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INTERNATIONAL SAFETY PANEL

RESEARCH SERIES #7

SHIP DESIGN CONSIDERATIONS FOR STEVEDORE SAFETY

by

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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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SHIP DESIGN CONSIDERATIONS FOR STEVEDORE SAFETY

PART A - GENERAL

1 Introduction

1.1 The construction of a seagoing ship must comply with national and international ship building standards. A ship also has to be designed and constructed to be a safe place of work for stevedores and crew. The planning and design of a ship is the critical stage, as it is difficult to change the ship after it has been built.

1.2 This pamphlet is based on –

- ILO Convention 152 “Occupational Safety and Health in Dock Work“
- ILO Code of Practice: “Safety and Health in Ports“ and
- ILO Code of Practice: “Accident Prevention on Board Ship at Sea and in Port“

1.3 Practical ideas, including different national requirements, are shown *in italics*.

2 Workplace

2.1 Stevedores have to work on ships from many countries under constantly changing working conditions. Therefore, regulations place an obligation on both masters of ships and employers of stevedores to ensure that there are safe working conditions on board ships before the cargo handling operations start.

2.2 All port operations on board ship should be carried out in accordance with safe systems of work. These should be drawn up following identification of the hazards, assessment of the risks and the development of measures to control them.

2.3 Injury accidents on board visiting ships account for the majority of accidents that occur in dry cargo ports. Experience has shown that regular inspections and reports on the condition of ships will help to reduce the number of these accidents that occur. These Vessel Condition Reports (VCRs) can then be used on future ship visits to forewarn the port workers of dangerous situations aboard ship.

2.4 If deficiencies on board ship, affecting the safety of workers, persist and are not corrected the VCR can be used as a document of record in a written report to the national competent authority inspector or Port State Control Officer

3 General requirements

3.1 General

There are some general requirements to ensure a ship is a safe place of work

- Stevedores need safe means of access to every part of the ship that any person has to visit for the purpose of cargo handling operations
- All parts of the ship that are being used for cargo handling operations shall be suitably and adequately lit

- Adequate and secure fencing shall be provided at places where persons engaged in cargo handling operations may be at risk of falling significant distances

These general requirements lead to the more detailed requirements below.

3.2 Access to the ship

3.2.1 National Merchant Shipping Regulations place an obligation on both the Master of the ship and the ship owner or operator to ensure that there is a safe means of access between the ship and the shore, or to another ship.

3.2.2 Accommodation ladders or gangways carried on board ships need to be appropriate to the deck layout, size, shape and maximum freeboard of the ship.

- *Most accommodation ladders or gangways in use in general cargo ships lead to the main deck or the poop deck. They may not be adequate during periods of low or high tide. Accommodation ladders from bulk carriers or car carriers are often too short for safe use. It is not essential that accommodation ladders or gangways lead to a specific deck but it is necessary that the gangway is useable in all ports of the world and at all states of tide*

3.2.3 Access should, generally, be provided by the ship's accommodation ladder or by the ship's gangway in accordance with national Merchant Shipping Regulations.

- *Because of the steady reduction of crew numbers on ships, gangways or accommodation ladders should be light enough to be handled by just a few persons if mechanical handling is unavailable. It would also be helpful if a remote controlled derrick that allows all necessary movements, such as lowering, hoisting and swinging, will be available.*

3.2.4 Gangways and accommodation ladders must be clearly marked with the maximum design angle of use and their maximum safe load, both by number of persons and by total weight

- *It would be useful if an angle indicator were fitted to the access equipment. This should show both the maximum angle and the actual angle of the equipment*

3.2.5 Each end of a gangway or accommodation ladder should provide safe access to a safe place. The lower end of a gangway or a ladder should be fitted with a platform. Where necessary bulwark steps should be provided and securely rigged.

3.2.6 The means of access should be so placed as to ensure that no loads pass over it and where access to it will be not obstructed.

- *Increasingly, ships are equipped with just one accommodation ladder each side at the mid-ships position. This is not a safe place during cargo handling operations as it is within the swinging radius of cargo. It is necessary to place the accommodation ladder or the gangway as far as possible out of the range of cargo handling operations*

3.2.7 Where a means of access passes over water, and there is a significant risk of a person falling into the water and drowning, suitable safety nets should be securely rigged so as to minimise this risk. Places where nets may be required are likely to be at either end of

the means of access or on the quay- side or ship's deck immediately adjacent to the means of access,

- *Sufficient suitable attachment points for safety nets should be provided.*

3.2.8 The accommodation ladder should: -

- be fenced on either side throughout its length with upper and intermediate guard rails of a height of not less than 1.1 m and 550mm respectively, measured from the surface of the tread, and at right angles to the longitudinal axis of the ladder
- be fitted with treads at least 550mm in width and of adequate depth
- be fitted with treads with a permanent non-slip surface
- have treads of such a shape or design so that, at the working angle of the ladder, a person's foot steps on a flat or curved surface not on a corner of a tread
- be kept adjusted in such a way that the ladders angle to the horizontal does not exceed approximately 40°

3.2.9 The gangway should :

- have a closely boarded walkway at least 550mm in width
- be fitted with transverse treads at suitable stepping intervals
- be fitted with upper and intermediate guard rails complying with the requirement for accommodation ladders
- be fitted with devices enabling it to be properly secured to the ship
- be fitted with proper slinging attachments so placed that it will balance about the attachments when it is suspended, if a lifting appliance has to be used to place it in position
- not normally used at an angle of more than 30° to the horizontal, or 45° if it is fitted with transverse treads every 500mm or so;
- never be used at an angel of more than 45° to the horizontal;

3.2.10 Where a gangway rests on the quay on rollers or wheels, they should be either fitted or guarded so as to prevent a person's foot from being caught between the roller or wheel and the quay surface, leaving a minimum gap of 50 mm.

