

ICHCA International Limited



INTERNATIONAL SAFETY PANEL

RESEARCH SERIES #13

LIFTING CONTAINERS BY RUBBER TYRED GANTRY CRANES

BY LAUREL BANDY



ICHCA INTERNATIONAL PREMIUM MEMBERS:



Hutchison Ports (UK)



ICHCA International Limited



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Studies are undertaken and reports are periodically issued on a wide range of subjects of interest and concern to members and their industry.

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ICHCA International Safety Panel Research Paper #13
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No. 1	Guidelines to Shipping Packaged Dangerous Goods by Sea – Advice to Consignors and Shippers
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This publication is one of a series developed by the International Safety Panel ("Safety Panel") of ICHCA International Limited ("ICHCA"). The series is designed to inform those involved in the cargo-handling field of various practical health and safety issues. ICHCA aims to encourage port safety, the reduction of accidents in port work and the protection of port workers' health.

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ABOUT THE AUTHOR

Laurel Bandy comes from Colorado Springs, Colorado and is participating in a year-long graduate exchange at the TT Club through the Mountbatten Internship Programme. This initiative promotes educational and business links between the USA and the UK by providing the opportunity to gain practical and theoretical business experience, whilst also developing social and cultural awareness and understanding. Laurel is working towards a Certificate in International Business Practice during her year in London. She earned a Bachelor's Degree in French and International Affairs from the University of Puget Sound in Tacoma, Washington in May 2007. Laurel agreed to carry out the research and collation for this Research Paper in September 2007 and she will return to Colorado in August 2008 to continue her career in International Business.

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LIFTING CONTAINERS BY RUBBER TYRED GANTRY CRANES

1. INTRODUCTION

- 1.1 This research was commissioned by the International Safety Panel (ISP) of ICHCA International Limited. ICHCA International is an independent, non-political international membership organisation, whose membership comprises corporations, individuals, academic institutions and other organisations involved in, or concerned with, international transport and the cargo handling industry. The ISP was established in 1991 and considers all aspects of safety and health in the handling of cargo and ancillary activities. It promotes, advises and informs those concerned with such issues accordingly and an important part of that activity is carrying out research. Research projects are reviewed or initiated when they are considered appropriate and relevant and they are reflected in the publication of papers in the Research Series of documents authorised by the Panel. This is the 13th in the series.
- 1.2 Following the receipt of a number of reports of accidents involving container lifting operations by rubber tyred gantry cranes (RTGs), the International Safety Panel decided that an investigation should be carried out to ascertain whether this was an international issue or one that was confined to a few terminals.
- 1.3 This was carried out by the Chairman of the Panel who reported that there did appear to be a more general problem.
- 1.4 Accordingly, the Panel decided to commission a research project and the TT Club agreed to manage it. Laurel Bandy, who had just started her one year internship with the Club, took on the research role.
- 1.5 The issue is concerned with lifting containers from road vehicles by RTGs such that the road vehicle was inadvertently lifted as well. Damage to the RTG, spreader, road vehicle, and bodily injury are all potential outcomes of such an incident. Although not the only method of stacking and moving containers on a container terminal, many terminals do use RTGs as they are particularly useful if space is limited. It was evident that many port terminals already have safe systems in place, some based on technological solutions, to prevent the inadvertent lifting of the road vehicle as well. The aim of this research is to produce advice and recommendations on the best practice when lifting freight containers with RTGs, and more importantly, suggestions for solutions to the problem.
- 1.6 Currently, although the practice of lifting containers using RTGs is essentially the same, there are some small variations from terminal to terminal globally. In general, the truck driver enters the terminal, he unlocks the twistlocks, drives to the unloading point in the terminal and the container is lifted from the vehicle and stacked by the RTG.
- 1.7 Variables to this practice are -
 - (i) The actual place where the twistlocks are disengaged on the terminal by the road vehicle driver
 - (ii) Whether the road vehicle driver stays in the vehicle cab during the time that the lifting takes place or, alternatively, is asked to get out
 - (iii) The degree of signage and information regarding lifting instructions given to drivers

