



INTERNATIONAL SAFETY PANEL

SAFETY BRIEFING PAMPHLET SERIES #17

Linkspans and Walkways

by

Richard Marks

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This pamphlet is published in association with **Haskoning UK Ltd** an operating company of Royal Haskoning. Royal Haskoning is an independent, worldwide consultancy firm with a history that dates back to 1881 in the Netherlands. The experience of the company in shore ramps dates back to 1963 when they planned and engineered the first Ro-Ro terminal at Felixstowe, UK. Since then the company has been responsible for more than 80 shore ramp and Ro-Ro terminal projects and 20 ship-to-shore passenger walkways worldwide.

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SHORE RAMPS AND WALKWAYS

1. Introduction

1.1 General

1.1.1 Shore ramps and passenger walkways provide access between a Ro-Ro ship or ferry and the shore marshalling area or passenger building. These items of port equipment are used by both the public and port employees and have to be safe in use and to operate and maintain. Passenger walkways are also used to provide access to cruise ships

1.1.2 This briefing pamphlet is intended to provide an introduction to the types of safety issues that arise from the operation and maintenance of shore ramps and walkways and to give guidance on good practice for buying, operating and maintaining these facilities.

1.2 Definitions

1.2.1 A shore ramp provides a connection between the vehicle marshalling areas on the shore and the Ro-Ro ship or ferry. The ship end of the shore ramp needs to accommodate movements of the ship caused by tidal variations, changes in the ship's draft and trim caused by the loading and unloading of cargo and movements of ballast, pitching and heaving motions of the ship under wave loads and sway and rolling motions of the ship under wind loads.

1.2.2 Ship to shore passenger walkways connect the passenger terminal building to the ferry. The ship end of the passenger walkway needs to accommodate similar movements from the ship but is also affected to a greater extent by wind and wave loads on the ship causing sway, heave and ranging motions.

1.2.3 Tidal variations can either be accommodated by powered movement of the shore ramp or walkway or by supporting the shore ramp or passenger walkway on a buoyant pontoon or float.

1.3 Shore Ramps

1.3.1 Unlike many other items of port equipment (which can be duplicated or easily replaced), shore ramps are absolutely critical to the operation of a Ro-Ro or ferry terminal because if the shore ramp is out of use for any reason, the berth is not able to handle Ro-Ro cargo. It is therefore important that shore ramps are both safe and reliable in use.

1.3.2 The majority of shore ramps support the ship ramp and finger flaps that form the final connection to the ship. Some of the ship motions are accommodated in the shorter ship ramp. However, there are some ships, and in particular the upper deck of Ro-Ro ships, which have no ship ramp and where finger flaps hinged onto the end of the shore ramp form this link.

1.3.3 Some types of ship ramp do not have finger flaps and in these cases the ship ramp is supported on a recessed or 'well' deck in the ship end of the shore ramp, which is provided with finger flaps that are lowered onto the ship ramp to form a smooth transition.

1.3.4 The landward end of the shore ramp is hinged and is normally provided with

short transition flaps to accommodate the movement of the ramp relative to the shore abutment.

1.3.5 It is important that each of these connections and changes in gradient provide a smooth transition for vehicles crossing the shore ramp. This is usually achieved by shaping the shore ramp at these changes in gradient to form a smooth vertical transition.

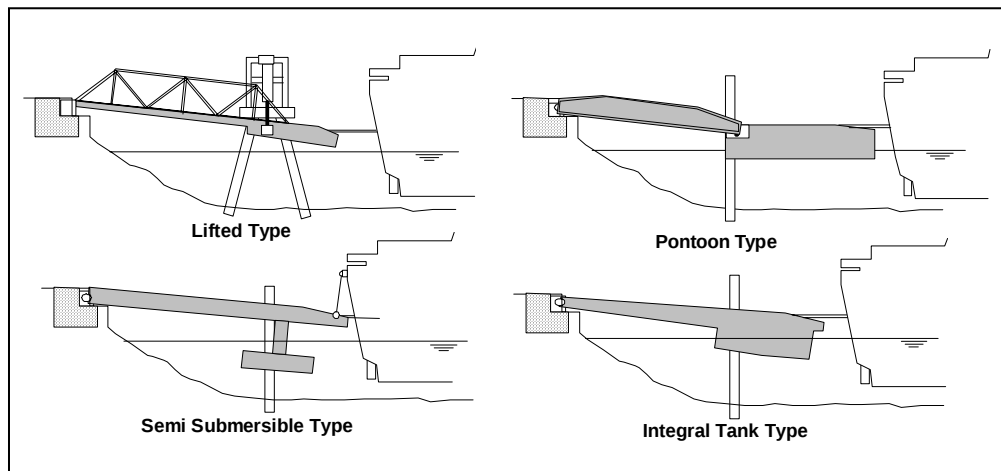
1.3.6 There are two main types of shore ramp:

- the lifted type
- the floating type.

1.3.7 The lifted shore ramp is the most common type and the lifting equipment is usually either rope winch hoists or hydraulic cylinders. Some shore ramps have combined the two types of lifting systems. One shore ramp is known to have a 'rack and pinion' lifting system.

1.3.8 There are three main types of floating shore ramp:

- Pontoon type consists of a pontoon with moorings or restraints and a link bridge to span the gap between the pontoon and the shore.
- Semi-submersible type, where a float supports the weight of the shore ramp. Additional support has to be provided by the ship to support the seaward end of the shore ramp under vehicle and other loads. These are known as 'linkspans' and this term has been applied generically to all shore ramps.
- Integral tank type where a large tank is attached rigidly to the link bridge and hinged at the shore.



1.3.9 All types of floating shore ramp require some adjustment of the freeboard of the ship end of the facility to suit variations in the ships vehicle door threshold height. These adjustments can be made either by ballasting with water or semi-permanent ballast (such as sand or steel ingots) or by mechanically operated flaps.

1.4 Ship-to-Shore Passenger Walkways

1.4.1 Passenger walkways are very different from shore ramps and normally have to accommodate movements of the ship more precisely because of the risk to

pedestrian traffic.

1.4.2 There are two main walkway configurations:

End loading onto the stern or bow of the ferry. This configuration is often used with a combined shore ramp and walkway.

Side loading into a door in the hull of the ship or onto an open deck.



Examples of End Loading Passenger Walkways



Examples of Side Loading Passenger Walkways

1.4.3 Side loading walkways usually have to accommodate significant variations in the level and location of the passenger access point along the ship. This requires passenger walkways to cater for a wide range of both vertical and horizontal movements.

1.4.4 There are many different types of side loading passenger walkway but they mainly divide into three configurations:

- A telescopic bridge that is hinged both horizontally and vertically at the passenger terminal building or fixed walkway end and supported on a rail-mounted hoist carriage on the quayside or jetty adjacent to the ferry.
- A motorised hoist carriage at the ship end with a gangway to connect to the ship and a hinged link to a slave carriage that connects to the building or fixed walkway.
- A mechanically lifted boarding pod with a hinged link to the building or fixed walkway and a traversing drawbridge gangway to the ship.

1.4.5 There is no standard connection between the ship and the passenger walkway. This is a key safety element, as the connection needs to allow for rapid movements of the ship mainly due to wind loads.

1.4.6 Side loading walkways are either hooked directly to the coaming on the ship or rest on the coaming. Alternatively the walkway rests on a bar or pin attached to the hull of the ship outside the doorway or access point.

1.4.7 End loading walkways usually rest on the stern or bow deck of the ship.

- 1.4.8 It is essential that the transition between the ship and the end of the walkway is safe for pedestrian use even when the ship moves under wind, wave or rolling cargo loading.
- 1.4.9 The location of the passenger terminal building and the configuration of the berth usually determine whether the walkway is end or side loading. Where the ship is secured at the linkspan by 'nesting' fenders an end loading configuration is preferred (typically at Dover, Calais, Dunkerque and Stena HSS berths). The open deck and restrained movement of the ship make the connection simpler. However most passenger ferries and cruise ships have their passenger reception areas and access points close to midships and therefore side loading walkways are preferred.