3.3 Lighting

3.3.1 Suitable deck and under-deck lightning should be provided. A minimum of 10 lux on access routes and 50 lux in working areas is required, taking into account any specific need that may require additional lighting.

3.3.2 The lighting should be -

- reasonably constant and uniform, minimising sharp contrasts
- adequate for safe movement and working, and to make any warning signs clear
- arranged so as to minimise glare to persons, including those navigating ships and others working on the water
- lights should be easy to handle and maintain. For example, it should be possible to change bulbs quickly from a safe position

3.3.3 When portable or temporary lighting needs to be used, fittings and leads should be suitable and safe for the intended use.

3.3.4 In order to avoid risks of electric shock from mains voltage, portable lamps used in damp or humid conditions should be of low voltage, ideally not greater than 24 volts.

3.4 Fencing

3.4.1 Fencing should be provided at any place where any person working or passing might fall a distance of more than 2 metres, whether the fall would be into water or not.

3.4.2 Guard rails or fencing should consist of -

- an upper rail at a height of 1000mm
- an intermediate rail at a height of 500mm
- a toe board at a height of 150mm or a second intermediate rail

3.4.3 The fencing may be of suitable wire rope or chain, provided that there are means to keep the ropes or chains taut as possible. Sufficient stanchions should be provided.

3.4.4 Deck sockets into which stanchions fit should be equipped with locking devices and should be sufficiently deep and designed in that way as to prevent the stanchions from moving unduly out of the vertical or being accidentally displaced.

3.4.5 The fencing should form a permanent part of the ship's equipment and be kept in place at all times with just a few exceptions.

3.4.6 Hatches at deck level should be protected by coamings of sufficient height to prevent accidental falls into the hold. Coamings should be preferably be 1m high.

3.4.7 Where necessary, barriers should be installed to prevent lift trucks working in the 'tween decks area from falling into the hatch or onto the quay if there are lift truck operations to and from side doors.

3.5 Transit areas

3.5.1 Transit areas connect the working places for stevedores with the means of access or other working places. Therefore, transit areas have to be safe and clear of cargo and all equipment.

- *All deck surfaces used for movement about the ship and all passageways and stairs should have non-slip surfaces.*

- *Where necessary for safety, walkways on deck should be delineated by painted lines or otherwise and marked by pictorial signs.*

- *The minimum clearance for transit areas is 2 m high and 600m m wide.*

3.5.2 Safe means of access should be provided to all places on board the ship that a dockworker is required to go in the course of work; for example, the operating area or any other part of lifting appliances or hatch covers.

3.5.3 Where a platform is provided it should –

- have a minimum dimension of at least 750mm in either direction

- be fitted with a guard rail and an intermediate rail, the guard rail being not less than 900mm above the floor of the platform

- be fitted with a toe board extending to a height of not less than 150mm above the floor of the platform

- have a floor of non-slip construction

- have a minimum headroom under any obstacle of 2.1 m.

3.5.4 Where a fixed ladder gives access to a platform from the outside of the platform, the stringers of the ladder should be opened above the platform level to give a clear width of 700 to 750mm to enable a person to pass through the stringers.

3.5.5 A fixed ladder should not slope at an angle greater than 25° from the vertical. Where the slope of a ladder exceeds 15° from the vertical, the ladder should be provided with suitable handrails not less than 540mm apart, measured horizontally.

3.5.6 A fixed vertical ladder of a height exceeding 3 m and any fixed ladder less than 3 m high from which a dock worker may fall into a hold should be fitted with guard hoops, which should –

- be uniformly spaced at intervals not exceeding 900mm apart
- have a clearance of 750mm from the rung to the back of the hoop
- be connected by longitudinal strips secured to the inside of the hoops, each equally spaced round the circumference of the hoop

3.5.7 Where a fixed ladder gives access to the outside of a platform, the stringers should be connected at their extremities to the guard rails of the platform, irrespective of whether the ladder is sloping or vertical.

3.5.8 Where fixed a ladder gives access to a platform through an opening in the platform, either an adequate handhold should be provided on the platform, or preferably

- the stringers should be carried above the floor level of the platform by at least 1m
- the ends of the stringers should be given lateral support and the top step or rung should be level with the floor of the platform unless the steps or rungs are fitted to the ends of the stringers

3.5.9 Manholes should not be situated in transit areas. If they have to be situated in such areas, proper fencing should protect them.

3.6 Access to holds

3.6.1 The access of persons to a ship's hold should be by means of a separate man-hatch and a permanent ladder separate from the hold. Where possible the ladder should be sloping.

3.6.2 A sloping ladder may be fitted with single rungs, provided that its angle to the vertical does not exceed 15°. Otherwise it should be fitted either with treads or with pairs of rungs.

3.6.3 The tread or rungs should -

- be equally spaced at intervals of 300mm
- provide a foothold of not less than 115mm in depth and not less than 350mm in width
- in the case of double rungs, be fitted adjacent to each other on the same horizontal level with the clear gap between them not exceeding 50mm
- be made from square bar steel, the sides of the square should not be less than 22mm and positioned with the edges up; and be horizontal

3.6.4 The ladder shall have the following clearances –

- behind the tread or rung (in case of double rungs, the rear rung), not less than 150mm for the user’s foot
- at the front not less than 760mm in case of a vertical ladder and 1 m in case of a sloping ladder, measured at a right angle to the axis of the ladder, (for the user’s body)
- at the side not less than 75mm for the user’s hand

3.6.5 If the length of a ladder, or the length of ladders that lie in the same line, exceeds 6 m, it shall be provided with suitable landing platforms for every 6 m of length, or fraction thereof.