- (iv) Training programs for internal staff including refresher training
- (v) Training and Induction procedures for external truck drivers

2. THE SURVEY

- 2.1 The project asks respondents to share their terminal's relevant accident history and to rate the effectiveness of technology and procedures they may have in place to prevent lifting a vehicle. The aim is to share information across the industry.
- 2.2 This approach by the Panel has led to the prevention of injury and loss in the past.
- 2.3 The survey was distributed electronically to all ICHCA International members as well as members of the International Safety Panel by ICHCA International. Members were asked to complete the survey and return it to the researcher.
- 2.4 Whilst the creation of an online questionnaire could not be funded, a down-loadable excel document was utilised instead.
- 2.5 Members were given three months to return their responses. It was stressed that the replies would be considered confidential in regard to names, locations and any other terminal related information. This has been the approach to every Panel commissioned research project and has proved to be acceptable.
- 2.6 The survey is, therefore, voluntary. Approximately 100 addressees received the questionnaire. The responses represent a total of 12 organizations on 5 different continents.¹
- 2.7 This demographic represents 19 individual terminal locations, although several are members of larger port groupings and, therefore, may represent a much wider summary of experience.
- 2.8 The total participation in the survey was considered fairly normal whilst the diversity of responses is high.
- 2.9 Chart 1 analyses the response to the questions:
 - Have there been experiences on the terminal of vehicles/trailers being lifted in the air when RTGs have attempted to unload the vehicle?
 - Have there been instances of vehicle drivers being lifted in the air?
- 2.10 It will be seen that 55% of respondents had experienced instances of vehicles being lifted. 25% have experienced driver lifting during operations. A driver being lifted in the air occurs less frequently than lifting the vehicle alone.

¹ Please refer to Appendix 2 for a complete list of respondents.

