Recommended minimum safety specifications for quay container cranes

A joint initiative from **TT Club**, **ICHCA International** and **Port Equipment Manufacturers Association (PEMA)**

In a concerted effort to reduce injuries and loss of life, as well as to reduce damages and delay to port and terminal operations worldwide, the TT Club, ICHCA International and the Port Equipment Manufacturers Association (PEMA) agreed in 2010 to join forces in creating recommended safety features that should be standard as a minimum on all quay container cranes.

The genesis for the project was a TT Club global analysis of insurance claims by ports and terminals, which revealed that 34% of the cost of asset-related claims worldwide was directly related to quay container cranes. While a range of technologies now exist that can significantly improve the safe performance of quay container cranes, and help address some of the most common causes of accidents and claims, many of these features are not currently included as standard on new cranes.

The three organizations therefore set out to identify and recommend a baseline specification for quay container cranes in relation to safety features that should be included in specifications, tenders and quotations for new quay container cranes.

This current document, first published in June 2011, is the result of this joint working initiative, and is intended for use both by buyers and suppliers of quay container cranes.

The recommendations provided here do not carry any force of law, and are independent of the various local, national and international regulatory regimes on the safe design, manufacture, specification and operation of cranes, which must also be satisfied. The hope of all three parties, however, is that the safety features outlined here will be embraced both by buyers and suppliers as a voluntary industry standard.

Introduction

With over 2,000 insured operations, including over 400 ports and terminals globally, the claims data gathered by the TT Club provides a real perspective of the types and causes of accidents globally. An analysis of global asset-related claims by TT Club identified that 34% of the cost of global asset claims are related to quay container cranes. This startling statistic was the catalyst for this document, which recommends standard safety features and specifications that can minimize or entirely prevent some of the most common causes of accidents involving this type of port equipment. The TT Club global analysis of quay crane claims data identified the leading causes of accidents and failures as:

Wind damage

Mainly involving cranes being blown along rails, this is the biggest preventable weather damage cost. While procedures are a significant issue in reducing this type of accident, equipment type and design can reduce these claims.

Hoist, spreaders and ropes

These are the most used and abused items of equipment in a terminal and require regular inspections and better preventative maintenance – or can we design them better?

Structural integrity issues

Crane collapses and other structural failures can be minimized if ports and terminals ensure that regular structural inspections are carried out as per ILO Convention 152. Or can we better design them?