3.6.6 The landing platform should be of a suitable size and protected on each side, other than the side on which the ladder is fitted, with a rigid guard rail fitted at a height of not less than 1000mm above the platform.

3.6.7 A separate hatchway giving access to a ladder should have a clear opening of not less than 600mm by 600mm and be fitted with a coaming not less than 150mm high. There should be a clear space of at least 400mm around the coaming to allow easy access. Ladder openings in decks or landing stages should be fitted with a hinged hatch cover, particularly if lashing operations are to be performed there.

3.6.8 The hatchway should be provided with adequate handholds, fitted clear of the coaming, and have its hatch cover provided with adequate securing arrangements, particularly where the required handhold is fitted to the inside of the cover.

- *Where the handhold is fitted to the underside of a hatch cover, the hatch cover shall be fitted with a vertical locking dead-stop*

3.7 Signallers

3.7.1 Where it is not practicable for the operators of lifting appliances to have a clear view of the cargo position, a signaller should be provided for each lifting appliance.

- *The signaller should be sited in a safe location on the weather deck with a clear view of the cargo area concerned. It must be possible for a signaller to look inside the hatch without climbing on the coaming. If necessary a fenced fixed or moveable platform should be provided*

- *If the view of a signaller on the weather deck is not clear and unobstructed, a second signaller, sited in a safe place, may be necessary: for example on the 'tween-deck*

3.8 Ships cargo-handling gear

3.8.1 Shipboard cargo-handling gear, where fitted, should be designed with adequate lifting capacities, sufficient hatch and dockside reaches, and effective operating controls for their use -

- *The weight of a remote control unit for cranes should be less than 2 kg*

4 Special requirements

4.1 General

There are more specific requirements for special types of ships. Bulk liquid and gas carriers normally call at specialised terminals. As these terminals do not employ general stevedores, these ships are not dealt with below. The following practical points for other ships are relevant.

4.2 General cargo ships

4.2.1 The following special requirements apply to cargo ships

- *Suitable and sufficient attachment points on the tween decks are required for the erection of safe fencing*

- *Ships with corrugated bulkheads need a system for the prevention of accidents in the space between the cargo and the corrugations in the bulkheads*

4.3 Bulk carriers

4.3.1 The following special requirements apply to bulk carrier ships

- *Bulk carriers need marked and fenced walkways on deck, from which it should be easy to clear cargo residues*

4.4 Ro/Ro vessels

4.4.1 The following special requirements apply to Ro-Ro ships

- *Whenever possible, safe pedestrian access, separated from vehicle access ramps, should be provided to ro-ro ships*

- *When pedestrian access via a vehicle ramp is necessary, a separate walkway or walkways should be provided on the outer edge or edges of the ramps Walkways should be fenced on both sides to prevent falls into water a provide protection from moving vehicles*

- *The slope of the ramp should not exceed one in ten*

4.4.2 If a ramp is capable of dealing with simultaneous two-way traffic, or there are two separate ramps in use, the traffic flow direction should be clearly marked: for example, traffic lights or arrows of sufficient size.

- *The decks and ramps should be covered with a non-slip surface that does not cause vibration inside the vehicles*

4.4.3 At every enclosed deck, adequate ventilation for the removal of fumes from vehicles using the deck should be provided.

- *Effective steps should be taken to reduce the noise level from ventilation fans, and other sources of noise, to an acceptable minimum*

4.4.4 All openings in decks for a cargo lift platform should be protected by barriers that are substantial and of a height of not less than 1 m above deck level on each side of the opening when the platform is not at that level.

- *The barriers should be hinged or retractable on the side or sides of the opening in use and be interlocked with the lift control so that the platform cannot be moved unless the barriers are all closed*

- *Additionally the barriers should not be able to be opened unless the platform is in the correct position at the opening*

- *If any part of a vehicle or cargo carried should overlap the deck opening, the barriers should be designed so that it is not possible to close them*

4.4.7 A flashing warning light, preferably yellow, should be fitted on the deck side of each opening at a place from which it can be readily seen from any vehicle on the deck. The light should operate continuously when the platform is not at the opening in that particular deck.

4.5 Refrigerated vessels

4.5.1 The following special requirements apply to refrigerated ships

- *Refrigerated vessels should have suitable and sufficient attachment points on the tween-decks to erect safe fencing*

- *The structure of the cargo holds and the tween-decks should be such that they can sustain forklift operations*

- *It should be possible to open hatchways from inside the hold*

- *Ships operating with a controlled atmosphere system should have an efficient warning indicator system that indicates any dangerous atmosphere in the hold. This warning device should be both visual and audible*

PART B –CONTAINER SHIPS

5. Introduction

5.1 Injury accidents on board visiting ships account for the majority of accidents that occur within container ports. The most common cause is the lack of suitable and safe access to lashing work -stations provided by the vessel, resulting in unorthodox and unsafe work practices. This often requires work to be carried out on unprotected platforms with the potential for a person to fall over the side of the vessel or into the well deck. During the development and construction of container ships the provision of a safe place of work for the crew and dockworkers should be considered to be of equal importance as the container capacity

5.2 Over the past few years there have been initiatives by individual ports, vessel owners, trade organisations and international standards committees to improve matters. However, much of these recommendations concentrate on the design of new vessels and does little to improve safety standards on existing vessels, or indeed new vessels currently being constructed to old designs.