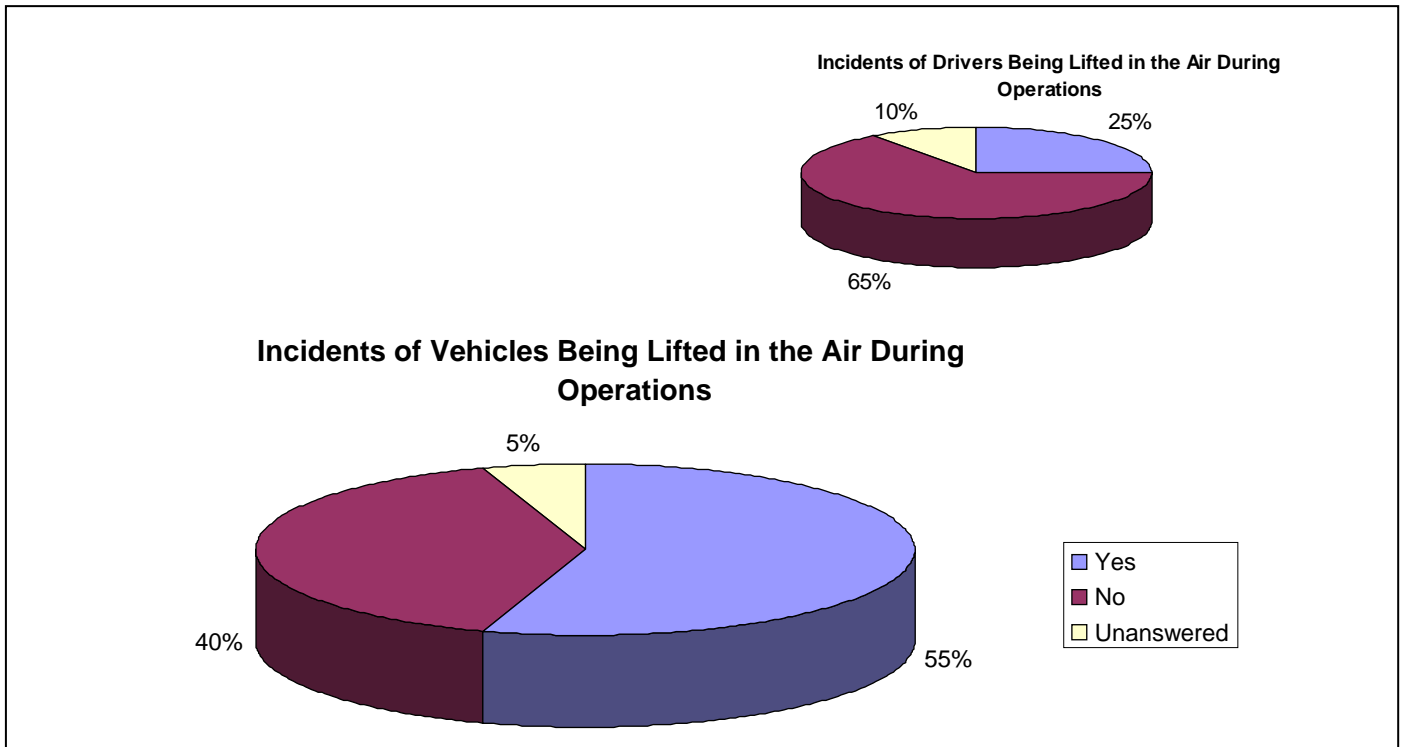


Chart 1 Occurrence of trailer lifting incidents and incidents involving the driver of the road vehicle

2.8 Chart 2 shows the frequency of incidents reported by those who have had accidents happen wherein the driver is lifted in the cab during the unloading process.

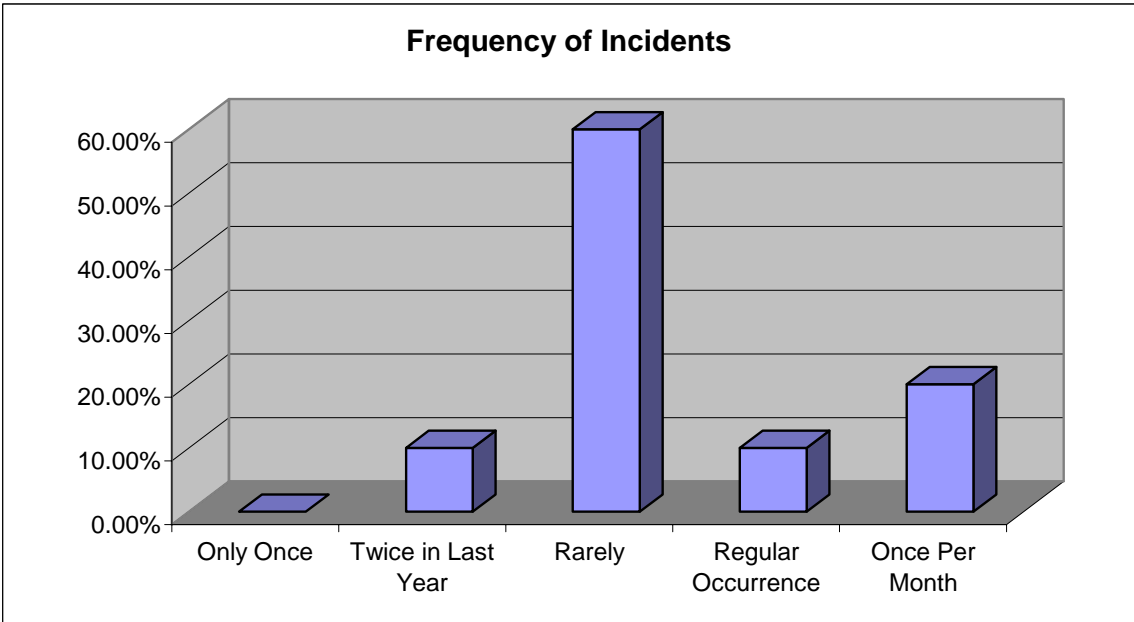


Chart 2 Frequency of Incidents with Injury

2.11 The majority (60%) claim that this type of incident is a rarity. However, 30% of terminals consider it a regular occurrence ("Once per Month" combined with "Regular Occurrence" responses). Thus, while the issue persists, the data indicates that the majority of terminals have either not experienced this problem, or experienced it to a

lesser degree. Alternatively, terminals may have experienced incidents at one time, but have now addressed the issue and eliminated it. Terminals that took measures to stop these incidents may provide other terminals that are still experiencing the problem with practical solutions.

