

# Identifying risks

*In February 2003 Felix Weinstein wrote an article for Cranes Today, examining accident causes. In the 13 years since, many varied tower crane accidents occur. In this article he reviews some prominent causes of recent accidents.*

**O**ver recent years there have been immense technological developments in all fields of tower cranes.

The tower crane plays a dominant and pivotal role at construction sites, and at many construction sites there may be several tower cranes working in unison, in order to remain on schedule and accomplish the required work capacity.

It is hard to imagine a construction site without a tower crane to hoist and haul heavy loads to the required heights. Tower cranes are situated in the center of urban areas, in between residential buildings, above busy highways, schools and kindergartens, and have come to serve a vital and necessary role in real estate development.

From the above review it is obvious that the siting of tower cranes at such central locations increases risk with every crane fault and accident, and in extreme cases – the collapse of a tower crane on site.

Unfortunately, accidents continue to occur despite all of the security means that have been developed. The development of tower cranes has brought about the development of command and control systems, of tower crane structures and construction and of their propulsion systems.

Moreover, security at construction sites and surrounding these construction sites has advanced and developed, and new laws and regulations have also come into play.

Yet despite all of these, accidents continue to happen from time to time, for various and many reasons, on which I shall elaborate in this article.

Tower crane accidents are

characterized by the level of injury caused to the workers at the construction sites, to passersby in the vicinity of these sites and by the type and degree of damage to property in the building project and in its surroundings.

Following is a partial review of the various tower crane accidents I have encountered since writing my first article.

The interesting thing in all the events recorded in the two articles, is the wide range of possibilities that may cause tower crane accidents and crashes. Hence the difficulty in securing tower cranes.

## **Assembly, disassembly, and service**

Accidents can occur during the assembling, servicing and dismantling of tower cranes. At a certain stage of the crane assembly process at the site, the crane operator or technician must climb up to the cab and operate the crane to complete the assembly.

One instance of note is a crane operator who fell with when the ladder came off in his hands, when he climbed a tower crane after its assembly. In a different accident, two technicians fell together with the cage they had disassembled from the crane and were killed.

In a third accident, a technician and a crane operator were killed when raising the crane on site. In this accident the entire top portion installed above the mast toppled over (the jib and balance arms, the apex and additional parts installed on the mast).

In yet another accident, two technicians fell to their death after performing maintenance works to the crane.



## **Falling loads**

Another source of tower crane accidents can be loads falling on site, due to failure of slings and hoisting equipment that secure the load to the crane. These accidents usually occur during routine works on site, when loading and hoisting cargoes, or when various appendages detach and cause havoc.

For example: a load being hoisted by a crane swung and hit a worker who fell from the fourth floor and was killed. In another instance, a loose load that was hoisted and was not properly secured detached, fell and hit cars in the road next to the site.

## **Gale force**

The crane height, structure and dominating nature as well as its location in the city are very attractive

## **A rare helicopter strike on a tower crane, close to the Thames in London**

and appealing to advertisers for billboard advertising. They tend to rent advertising space in the form of billboards, which may cause stability problems to the crane and cause its collapse in face of strong winds. In strong winds they can also fly off and fall, damaging cars and other property in the roads below.

Advertising billboards on cranes must be the correct size and placed in the correct position, according to crane manufacturer directives concerning the prevention of "wind sails".

Another cause of accidents is the failure to release the lateral brake when the crane is in "out of service" mode.

One of the most important actions

the crane operator must take before descending the crane is to release the crane lateral brakes so that the crane will remain stable in winds that affect the region. There are several types of mechanisms that release brakes.

Some crane operators do not release the brakes because they are not familiar with the release mechanism or in some cases despite the crane operator having released the mechanism, in actual fact the brake was not released due to a malfunction of the system.

These factors may affect the crane equilibrium, causing it to crash in strong winds.

### Mechanical failure

Accidents in cranes may be caused by failure to any of its mechanical systems, such as the transmission, braking or reel mechanisms, as well as detaching of pins.

One incident occurred when the pins connecting critical parts of the crane detached without anyone noticing, causing dismantling of parts.

In another incident a load fell due to mechanical transmission failure of the hoisting mechanism, resulting in the free swinging (without brakes) of the winch drum with the hoisting cable causing the load to free fall to the ground.

When failure occurred to the braking system of the hoisting winch the result was the fall of a tank of cement, while in a separate incident the detachment of the hoisting cable from the arm end, following failure of



This crane collapsed during high winds

the reel mechanism at the end of the arm attached to the hoisting cable, resulted in a fall of the load.

### Incorrect assembly

Cranes arrive dismantled into small parts that are packed in containers and shipped. Upon arrival, the many parts have to be assembled.

On occasion the teams assembling the parts are not professional and may therefore assemble the parts incorrectly. When these parts (mast units, jib units, etc.) are later assembled onto the crane, they constitute potential failure points.

### Electrocution

The urban setting of tower cranes inevitably leads to the installation of tower cranes close to power lines that are adjacent to construction sites. As a result, power lines can be hit, with all the risk that entails, despite the travel limiters installed on the cranes to prevent them from reaching electricity power lines.

In winter cranes are exposed to being struck by lightning, while cranes that are located in the vicinity of broadcasting stations have constant static electricity.

### Bases and foundations

The infrastructure and base foundation for tower crane installation at the construction site have over the years also been a potential cause of accidents. The failure of these foundations and infrastructures can include: ground sinking, sinking of posts and cracking of cement beams under the crane, any one of which has disastrous results.

### Collision of cranes

On sites where there are several cranes working together, collisions occur between cranes despite the sector limits or other means designed to prevent such collisions.

As a result of collisions between cranes, there have been work accidents in which workers on site

were killed or injured and damage was caused to the cranes.

### Tie-in failures

Construction projects of skyscrapers require harnessing of the crane mast to the building in order to elevate the mast over the building.

These harnessing systems provide stability and security to the cranes. If, as has happened, a load being hoisted on site, for any reason falls onto or hits the harnessing system, it can cause the system to fail.

Loads such as walls or beams being hoisted for assembly onto the building, are particularly damaging to the harness system if they fall.

These type of accidents can cause the crane to collapse.

### Aircraft

The height of tower cranes makes them susceptible to collisions with low flying aircraft, particularly if they are not properly illuminated and marked. An accident that illustrates this danger occurred in London, when a helicopter collided with a tower crane, resulting in 2 dead, several injured and extensive surrounding damage.

Cranes that are situated near airports and runways, are equipped with special lighting, so that they can be discerned by the aircraft, however regulations concerning the proper illumination of tower cranes in urban areas to prevent collisions require updating.

### Conclusion

After reading the two articles, it is obvious that there are many factors affecting the safety of tower cranes and their surroundings.

In this article I have reviewed several of the factors that endanger safety of the crane, the crane operator, the construction site workers and passersby in the vicinity of the construction site, as well of course property damage.

Risk management of tower cranes is a very complex matter that requires professionals, regulations and strict adherence to instructions and safety considerations. 

## About the author

**Felix Engineering was established in 1991.**

The company provides engineering and consultation services for cranes and lifting equipment.

Felix Engineering offers expertise in the engineering and safety of: Tower cranes; Mobile cranes and heavy lift cranes; Industrial cranes and handling



equipment; Marine Cranes; Welded structures; Risk Management; Lifting equipment; Hydraulic lifting

systems.

It offers arbitration and professional opinions for courts of law, is a member of professional committees. Weinstein is a certified inspector of tower cranes, mobile cranes, heavy lift cranes, industrial cranes, and handling equipment.

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