5.3 The following basic safety criteria should be adhered to by all designers of container vessels to ensure that the risk of accident to crew or port-worker is reduced to as low a level as possible

- All containers should be stowed in the same direction - alongships. To discharge containers which are standing in other directions is difficult and can lead to dangerous working situations

- Bins or other stowage places for lashing materials should be provided between the container bays to prevent lashing materials being placed on the removable hatch covers or in the transit areas

- Container ships need a cargo securing system, which is easy to handle and will not slow down the cargo handling operations. The development of open hatch ships, equipped with cell guides up to the 4^{th} or 5^{th} layer on deck is one way of achieving this objective

- On conventional container ships it is necessary to use lightweight lashing gear. If it is necessary to secure containers on the outer positions, this should be achievable from a safe position

5.4 The space provided between the containers stows for port-workers to carry out lashing operations should provide.

- a firm and level working surface

- a working area, excluding lashings in place, preferably of 1m and not less than 750mm wide to allow clear sight of twistlock handles and the manipulation of lashing gear

- sufficient space to permit the lashing gear and other equipment to be stowed without causing a tipping hazard

- sufficient space between the fixing points of the lashing bars on deck, or on the hatch covers, to tighten the turnbuckles

- a separate fixed lighting system for each working place between the container bays which is bright enough for the work to be done but will minimise glare to the riggers

5.1.2 The following sections of the document will further discuss and develop these criteria, identify the hazards and difficulties involved during vessel lashing operations, and offer possible solutions. Some of these have already been successfully progressed by vessel owners and shipping lines. Many of the construction recommendations in this document reflect current ISO, and European standards, but where none apply to particular applications, other standards such as USA Occupational Safety & Health Administration (OSHA) standards and industry guidance, or what is considered best practice, has been used.

6. Hatch Covers and Coamings

6.1 Container lashing on board ship is often performed, by standing on the exposed edges of hatch covers, or a step formed by the coaming. In many cases the turnbuckles (bottlescrews), themselves restrict access once in position, often reducing footholds down to less than 150mm (6inches). *(See Figs.1 & 2).* Where three high lashing is required it is necessary to stand back from the container stack to locate the head in the corner castings. These bars are often five metres long and weigh up to 21kg (46lb.) and when in the final locating position, the centre of gravity is high in the bar.

- *In most cases narrow ledges are unnecessary, as modifications in the form of extension plates or gratings not only ensures an improved working surface, but makes lashing easier also. (see Figs.3 & 4)*

- *Hatch extensions can be applied to most rolling (McGregor) hatches, but they must be a precision fit so as not to foul hinges and dogs.Many container vessels in operation are converted bulk or general cargo carriers and these tend to offer the worst situations for access. Invariably, the design for container stowage concentrates on the maximum number of containers achievable with little thought to how stevedores', or crew will access these areas*

- *Experience has shown that on modern purpose built container vessels, walkways and work-stations are often no more than an after thought in the final construction phase*

Figure 1

Figure 2

Figure 3

Figure 4

- *On existing vessels and converted bulk carriers much can be done to improve lashing access and turn-round time efficiency by simply providing good access platforms.*

- *Lashing platforms can be constructed to fill in the void spaces between hatches and other structures. In some cases these gratings can be hinged to form secure storage space for gear during the voyage.*

Figure 5

BEFORE - No consideration given to access Vessel securing plan dictates three high lashing which is not safe from this position, particularly when wet or icy. Stevedore has only lower walkway handrail to stand on. Badly stowed gear also provides an extra hazard

Figure 6

***AFTER** – Same vessel after modifications, with gear properly and safely stowed. Access is now much safer enabling improved lashing efficiency and improved 'turn round' times in port, and – most importantly-reduces the risk of injury.*

Figure 7

Figure 8

- *The platform in Figure 7 is of little use because it is far too low. For lashing purposes, it needs to be one metre high, (with access ladders at each end), to ensure it is level with the deck cleats. As it exists no lashing can be performed from this current platform level and ships crew revert to standing legs apart either side of the walkway, to perform three high container lashing.*

- *Figure 8 shows the same location on a sister vessel with the modified lashing platform at the correct height. This has improved both safety and lashing efficiency.*

- *Further good practice is to highlight leading edges, or unavoidable gaps and spaces, where electric cable supplies, hatch dogs need to be accessed.*

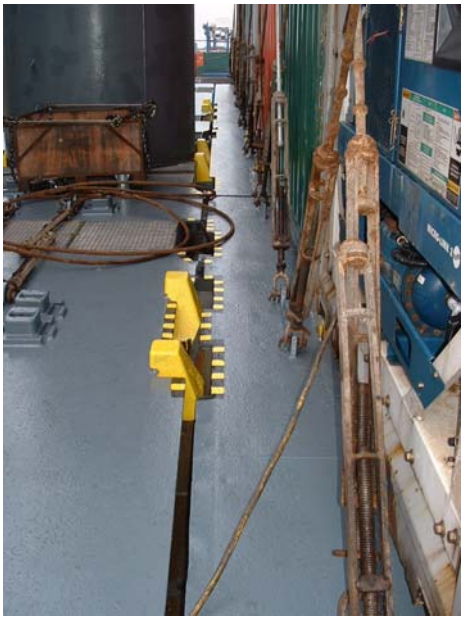

Figure 9

Figure 10

Figure 9 and 10 show hatch and well deck areas constructed with adequate platforms and all leading edges highlighted

7. 45 Ft. Long Containers

7.1 It has been estimated that 45' containers now account for approximately 20% of the container fleet and numbers are increasing rapidly. This does lead to on deck stowage and access conflicts with the obvious being 45' containers, on hatches designed for 40' containers and their lashings. Invariably this leaves little, if no room, to physically stand to perform the lashing and considering some hatches on their coamings can be three metres high, any fall with result in serious injury.