2 Typical Incidents

2.1 Introduction

- 2.1.1 Like any other item of port equipment, shore ramps and passenger walkways suffer from mechanical failures, structural failures, control system failures, wave damage and ship impact, and a few suffer from inherent design faults.
- 2.1.2 Shore ramps and walkways are used by the public, port employees and ships crew and must be safe. Indeed research shows that they generally are safe. However there have been a number of incidents of damage and failure over the years that have led to concerns within the industry about some features of these facilities. In particular the collapse of the passenger walkway at Ramsgate in 1994 caused the port industry in the UK to review the safety of shore ramps and walkways.

2.2 Ramsgate Collapse

- 2.2.1 The walkway at Ramsgate was part of a combined pontoon type facility. The pontoon and link bridge formed the lower deck of the shore ramp. An upper deck was provided supported on the pontoon with an upper link bridge and the walkway consisted of a hinged link together with a walkway again supported on the pontoon with a hinged drawbridge onto the stern of the ship.
- 2.2.2 The hinged link collapsed killing six passengers. The primary cause of the collapse was the failure of the hinged link bearings, which were found to be both under-designed and with poor welding.
- 2.2.3 In addition the investigation showed that there was no clear project management of the installation of the walkway, which was provided as a modification to the original pontoon type double-deck shore ramp. It was identified that the lines of communication in the supply chain were unclear and that the programme for the installation was very short.
- 2.2.4 Revisions to the configuration of the walkway were introduced during the course of supply and there were fabrication mistakes that added to installation problems on site. There also appears to have been a lack of checking and review of the design.

2.3 Other Incidents

- 2.3.1 A survey of ports in North West Europe was carried out in 1998. Ports were invited to return questionnaires giving details of incidents that had occurred to shore ramps and ship to shore passenger walkways. Out of the 125 shore ramps reported, over 50% had suffered some type of major incident. Only limited information was received for the approximately 50 ship-to-shore passenger

walkways reported.

2.3.2 Typical incidents are set out in the following items.

2.3.3 There have been problems with sinking of floating facilities, particularly semi-submersible types, during construction and installation.

2.3.4 A number of shore ramps and ship to shore passenger walkways have been hit by ships, mainly on their approach to the berth, but some on departure from the berth or as a result of the failure of moorings while on the berth. Ship impact can cause considerable damage to the shore ramp or passenger walkway, but in general has not resulted in injury to personnel.

2.3.5 Structural failures of shore ramps and ship to shore passenger walkways have fortunately been rare, although several shore ramps and passenger walkways have suffered problems with bearing seizure or poor functioning.

2.3.6 Mechanical failure again is rare, although there have been one or two failures of linkages within mechanical lifting systems. More recently there has been the failure of a corroded clevis bearing that was not maintained which led to the complete collapse of the linkspan and the breakage of the wire on the counterweight on one side of a winch lifted linkspan leading to partial collapse due to lack of maintenance.

2.3.7 The majority of mechanical failures however have been due to failure of the control system or some leakage in the hydraulic circuit for hydraulically lifted types. Failures of the control system are more common than is desirable but in general these failures cause the shore ramp or ship to shore passenger walkway to cease to function rather than cause any injury. Some of these failures have been caused by inadequate maintenance.

2.3.8 Wave damage to shore ramps is generally limited to the restraint systems of floating shore ramps. However there have been a few problems with wave impact on the underside of mechanically lifted shore ramps that have caused damage to the lifting systems and shore bearings. Some of these wave impacts result from a failure to properly assess the wave climate at the berth prior to design.

2.3.9 There have been a few failures due to fatigue loading of shore ramps, but generally these have not caused the ramp to be out of commission.

2.3.10 There have been failures due to design and these generally have been caused by a failure of the designer to appreciate the rotations and displacements of the structure in the six modes of freedom that can occur. This has led in some cases to insufficient clearances and to the under-design or inappropriate selection of bearings.

2.4 Incident Reduction

2.4.1 The effect of many failures of control systems could be minimised by proper training of operating and maintenance personnel in simulated breakdown situations.

