TIN 054 Installation of Camera Systems on Tower Cranes

1.0 Introduction

Camera systems are increasingly being fitted to tower cranes to assist the crane operator with the safe lifting of loads. Cameras are typically fitted to the hook block, trolley or jib to improve visibility to the operator of the load. Cameras can also be fitted to crane cabs to record the view available to the operator, monitor how the operator controls the crane and record visual / radio communications with the signaller.

When selecting a camera system and mounting position, the following should be considered:

- Where should the camera be mounted to provide the best view whilst being protected from being struck or damaged;
- The effect of wind and jib angle on the camera (particularly for luffing jib cranes);
- How will the camera system be accessed for inspection, cleaning and adjustment;
- How will cameras be mounted to the crane;
- Whether secondary security tethers be required;
- How will the camera system be powered;
- Where in the operator cab should the monitor and controls be positioned;
- Whether recording is required.

Cameras should be regarded as an aid rather than a replacement for good communication between the slinger signaller and the operator. They are primarily provided to prevent dangerous occurrences and must not be used to initiate a lift.

This TIN does not address the security of recording data, nor who has access to it and how it is accessed.

2.0 Regulations

Regulations 4(1) & 4(2) of the Provision of and Use of Work Equipment Regulations 1998 (PUWER) require that when work equipment is selected, regard is given to the working conditions and risks associated with use of the equipment. This includes:

- Its initial integrity;
- The place where it will be used, and
- The purpose for which it will be used.

Regulation 3 of the Management of Health and Safety at Work Regulations 1999 requires a risk assessment to be undertaken for the installation of work equipment. The assessment for a camera system on a tower crane should consider:

- Whether the camera system will allow the operator to see potential obstructions when both lowering and raising loads;
- How the camera system is to be mounted on the crane;
- The consequence if the camera or associated equipment were to fall from the crane;
- How will the camera system be inspected, maintained, and adjusted.

Technical Information Note

Regulation 6(2) of the PUWER requires work equipment to be inspected where safe operation is critically dependent on its condition in use and where deterioration would lead to a significant risk to persons.

3.0 Camera Mounting Positions

Cameras can be mounted to various positions on tower cranes to improve visibility of the load and hook block. The three common positions are shown in **Figure 1**.

Hook Block Mounted Camera

Trolley Mounted Camera

Jib Mounted Camera

Figure 1: Mounting position of cameras fitted to tower cranes

3.1 Trolley Mounted (Saddle and Flat Top Cranes)

Advantages:

- The camera moves with the trolley and provides a view from above;
- The view from above assists the operator to identify obstructions that may be struck by the load, hook block, lifting accessories or hoist rope, dependent on the field of view of the lens;
- The view is insensitive to wind actions or rotation of the hook block;
- The camera can be securely mounted to the trolley where it is unlikely to be struck or damaged;
- Solar cells can be used to provide a power supply for the camera, eliminating the need for frequent battery changing or a hardwired power supply.

Disadvantages:

- On taller cranes, the view provided to the operator may be too restricted unless a remotely operated zoom lens is fitted to the camera. The zoom lens is typically controlled by a foot switch in the operator cab;
- Access to inspect and service the camera will be difficult unless the trolley is fitted with an inspection basket;
- It is difficult to provide a hardwired power supply to the trolley mounted camera system.

3.2 Hook Block Mounted (All crane types)

Advantages:

- The camera moves with the hook block and provides a view from above;
- A zoom lens is not required;
- Access to inspect, adjust/clean the camera, or change batteries can be completed at ground level.

Disadvantages:

- The view provided by the camera is sensitive to wind and/or rotation of the hook block;
- The camera and associated wireless communication equipment will have to be battery powered. This will require the battery pack to be removed periodically for recharging;
- The camera will only be able to see what is below the hook block. The camera will not be able to see what is above the hook block. The crane operator will not be able to see potential clashes between the load and any obstructions when a load is being lifted. When a load is being raised or lowered, the operator will not be able to see any potential clashes between the hoist rope and any obstructions;
- The size of the load may obscure the vision of what is happening beneath the load;
- There is an enhanced risk associated with hook block / structure collisions where, even with tethers, hook block attachments can be sheared off their fixing.
- It is unlikely that the crane manufacturer will have made provision to mount the camera, battery pack and wireless communication equipment to the hook block. If the camera, battery pack and wireless equipment are secured to the hoist block by magnets, security tethers will be required (See Section 5.0).

NOTE: *There have been several incidents where camera systems that were attached by magnets were knocked off after striking an obstruction.*

3.4 Jib Mounted (Luffing Cranes)

Advantages:

- If the camera is mounted at the end of the jib, the camera will provide a view from above that includes the load, hook block, lifting accessories and hoist rope. This assists the operator to identify and monitor any objects that may be struck;
- The view is sensitive to wind actions or rotation of the hook block;
- The camera can be securely mounted to the jib where it is unlikely to be struck or damaged;
- Power can be brought to the camera system by running cables on the jib or by solar panels.