- *One simple solution is to ensure 45' boxes are planned to be stowed on the third tier and upwards only. In most cases this will not interfere with the standard securing plan and permit good access for the lashing of the lower tiers. Where three high lashings are required 45' containers may have to be stowed on the fourth tier and upwards. All this does not lead to a particularly aesthetically pleasing stow, but the safety of labourers and deck hands, as well as container securement is assured*

8. 9'6" (2.9 metre) High Containers

8.1 Containers that are 'overheight' (as often referred) also lead to lashing access problems. Should more than one 2.9 metre container be placed in any one vertical tier, additional lashing extensions will be required. A three high (bottom) corner casting is in excess of 4.8 metres from hatch level with standard boxes; 5.3 metres with one overheight and 5.8 metres with two, with the latter the three high corner casting is un-reachable with standard lashing bars.

- *Unless good quality 'bridges' are provided in the wings over the well decks either side of the vessel, even a single 2.9 metre box becomes impossible to lash in these locations*

8.2 Typical vessel cargo securing manuals only indicate one 2.9 metre container in any given vertical stack, but two or three is not uncommon. Lashing is often achieved by creating a chain of extension pieces, located by use of vertical ladders. In some cases witnessed, crew or labourers climb the doors or other lashing bars to establish these chains

- *Vessels that intend to stow multiple 2.9 metre containers should provide a sufficient number of extended lashing bars*

- *However, as with the 45' boxes, the most simplistic and economical solution is to plan the stowage to ensure all 2.9 metre high containers are placed three high or more only on deck*

9. Lashing Gear and Planning

9.1 In some cases it has been known for the approved lashing plan not to be compatible with the design of the vessel, with the intended container securing method not being physically possible. This is often exacerbated by incorrect lashing gear for the intended lashing plan. For example two high bars being used for one high containers, or a combination of two high and one high bars being used for three high lashing. At face value this appears reasonable, except the securing heads, the container corner casting apertures and the final lashing bar angles, differ considerably. Unless the correct bar is used, containers are not secure with an additional risk of the bar falling out and injuring workers.

9.2 In circulation currently there are 30 different types of twistlock. This can result in a multitude of types on board on e ship. Not only does this create confusion as to whether a twistlock is locked or not, it compromises the safety of stevedores and ships crew during container handling. It also leads to vessels on the oceans without secure cargo with the potential for marine environmental pollution.

9.3 This is further exacerbated by the introduction of automatic and semi-automatic twistlocks that are not compatible with existing ‘short head’ lashing bars used with manual twistlocks. The bars can unlock a twistlock, as they are positioned for lashing and the bars themselves are under considerable outward tension, forcibly ejecting them when slackened or disturbed during unlashing.

- *Lashing and securing gear on any vessel must be uniform and compatible*

10. Outboard Lashing Stations

10.1 Containers stowed over the well deck are secured by deck fittings and lashings attached to the top of a steel post structure, often an extension of the bulwark or gunwale.

10.2 However, in most cases this post only performs that function with little consideration as to how workers will access it. On large container vessels a fall from this post has the potential for a person to fall over the side into the sea or onto the quayside. The latter may involve heights of up to 22 metres into the sea, or 15 metres to the quayside.

Figure 11

Figure 12

Figures 11and 12 - Before: stevedores and crew standing on the gunwale to lash containers.

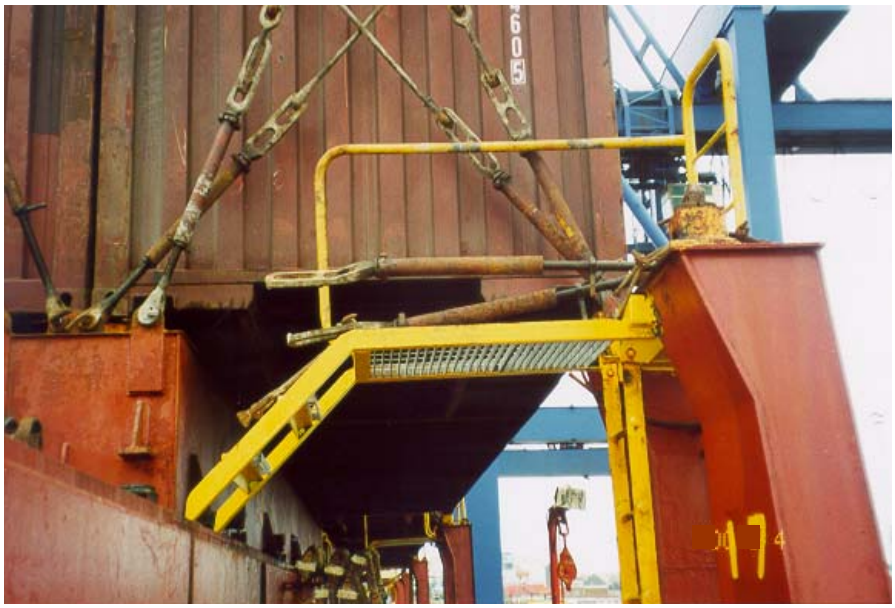

Figure 13

After the construction of a lashing platform and access ladder, to allow safe access. This particular platform is collapsible to allow the removal of hatch covers.