2.4.2 Failures could also be reduced if owners, operators and maintenance organisations co-operated on setting up a system for the collection and monitoring of records of near misses, incidents, accident and failures. This would assist the industry to have a wider understanding of these incidents so that they could be

minimised in future.

3 Buying Shore Ramps and Walkways

3.1 Introduction

3.1.1 This section is aimed at port owners and terminal operators who are planning to purchase a new or second-hand shore ramp or ship to shore passenger walkway. It is not intended as a reference for suppliers and manufacturers of shore ramps or passenger walkways and such suppliers should refer in detail to the appropriate national legislation and in Europe to the Machinery Directives.

3.1.2 In the European Union machinery is defined in the Machinery Directives as “an assembly of linked parts or components, at least one of which moves, with the appropriate actuators, control and power circuits, etc., joined together for a specific application.”

3.1.3 Both shore ramps and ship to shore passenger walkways fall within this definition and are therefore machinery.

3.1.4 Shore ramps and walkways are complex, hybrid assemblies that may involve a mixture of civil engineering foundations and structures, moveable bridge structures, floating structures, lifting equipment, machinery and control systems.

3.1.5 Most mechanically lifted shore ramps and walkways have a substantial element of their costs in the form of mechanical, electrical and control system elements.

3.2 Purchase

3.2.1 Historically many shore ramps and ship to shore passenger walkways have been purchased under construction contracts with construction contractors providing the foundations and with steel structures and machinery usually supplied under specialist sub-contracts. However more recently the equipment and machinery in shore ramps and passenger walkways has become more sophisticated and thought should be given to purchasing from a mechanical equipment supplier using a ‘plant’ contract.

3.2.2 It does not appear that the type of contract or method of purchase had a significant effect on the range of incidents that occur to these items of equipment.

3.2.3 Since both shore ramps and ship to shore passenger walkways involve the construction of foundations and structures the construction of these elements should be covered by national legislation related to the safety of construction works and in Europe by the Construction Sites Directive.

3.2.4 The interpretation of the legislation relating to machinery and construction and the selection of an appropriate form of contract is a specialised business and purchasers should seek professional advice unless sufficient competent advice is available within their own organisation.

3.2.5 When buying a shore ramp or ship to shore passenger walkway it is important that purchasers plan how they intend to use the shore ramp or passenger walkway. Generally most port owners and terminal operators already have procurement procedures for port infrastructure, structures and equipment. However there are a number of key roles in the procurement process that, if fulfilled competently, will

help to ensure safety.

3.2.6 The purchaser is not always the future operator of the shore ramp or passenger walkway and it is essential that the operator is involved in the planning and specification of the equipment.

3.2.7 A number of roles have been defined in order to help ensure that no tasks are omitted between the various parties involved in buying a shore ramp or ship to shore passenger walkway and that the purchaser can then be reasonably certain that all reasonably practicable steps have been taken to ensure the safety of employees and users of the equipment.

3.3 Planning

3.3.1 It is strongly recommended that a "project adviser" is identified or appointed to prepare a "project brief". This project brief will define

- where and how the shore ramp or ship to shore passenger walkway will be used and
- who will use it.
- properties of the classes of ship and traffic that will use the equipment and
- information about the site.
- The experience, skills and likely qualifications of staff that will operate and maintain the equipment.

3.3.2 The project brief is not intended to be a detailed performance specification for the equipment but it is a checklist of information required to properly interpret the buyers' requirements.

3.3.3 Any person appointed to any of these key roles should be knowledgeable and competent in the specialist areas required.

3.3.4 In the case of the "project adviser" they should be knowledgeable and competent about port operational requirements, particularly for Ro-Ro and ferry terminals, and should have a good understanding of the purchase options for both construction and equipment.

3.3.5 The buyer may wish to appoint a "project manager" to draw up the procurement arrangements including any tender enquiry documents and in identifying any risks to health and safety. The project adviser or the "Engineer" could fulfil this role.

3.3.6 The "designer" is usually selected and appointed by the buyer to develop the functional brief for the shore ramp or ship to shore passenger walkway. The designer will carry out the detailed design of the foundations, structure and machinery.