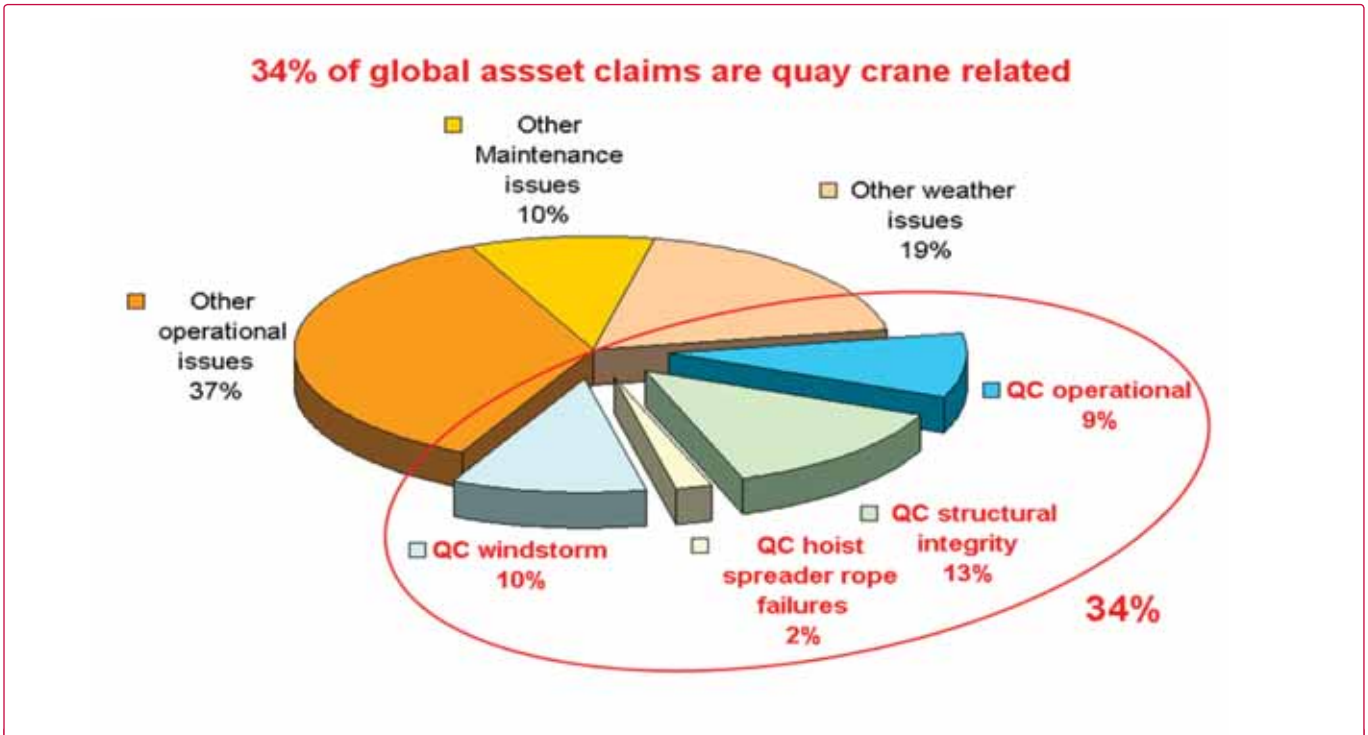

Figure 1. Global cost analysis of asset-related claims in ports and terminals. (Source: TT Club)

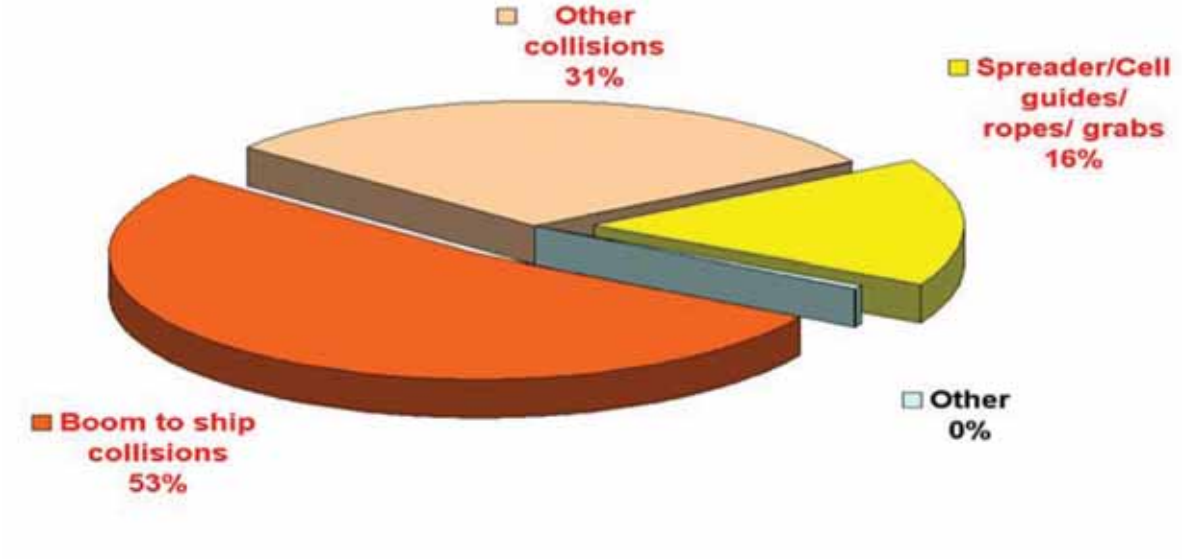

Figure 1. Global cost analysis of operationally-related quay crane claims in ports and terminals. (Source: TT Club)

Windstorm damage.