Figure 14

Figure 15

- *Figures 14 before and 15 after the construction of well deck platforms or bridges from the hatch coaming to the gunwale. Where a risk of falling exists either into the well deck or overboard, collapsible safety rails should be considered.*

- *These platforms can be constructed so that they are portable (see figure 17). Some vessels may only have one per well deck, but they must be of a design that enables ease of movement and handling, regardless of in–situ containers*

10.3 Vessels that have their own above deck gantry offer a particular problem, as the rails on the well deck coamings prevent the construction of permanent well deck platforms.

- *These rails may in some circumstances be utilised to provide a method of transferring a portable access gantry along the vessel.(See Fig 16)*

Figure 16

A portable well deck platform (this particular example utilises the ships' gantry rail running along the hatch coaming)

11. Lashing Platforms - Design Recommendations

11.1 The following criteria for the design of lashing platforms are proposed as adequate to allow lashing operations to be carried out safely, based on practical experience

- *Where outboard stations are level with the hatch covers or coamings and the height does not exceed two metres, removable flat sections of steel grating can be used to bridge the well deck. However, as with all lashing platforms, they should be wide enough to perform the task and the width will depend on whether one, two or three high lashings are required*

- *Permanent platforms should ideally be 1 m wide, but they should never be less than 750mm wide. Likewise, platforms provided at outboard lashing stanchions should not be less than 750mm X 750mm*

- *Where practical, permanent platforms should be provided with toe boards (or kick plates) around the sides of at least 100mm high*

- *Portable or removable lashing platforms should ideally be 750mm wide, but no less than 500mm wide and sufficiently strengthened to prevent springing or warping*

12. Safety Barriers/Handrails- Design Recommendations

12.1 The following criteria for the design of safety barriers and hand rails are proposed as adequate to allow lashing operations to be carried out safely, based on practical experience and ISO, BS and EN standards for similar shore-side constructions.

- *Where platforms are above 2 metres high they must have safety barriers. Collapsible posts and ropes are acceptable if correctly raised and tensioned before lashing operations*

- *The presence of safety rails is essential to prevent falls*

- *The top rail of safety barriers should be 1.1 metre high from the base, with an intermediate rail at 0.5 metres*

- *Ideally, safety barriers and handrails should be highlighted with a different colour (white, yellow or orange), to the background (See Fig. 17)*

Figure 17
Good example of a safety barrier, please note that the bridging platform that slots into the outboard platform is not shown

Sockets for removable handrails

Figure 18

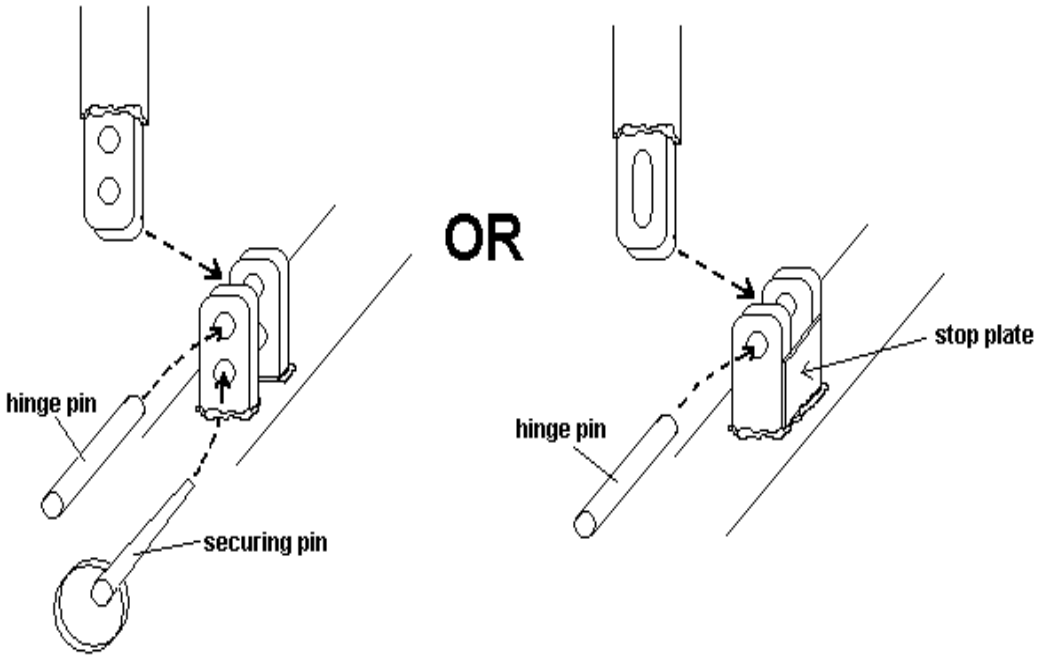

Figure 19

- *Figure19 show two methods of constructing collapsible safety rails. The first on the left is a simple hinged bar with a securing pin. The other relies*

on an elongated slot in the bar and a stop plate to allow the bars to drop into place. To collapse the bar it must be lifted then folded away from the platform or gunwale.