Disadvantages:

- The mounting arrangement will have to include a pivot/hinge to allow the camera to look vertically down as the jib angle/radius is altered. The view from the camera will be affected by gusts of wind if the camera can swing freely;
- On taller cranes, the view provided to the operator may be too restricted unless a remotely operated zoom lens is fitted to the camera. The zoom lens is typically controlled by a foot switch in the operator cab;
- Access to inspect and service the camera may be difficult once the crane has been erected. Most larger luffing cranes have inspection baskets at the jib tip, but access to the end of the jib will require the jib to be walked as walkways are not provided.

Figure 2: View from jib mounted camera.

3.5 Cab Mounted Cameras

Cameras fitted to crane cabs should be positioned above the crane operator so not to restrict their view through the crane windscreen and of the crane controls.

4.0 Maintenance and Inspection of Camera Systems

Camera systems fitted to cranes should be periodically inspected to confirm that:

- The camera system is functioning as intended;
- The camera and associated components are securely mounted to the crane;
- Batteries and any covers are securely fastened;
- Electrical cables, connectors, and security tethers are not damaged and are secure.

The periodicity of inspection and who should undertake the inspection will depend on where and how the camera system has been installed **(see Table1).**

When a camera is fitted to a hook block, the block can be lowered to ground level to enable the camera system to be inspected without persons having to work at height. When a camera is fitted to a trolley or luffing jib, a safe means of access will be necessary. On trolley jib cranes, the jib inspection basket can be used to inspect the camera system.

Figure 3: Inspection of hook mounted camera by slinger whilst hook block is at ground level

	Hook Mounted Camera	Trolley Mounted Camera	Jib Mounted Camera
Pre-use Inspection *(Operator or Slinger)*	• Visual inspection with hook block lowered to ground level. • Physical check of security of mountings • Functional check of view provided by camera	• Functional check of view provided by camera	• Functional check of view provided by camera
Maintenance Inspection *(Maintenance Technician)*	• Visual inspection with hook block lowered to ground level. • Physical check of security of mountings • Functional check of view provided by camera	• Visual inspection using trolley basket. • Physical check of security of mountings • Functional check of view provided by camera	• Visual inspection with binoculars. • Physical check of security of mountings • Functional check of view provided by camera.

Table 1: Camera System Inspection Requirements

5.0 Installation of Camera Systems

Camera system components should be securely fastened to the crane to reduce the risk of components falling from the crane. Where magnets are used to mount components, additional security tethers should be used to provide a secondary back up.

- Tethers should be fastened to suitable anchor points.
- Tethers, anchors, fasteners, and any associated connectors should be sized to take twice the weight of the components that are being secured.

Note: *The enhanced factor of safety is to allow for dynamic loading if the tethered items are struck and fall.*

Carabiner with double locking action

Key ring spring gate carabiner without locking device

Figure 4: Carabiner Types

- Tethers should be as short as possible to reduce the risk of the tethers snagging or contacting moving parts of the crane or other objects.

5.0 Cont'd

- Any carabiners used in the tethers should be of a type that includes a double action locking device to prevent inadvertent opening. Key ring type spring carabiners should not be used (**see Figure 4**). Tethers should be suitable for outdoor use.

6.0 Monitor in Operator Cab

The position of the monitor provided in the crane cab should be selected to allow the operator to easily view the monitor without restricting their direct line of sight or impeding any controls. The monitor should be capable of being seen in direct sunlight.

Figure 5: Monitor in operator cab

7.0 Recording

It is recommended that camera systems fitted to tower cranes are provided with systems that record video and voice communications. The information may be stored securely on a local computer or server, or remotely using cloud-based servers. The information should be readily retrievable in a commonly accessible format. The recording should be protected against inadvertent deletion or unauthorised alteration.

Recording assists with the investigation of incidents and helps prevent recurrence. Recordings can also be used during training and briefing sessions with the lifting team.

It is essential that the crane operator and signallers are told that camera systems will be recording video and voice communications and the reason why recordings are being made. Signage should be provided around the site, at the entrance to the crane mast and on the tower crane operator's cab door, so that all involved in the lifting operations are aware that they are being recorded.

8.0 Electrical Installation, Power Supply and Battery Charging

It is essential that any wires used to connect the camera system are secured in an appropriate manner. Camera systems, charging equipment, connectors, enclosures and glands should be rated for arduous outdoor use.

Where cameras are powered by batteries, provision should be made for battery charging. It is recommended that the charging is completed indoors or within a weatherproof enclosure.

When docking a jib trolley to an overnight jib mounted charging point, it needs to be ensured that the camera is being charged in preparation for use the next day.