2.12 The bulk of the survey asks about terminal procedures during unloading from vehicles. Most ports surveyed abide by similar practices, and although there is slight variation in the data, there is no determinable pattern amongst those who experience lifting issues during unloading that would set them apart from those who don't. For example, Chart 3 will show that the majority (84%) of respondents reported that the Vehicle Driver is responsible for disengaging the twist locks. Of that, 67% reported at least one incident involving driver injury during lifting operations. People who reported "Other" indicated "Traffic Assistant" or "Dock Signal Person" as the responsible party for disengaging the twistlocks.

2.13 A third of the minority 16% who had someone other than the vehicle driver unlock the twistlocks reported accidents with injuries. This does not include accidents without injury.²

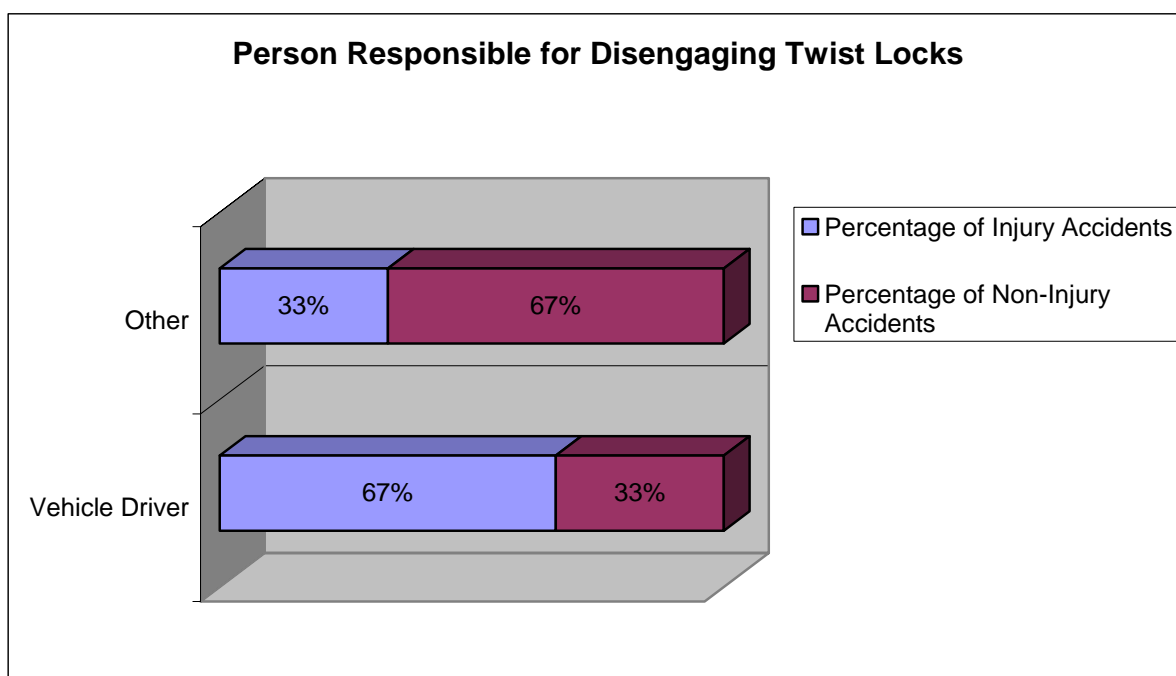


Chart 3 Correlation between who is responsible for disengaging the twistlocks and Accident type.

2.14 Survey respondents identified two primary causes for lifting incidents:

- faulty twistlocks on the road haulage vehicle; and
- vehicle driver error
- .