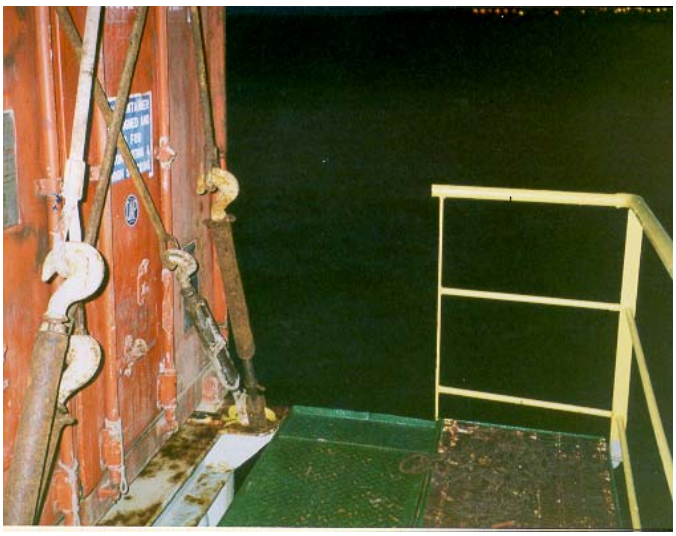

Figure 20
Typical gap in safety barrier

12.2 Openings in safety barriers are necessary to allow some tolerance during container movements, particularly with derricking cranes. (*See Fig 20*) However, such openings are hazardous for the stevedore as this is precisely where the lashing and turnbuckle handling takes place.

- *In this location a drop down bar would enhance safety and should be considered. Some designs also incorporate hinged hanging framework that forms the intermediate protection*

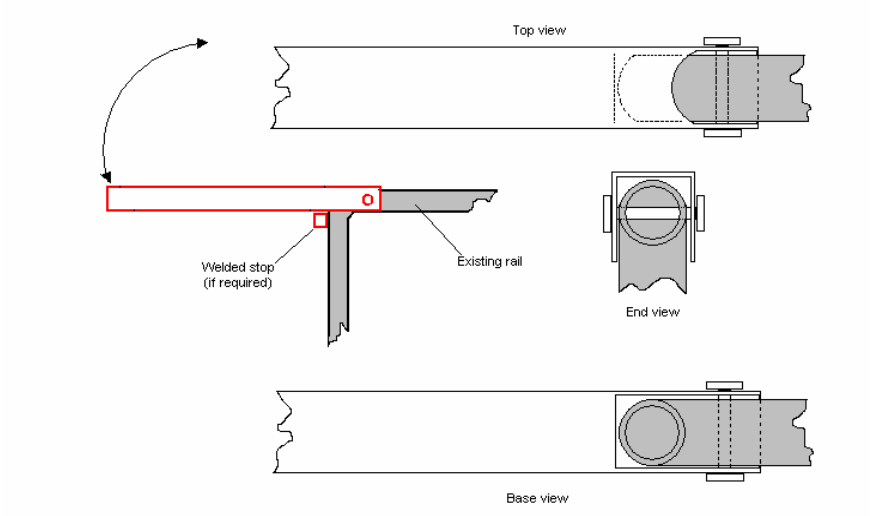

Figure 21

13. Access between Containers on Deck

13.1 Narrow access between hatches (*see Fig 22*) can be worked but it is slow and every lashing will have to be removed on the way in and replaced on the way out. Three high lashings are not possible in these confines.

13.2 Lashing bars weigh up to 21kg and turnbuckles up to 17kg and this confined space greatly increases the risk of muscular-skeletal injuries.

13.3 As well as being dangerous, this situation will lead to delays because of the extra time taken to un-lash and re-lash ROB containers, to allow access to stacks

- *Access between lashings should ideally be at least 1 metre but no less than 500mm*

Figure 23
Insufficient access in between container lashings (gap shown is only 200mm)

PART C – BUSINESS CASE

14. Introduction

14.1 Many years experience of dealing with workplace access problems on board container ships have demonstrated that any delay at the ship and quay interface can promulgate a considerable negative financial impact for not only the vessel operator, but the terminal operator also.

15. Operational Delays

15.1 Delays in stevedoring operations through shipboard problems can occur for the following reasons -

- *No access (or unsafe access) to lashing stations, outboard lashing posts in particular*
- *No workspace (or unsafe workspace) at lashing stations and again, outboards in particular, that offer no fall protection*
- *No access (or unsafe access) to the tops of hatch coamings and the hatch cover ends*
- *No workspace (or unsafe workspace) at the tops of hatch coamings and hatch cover edges*
- *Hatch cover edges too narrow and/or exceed 2 metres in height from well decks, without fall protection*
- *Intermixture of varying types of lashing gear*
- *Intermixture of varying types of twistlocks. This can be particularly confusing either with semi-automatics or mixtures of right and left closing twistlocks .Damage to both vessel and cargo can results from mixing twistlocks*
- *Poorly maintained and sub-standard lashing equipment*
- *Insufficient quantity of lashing equipment for the number of containers loaded*
- *45' containers as 'on deck' stows and 9'6" stacked more than one in a vertical stack, without access platforms*

15.2 It is safe to say that any one of these has the potential to cause delays of between one and two hours per port visit.

15.3 In the event of a serious accident on board ship, delays of three to four hours are not uncommon. Where fatalities have occurred and enforcement agencies are involved, vessels have been "impounded" for three to four days.

16. Financial Implications – Terminal Operators

16.1 Box rates-where terminal operators have refused to work a vessel, or a specific area of a vessel for safety reasons, shipping lines are frequently asking for reduced container handling rates, particularly where the crew has to be reimbursed to perform extra lashing and unlashing duties. In the past some shipping lines have asked for an $8 (£5) reduction per box.