Operational issues

Boom-to-ship collisions are the single largest cost of claims in this area, followed by other collisions and claims caused by issues with spreaders, ship cell guides and ropes.

The need for a new approach

Technology solutions are now available for quay container cranes that can dramatically improve their safe performance and help address the issues outlined above. However, many of these features are not currently included as standard on new cranes.

The TT Club, PEMA and ICHCA International are committed to supporting and promoting technological advances that will enhance safety and performance in the operational port environment. By way of example, the TT Club has recommended installation of boom anti-collision sensors, which have been proven to prevent significant damage cost and business disruption, as well as enhance safety for crane drivers, stevedores and ships' crews.

Based on the latest technologies now available, this joint initiative aims to provide the industry with a benchmark minimum standard safety specification that can be incorporated into specifications and quotations during the new crane procurement process. The full recommended list of these safety features is shown in the table below. Just like seat belts in cars, such features, which have been proven to reduce injury and damage, should be standardized and not offered as optional extras.

Inevitably, crane procurement is price sensitive, requiring a significant budget, and buyers will not always be familiar with the most effective safety technologies. Furthermore, the process frequently is complex. Any quote needs to be carefully assessed against the invitation to tender, and subsequent change requests can be costly. For these reasons, all tender specifications should provide a standard safety baseline.

This document recommends that the features outlined below should be included in the tender specifications developed by buyers, and should also be listed as standard in initial quotations from suppliers, rather than as optional extras. The resulting safety enhancements will reduce injuries and damage costs over the life of the crane, and improve the reputations of both the container terminal and crane industries through the increased focus on safety.

In developing this project, all the relevant stakeholders have been involved. PEMA represents the container crane and technology suppliers, and the TT Club and ICHCA International represent the container terminals. Each group has liaised with its members to ensure input and ownership from all and the best result.

Crane manufacturers that choose to include the minimum standard safety features in their initial quotation, and not as optional, will now be entitled to state in their tender quotation: "This tender quotation includes all the minimum standard safety features recommended by the TT Club, ICHCA International and PEMA."

While this current document is restricted to quay container cranes, it may also be relevant for other cranes and terminal equipment. The longer term aim of the three parties is to establish similar international baseline safety standards for all types of terminal equipment.

Recommended minimum safety features

The table overleaf is not all-inclusive, but rather a shortlist of key safety features that are both practical and effective. Based on experience, accident records and insurance claims analysis, this list covers the systems, structures, features, equipment and technology that have been most proven to reduce injury or damage, and which are currently not standard.

The aim is for suppliers to include as standard, not optional, the features on this list in all their quotations. Terminals and buyers are also recommended to include these features in their tender specifications. Many, if not all, of these safety features can be retrofitted to existing cranes and this is also highly recommended. Existing international, national and/or local regulatory standards must be also be satisfied.