The data shows that neither communication issues nor crane driver error are believed to be the problem. This would suggest that a successful solution addresses what is happening on the ground with the truck and the truck driver.

3. Solutions

² This graph is based on data that may not be representative of the overall population. While appointing a traffic assistant to disengage twistlocks may help reduce the risk of injury incidents, this data does not prove this hypothesis. Port Safety Officers should not rely on this data alone when taking risk management measures.

- 3.1 The data did show that the process for unloading is generally consistent across the industry. However, there is variation in (a) who disengages the twistlocks, (b) where this is done, and (c) where the vehicle driver is during lifting. Furthermore, there is no apparent correlation between the procedure a terminal uses for unloading containers from trucks and the occurrence of accidents. Therefore, solutions cannot be geared towards a standardised method. It is not practical as the survey suggests that, even if that were possible, it would not solve the problem. A successful solution will be something that can be implemented in a wide variety of ports irrespective of the procedure at each individual port.
- 3.2 One line of preventative thought can be aimed at the vehicle and vehicle driver (such as induction and refresher training). However, an alternative and, more appropriate, approach could be to seek solutions that bypass human interaction all together. Human error is something that can never be fully resolved. This paper will explore some technological solutions already in practice and another that is developing.
- 3.3 Chart 4 shows the measures that the survey showed have been taken to prevent this type of accident. There are two types of actions terminals can take to reduce the occurrence of lifting vehicles during unloading: infrastructure and technological.

