in the load capacity is disallowed unless specifically allowed by the manufacturer. Extrapolation is strictly disallowed.

No additional counterweight shall be added to the crane unless specifically allowed by the manufacturer.

All contractors are advised to familiarise themselves with the requirement stipulated in the code.

**Accident Case 3: June 2000**

The crane operator had lowered his hook block from an opening into the basement infrastructure. The workers at the basement then pulled the hook block away from the opening and rigged up a truss structure. They then gave the signal to the operator to lift. The boom of the crane snapped when the load was dragged out.



**Dragging is expressly forbidden**

**Checks and Maintenance**

The crane should be in good working condition when it arrives on site and before the start of the workshift. In addition to the statutory annual inspection, the manufacturer's recommendation on the inspection and maintenance regime should also be followed closely.

<i>Types</i>	<i>Checks</i>
<b>Functional Checks</b>	<ul style="list-style-type: none"> <li>• Check limit switches e.g. over-derricking; over hoisting</li> <li>• Slewing</li> <li>• Telescoping</li> <li>• Travelling</li> <li>• Safety devices</li> </ul>
<b>Integrity Checks</b>	<ul style="list-style-type: none"> <li>• Wire ropes</li> <li>• Rope terminations</li> <li>• Hook block</li> <li>• Boom section</li> <li>• Rope pulleys</li> <li>• Rope guards</li> </ul>
The checks listed in this table are not exhaustive.	

Issued by  
**THE CHIEF INSPECTOR OF FACTORIES**  
**MINISTRY OF MANPOWER**