TABLE 1: RECOMMENDED KEY SAFETY FEATURE

No.	RISK	SAFETY FEATURE	FUNCTIONAL REQUIREMENT
1	Boom colliding with ship	Boom anti-collision	• A minimum of 2 detection zones: ◦ Warning or slow down ◦ Stop • Detection range shall be such that it will allow enough time for the crane to come to a "normal" stop. • Suitable electronic sensors designed specifically for this application must be used. Lanyard or tripwire systems are not adequate.
2	Gantry colliding with objects on rail tracks or near vicinity	Gantry travel anti-collision	• A minimum of 2 detection zones: ◦ Warning or slow down ◦ Stop • Detection range shall be such that it will allow enough time for the crane to come to a "normal" stop.
3	Adjacent cranes colliding	Crane to crane anti-collision	• A minimum of 2 detection zones: ◦ Warning or slow down ◦ Stop • Detection range shall be such that it will allow enough time for the crane to come to a "normal" stop.
4	Crane drivers adversely affected by ship stack emissions or other air pollutants	Operator cabin air conditioning	• The cabin shall be provided with a proven positive pressurized air filtration system with high efficiency particulate and gas absorbers, or similar, to protect the operator from harmful emissions from ships' stacks or other air pollutants.
5	Damage and injury caused by operating the crane in high winds	Wind speed detection and alarm to enable driver to stop the operation, park and shut down the crane safely	• An anemometer shall be installed in clear air at the top of the crane, giving an indication in the driver's cab, both audible and visual, that the safe operating wind limit has been reached. • An audible alarm shall also be installed to indicate to persons on the berth that this limit has been reached. • The anemometer shall be capable of recording well over the expected worst case windstorm. The wind speed, direction and time shall be recorded. The recommended maximum operating wind speed should be set at 22m/s. • Crane must not shutdown automatically, even if the alarm sounds continuously. This allows the crane to travel to the storm pin/tie-downs.
6	Cranes being blown along the crane rails	Means to engage the crane horizontally on rails	• Crane storm pins shall be installed at the centre of the crane under the sill beams on both waterside and landside and one or more corresponding locking positions on dock in distance reachable within the expected time to high wind condition. • The storm pins, the mounting on the crane and also the pin sockets in the quay structure must all be designed to withstand the maximum forecast forces exerted.
7	Cranes being blown over	Means to engage the crane vertically to prevent wheels being detached from rails	• Substantial crane tie-downs on each corner and one or more corresponding locking positions on dock in distance reachable within the expected time to high wind condition. • The tie-down connections on the crane and also the anchor points in the quay structure must all be designed to withstand the maximum forecast forces exerted.
8	Runaway crane due to sudden high wind condition	Gantry braking	• Gantry drive braking system shall be designed to stop and hold the crane with a wind speed of 40m/s from behind. • Design shall take into account uneven weight distribution so that the braking force transfers to the crane rails. This means no wheel skidding under normal braking.
9	Structural or lifting system damage caused by snagged spreader or container	Hoist snag load protection	• Detection system to activate "fast stop" of the lifting system and a system to absorb or isolate the kinetic energy in the lifting system, to prevent the excess of designed load in the lifting system.
10	Electrical or machine room fire	Temperature and smoke detection in the electrical and machine room	• Temperature and smoke detection alarm systems inside the electrical control and machinery rooms which give audible and visual alarms in the driver's cabin, electrical and machinery rooms, outside the machinery house access door and on the landside sill beam.
11	Electrical room fire	Fire suppression	• A fully automatic fire suppression system mounted inside the electrical cubicles.
12	Falling or jamming between movable parts of the crane while personnel entering enclosed non access or operating areas	Prevent unintended access to risk areas	• Spring set self closing gates with positive means to open. • Any access gates to risk areas (i.e. boom/trolley, cabin/boom etc.) shall be interlocked to prevent access when not in parked positions, or when in operation, and to prevent crane operation when open.

TABLE 1: RECOMMENDED KEY SAFETY FEATURE (CONTINUED)

No.	RISK	SAFETY FEATURE	FUNCTIONAL REQUIREMENT
13	Overloaded or mis-declared container weights and eccentrically loaded containers causing risks: trucks overturning; road damage; ships sinking; containers collapsing	Measure the weight and eccentricity of each container	• System to measure, indicate and record the actual weight and eccentricity of each container. Data to be capable of being transferred to the terminal operating system (TOS).

ABOUT THE ORGANISATIONS

The **Port Equipment Manufacturers Association** (PEMA) provides a forum and public voice for the global port equipment and technology industries, acting as a neutral platform to enhance industry best practice and knowledge, and to raise awareness of how equipment and technology can enhance port efficiency. Founded in 2004, the Association currently has over 50 members and counting.

The **TT Club** is the international transport and logistics industry's leading provider of insurance and related risk management services. Established in 1968, the Club's membership comprises ship operators, ports and terminals, road, rail and airfreight operators, logistics companies and container lessors.

ICHCA International is the only global association dedicated to the promotion of safety and efficiency in the handling and movement of goods by all modes and throughout the supply chain. ICHCA International members include ports, terminals, transport companies and other groups associated with cargo handling and coordination. Members of its Panels represent a substantial cross-section of senior experts and professionals from all sectors of the cargo transport industry globally.

ENQUIRIES

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