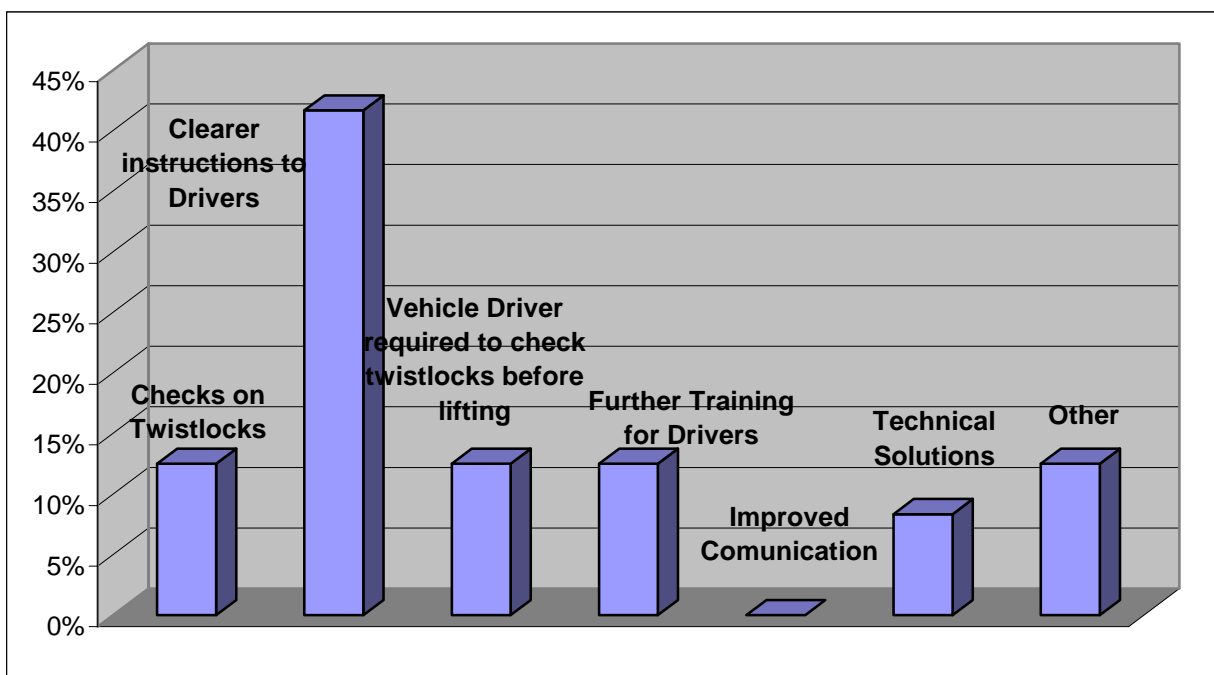
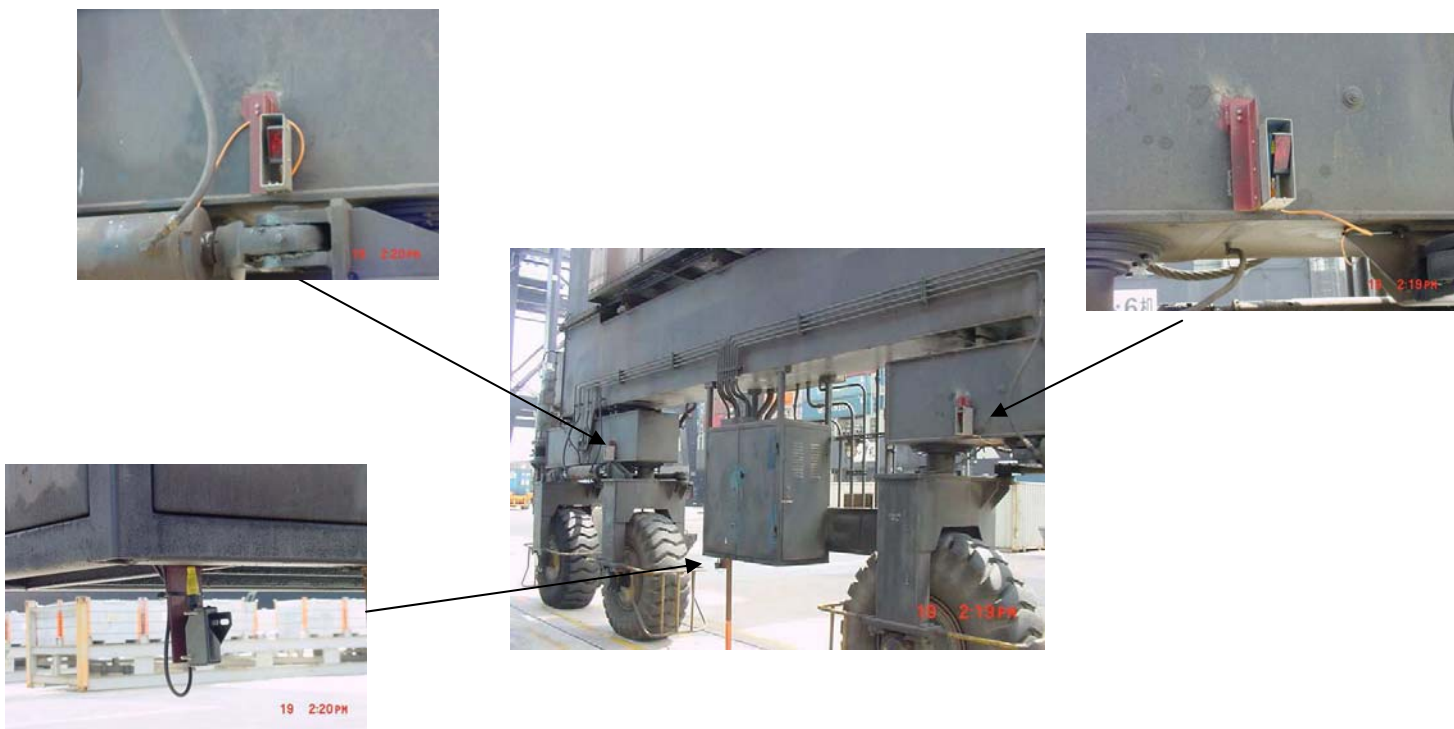


Chart 4 Measures Taken to Stop Incidents

- 3.4 Chart 4 clearly demonstrates that the industry's response to these incidents is directed towards external factors (i.e. drivers and vehicles that are not from the port). However, many terminals have successfully approached the problem from a technical perspective and implemented technological solutions.
- 3.5 One of the perceived major factors contributing to such incidents is a faulty road vehicle twistlock. This is an issue of maintenance and inspection, an essential part of infrastructure. ICHCA International Safety Briefing Pamphlet BP#24 *Safe use of road vehicle twistlocks* was published in response to this and terminals should consider what they can do to influence road vehicle owners in this regard. Equally, systems and clear communications with vehicle drivers can be utilised.