16.2 Productivity Clauses - the majority of large shipping lines operate to a rigid schedule and therefore set a contractual box rate for each of their ships, with terminal operators. Should a port or terminal operator fail to meet the target rate or the sailing times because of delays, this can result in contractual 'fines' and can be up to $1,000 (£600).

16.3 Wait for Berth Penalty Charges - on arrival at port pre-entry anchorage, vessels expect to be berthed and serviced within an acceptable time frame. As with productivity clauses, many shipping companies insist on contractual berthing arrangements with penalty clauses for failure to berth within a specified time. This can be a matter of merely a few hours for larger shipping companies on tight schedules.

16.4 Where a vessel is alongside and delays occur due to slow stevedoring operations, or cessation of operations because of safe access or lashing equipment problems, delays occurring to waiting vessels can cost a terminal operator up to $500 (£300) per hour.

16.5 This may have a domino effect on vessel berthing schedules and take several days to recover.

17. Financial Considerations -Vessel Operators

17.1 The following cost estimations are based on a 5,500 to 6,000 TEU vessel and the information has been obtained from various sources including Port of Rotterdam, Container International and Port of Felixstowe.

17.2. Harbour (Port) Dues are approximately $45,000 (£28,000) per visit. This includes all taxes, pilots, towing and mooring, but stevedoring costs are not included.

17.3 In total it is estimated that each container costs $144 (£90) based on 500 containers.

17.4 **Charter** Rates-this can be looked at in various ways but is generally around $5,000 (£3,000) per day, excluding manning, insurance and maintenance. However, to obtain a better appreciation of costs, a ten year charter arrangement would cost approximately $27,000 (£17,000) per day, <u>including</u> manning, insurance and maintenance**.**

17.5 Fuel costs must be added and this equates to around $23,000 (£14,000) per day.

17.6 Given the above figures it is evident that vessel operators can ill afford to have vessels berthed alongside and sitting idle, due to delays aforementioned in this document.

17.7 Considering harbour rates, charter and fuel costs and the fact that delays are often one to two hours, these idle periods are costing a vessel operator around $4,000 (£2,500) per hour.

18. Conclusions

18.1 After considering all the above factors the following conclusions can be reached

- *Clearly delays at the quay and ship interface have a negative financial influence to all concerned*
- *Any improvement in lashing access and equipment is not only a moral responsibility to reduce injury accidents, but sound risk management in financial terms*
- *Society in general is becoming increasingly intolerant of organisations that do not attempt to manage safety risks and who appear to place profit before moral responsibility*
- *In truth, failure to provide a safe workplace and adequate safe equipment has the opposite effect and seriously risks potential profit*

18.2 In an attempt to illustrate these risks the following scenario is offered -

- *a 45 year old dock worker (longshoreman) falls from an unprotected lashing platform, 3 metres to the well deck. It appears he was trying to release a poorly maintained and corroded turnbuckle*
- *the worker suffered serious injuries and now has a permanent limp and is likely to rely on walking aids for the remainder of his life*
- *depending on the circumstances of the accident the dock workers employer, the ship-owner, the ship operator or its officers may be jointly or separately criminally liable. In this case action by Government Enforcement Agencies has the potential for fines and imprisonment, with the accompanying expenses and legal costs, fines for health and safety offences in some countries are unlimited*
- *emergency services and accident investigators attended this incident, delays were around four to five hours whilst the accident was thoroughly investigated*
- *Based on aforementioned costs, this delay has already cost approximately $20,000 (£12,000) for the vessel operator*

- *The injured party will of course seek compensation through civil proceedings and based on current litigation costs, including legal fees @ 20% and the fact that in this illustration the injured man had 20 years of potential earnings, the compensation claim and legal costs is likely to be anything from $600,000 (£375,000) to $970,000 (£600,000) on top of fines*

- *In the worst case scenario, individuals guilty of health and safety offences can be imprisoned for a maximum of two years (depending upon national legislation)*

18.3 This accident cost analysis is by no means out of the ordinary, similar accidents on board are commonplace, although the outcome may vary considerably.

19. Summary

19.1 This section of this document devoted to container ships is best summarised by the following statistics from 250 vessel assessments at a large container port in the UK

- *approximately 6% of those container ships had unprotected work stations above 2 metres*

- *16% had unprotected outboard lashing stations with a fall potential in excess of 20 metres*

- *30% of those container ships had defective, inadequate or incompatible lashing or securing equipment*

19.2 Given these statistics the risk in human and financial terms is very real. Such accidents not only initiate bad public relations, negative media publicity and the risk of a criminal record for individuals, but also vessel operators in the scenario above would be facing potential insured costs of around $980,000 (£608,000) and uninsured losses of around $400,000 (£250,000).

19.3 Many shipping operators claim that due to a very competitive market they cannot afford the required modifications to improve access arrangements, in truth it is a question of can you afford not to?

NOTE: Currency quoted is US dollars and (UK pounds)

ANNEX A

ILO Convention 152 has been ratified by the following 25 countries:

Brazil
Congo
Cuba*
Cyprus
Denmark*
Ecuador
Egypt
Finland*
France*
Germany
Guinea
Iraq
Italy
Jamaica
Lebanon
Mexico*
Netherlands*
Norway*
Peru*
Russian Federation
Seychelles
Spain*
Sweden*
United Republic of Tanzania*
Turkey

The earlier ILO Convention 32 was ratified by 45 countries, *11 of which are included in the above list of countries that have ratified ILO Convention 152.