- 3.6 Awareness is key in preventing mistakes that could cause injury and loss. If a terminal's infrastructure is catered toward making drivers aware of the proper procedures many accidents could be avoided. This includes clear and appropriate signage and other indications such as terminal surface markings and sufficient lighting to indicate procedures to drivers, giving special consideration to night time deliveries, where relevant. Of the 19 surveys received, 10 indicated that they had taken measures to provide clearer instructions to the vehicle driver in this regard and that this had been successful.
- 3.7 In one country there was also a move to place responsibility directly on the truck drivers in which it was said that terminals would not accept claims from truck drivers for this kind of accident. With the visible and direct shift of responsibility onto the vehicle driver to ensure that the vehicle twistlocks are undone and remain undone, lifting in the air accidents stopped happening.
- 3.8 One example of a technological solution currently in place at many European terminals is a Trailer Lift Protection System wherein infrared sensors are mounted on the RTG (see figures 1-4 below). As the container is lifted from the chassis, the sensors "look" under the container. If the chassis has been lifted with the container, the system will not recognize a break and will disable the lift hoist. This system is effective due to the consistency in trailer height and chassis depth. The system not only detects the container by infrared sensor, but it can measure the height of the container through pulses from the hoist drum. It will automatically begin to "look" for a gap between the trailer and container when a height of 70cm is reached. If a gap is detected the system re-sets, or in the event that a gap is not detected, the system will abort the hoist automatically. Outfitting one crane with the system costs about \$1,000 USD. This system is a cost effective way of reducing risk. One of the major advantages of this system is that the cost makes it available and safety does not need to be compromised for financial reasons.



Figures 1-4 Trailer Lift Protection System

- 3.7 A second system reported used sonar technology to read the increasing distance between the container and the trailer bed. However, this system was susceptible to interference from high winds and heavy rain. It was considered obsolete and discontinued when the infrared anti-lift system was developed.
- 3.9 A system, which is still in development, is Lasstec's automated twistlock system. It is mentioned here, although somewhat premature, as the technology has not yet been used commercially in terminals. A fibre optic probe feeds through a hole drilled in the twistlocks on the RTG lifting frame which, when the locks are engaged, senses the distribution of weight on the frame. If there is a massive disproportion in the weight, as would occur if the trailer plus cab has been lifted as well, the system will not allow the crane to continue lifting. This system is currently being developed and tested in Lyon, France. LeMantec International has acquired a patent and is working with industry partners to adapt the product for specific use with RTG accidents. LeMantec presented an outline of their product to the International Safety Panel in April 2008 and will make a further presentation when the system has been tested and proved.

4. Conclusions

- 4.1 While many terminals have addressed the concern over the safety of truck drivers during the container unloading process using RTGs, many ports are still experiencing problems. The best solutions are likely to be those that account for the least amount of human interaction possible, although the experience of one country which directly tackled the issue of vehicle drivers, shows that such approaches can work.

5. Recommendations

- 5.1 The Safety Panel recommends that ports who have experienced this problem seek a technological solution similar to one of the aforementioned. The benefits of investment in a safety mechanism will far outweigh the initial cost of the technology in avoidance of personal injury and future claims savings.

Questionnaire

This questionnaire is part of a research project being undertaken by the International Safety Panel of ICHCA International and is aimed at highlighting problems and solutions regarding the lifting of freight containers by RTGs. *As with all ISP research initiatives, responses to this survey are confidential as far as people, companies and locations are concerned and this will be strictly followed. This project is being carried out for the Panel by Laurel Bandy of the TT Club. Responses should be sent direct to her at email: laurel.bandy@thomasmiller.com*

This part is fully confidential:

Survey Completed by: _____

Contact details: _____

Firm/Organisation: _____

Port/Terminal: _____

Approximate annual number of TEUs handled by its RTGs _____

Date: _____

This part will be included in a general analysis and summary of the overall position:

- 1 Does your terminal lift freight containers by RTGs?
☐ YES ☐ NO
- 1a If YES, please give approximate number of TEUs per year handled in this way
- 2 Does your company own the RTGs?
☐ YES ☐ NO
- 2a If NO, who does own them?
- 3 Does your company employ the drivers of the RTGs?
☐ YES ☐ NO
- 3a If NO, who does employ them?
- 4 Does your company determine the safe system of work associated with this operation?
☐ YES ☐ NO
- 4a If NO, who does determine it?
- 5 Concerning the lifting of containers off road vehicles, who unlocks the

- road vehicle's twistlocks?
- ☐ Vehicle driver ☐ Other (please specify)
- ☐ Safe system does not specify
- 6 At what place does this occur?
- ☐ At gate entrance ☐ Inside gate
- ☐ Below RTG ☐ At designated special area on terminal
- ☐ Safe system does not specify
- 6a Are there signs at the site clearly telling the vehicle driver what he should do?
- ☐ YES ☐ NO
- 6b Who is responsible for ensuring that the twistlocks are unlocked before the RTG begins the lifting process?
- ☐ Vehicle driver ☐ RTG driver
- ☐ Other (please specify) ☐ Nobody
- 7 According to the safe system of work, where does the driver stay whilst his vehicle is being unloaded/loading
- ☐ In front of vehicle ☐ Nearside of vehicle to container stack
- ☐ Offside of vehicle to container stack ☐ Inside cab
- ☐ Special area provided (please state where this is sited)
- ☐ Safe system does not specify
- 8 Have there been experiences on the terminal of vehicles/trailers being lifted in the air when RTGs have attempted to unload the vehicle?
- ☐ YES ☐ NO
- 8a If YES, can you give some indication of frequency?
(please tick the box that seems to be the most appropriate)
- ☐ Only once ☐ Twice in past year
- ☐ Rarely happens ☐ Regular occurrence
- ☐ Once per month
- 8b Have there been instances of vehicle drivers being lifted in the air?
- ☐ YES ☐ NO
- 8c Have there been injuries caused?
- ☐ YES ☐ NO
- 8d If YES, have they ever been serious injuries?
- ☐ YES ☐ NO
- 9 What does the terminal consider the problem to be?
- ☐ Faulty twistlocks on vehicle ☐ Vehicle driver error
- ☐ Movement of TL caused by vibration as vehicle moves through terminal

- ☐ Crane driver error
 - ☐ Lack of communication between the two drivers
 - ☐ Lack of communication between drivers and ground crews
 - ☐ Other (please specify)
- 10 What measures has the terminal been able to take to stop these incidents
- ☐ Checks on twistlocks on vehicles
 - ☐ Clearer instructions to vehicle drivers
 - ☐ Vehicle driver required to check TL before lifting commences
 - ☐ Further training of crane drivers
 - ☐ Improved communications between drivers and ground crews
 - ☐ Technical – telling the crane driver if the load does not come clear of the vehicle (please specify details)
 - ☐ Other (please specify)
- 11 Have these measures had any effect?
- ☐ YES – incidents have now ceased/reduced/rarely* happen now
*delete those inapplicable
 - ☐ NO – the number of incidents continues as before
- 12 Do you have any other comments/suggestions?

List of Respondents

Ashod Port Company Ltd., Israel
Calgary International Container Terminal
Copper T. Smith Stevedoring
Cyprus Ports Authority
DP World, Chennai
DP World, Karachi
DP World, Nhava Sheva
DP World, Sydney
DP World, Constanta
Hutchison Ports UK
Malta Freeport Terminals Ltd.
OPCSA Container Terminal, Las Palmas, Spain
OPM Aden LLC.
Sacerth Container Terminal
SSA Terminals, San Francisco
SSA Terminals, Seattle
Transnet Ltd., Durban, South Africa
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