3.3.7 A safety specialist should be appointed. In Europe the "Project Supervisor" is a role defined in the European Construction Sites Directive and is appointed by the buyer before decisions are made that could have health and safety implications for construction, cleaning work, maintenance and demolition. The Project Supervisor should be appointed as soon as possible after the project is confirmed. Outside Europe a safety specialist should be appointed.

3.3.8 The "Engineer" is an appointment usually defined in the particular form of contract

adopted. The Engineer administers the contract on behalf of the buyer. The Engineer is often involved in the inspection and examination of construction work on site and the assembly of the machinery at the factory or workshop and on site.

3.3.9 In order to make sure that the design is both safe and satisfies the performance specification an “independent design assessor” should be appointed to give technical approval for the equipment. The independent design assessor reviews the suitability and adequacy of the technical and performance specifications including any environmental, geo-technical and loading criteria. The assessor will also review risks to health and safety inherent in the design assumptions and solutions.

3.3.10 Research has shown that the vast majority of shore ramps are subject to independent checking but only about half the ship to shore passenger walkways were reported as having an independent check.

3.4 Design

3.4.1 One of the most important items to consider when buying a shore ramp or ship to shore passenger walkway is the contractual and physical interface between the various elements of the facility.

3.4.2 Serious consideration should be given to the contract packages required for the implementation of a Ro-Ro ferry terminal, such that suitably experienced contractors and manufacturers are employed in the installation of the shore ramp or ship to shore passenger walkway.

3.4.3 The national legislation for the design and construction of structures and the manufacture and supply of machinery are usually separate and it is important to ensure that the various elements are in accordance with the appropriate legislation.

3.4.4 Since shore ramps and ship to shore passenger walkways have moving elements it is important that the interfaces between these elements are properly defined.

3.4.5 In particular the interface between the bearings for the lifting system and the structures must be carefully defined. Any hinge or bearing should be supplied complete by a single manufacturer such that all anticipated movements of the interface are accommodated within tolerances that are compatible with the performance of the bearing.

3.4.6 Bearings between the structure and the foundations should also be a single supply item and should be designed to suit a method of installation and allow for all anticipated movements of the equipment particularly for floating shore ramps.

3.4.7 The buyer should preferably purchase all the elements of the shore ramp or ship to shore passenger walkway under a single contract from a suitably experienced contractor. This is in order to ensure that the contractor is responsible for resolving all the above interface problems. This may require separating out packages on a large port terminal project.

3.4.8 The buyer should ensure that suitable and competent suppliers and sub-contractors are incorporated in the tenders from contractors. Contractors should not be allowed to substitute key suppliers and sub-contractors after approval has been given during the normal course of the project.

- 3.4.9 The design of the equipment should provide for adequate safe maintenance access.

3.5 Construction and Installation

- 3.5.1 The mechanical, electrical, structural and control elements of shore ramps and passenger walkways are complicated and should be fully co-ordinated and integrated to produce a safe installation. It is recommended that the purchase contract requires the contractor or supplier of the facility to appoint a competent "systems engineer" to manage the day-to-day design and manufacturing activities for the machinery on behalf of the contractor or supplier.
- 3.5.2 In Europe the contractor and manufacturer are required to provide assessments of risks to health and safety and documentation related to the supply of the machinery. This would also be good practice outside Europe.
- 3.5.3 The buyer should check that the machinery is in fact safe and for this purpose a "project safety auditor" should be identified or appointed. The auditor will need to be sufficiently competent to review all the documentation provided by the contractor and the manufacturer and will then produce a safety audit certificate that would record any unsatisfactory findings of the audit.
- 3.5.4 Under the European Machinery Directive the manufacturer of the machinery must issue a declaration of conformity that includes a description of the machinery, the business name and address of the manufacturer, the standards and technical specifications used and the relevant provisions of the Regulations with which the machinery complies.
- 3.5.5 Under the European Construction Sites Directive the contractor should provide the buyer with a Health and Safety file which will include the Health and Safety Plan for the facility, the design parameters which affect the use and maintenance of the facility, as built drawings, pile records, soils investigations, materials test certificates and a maintenance plan for the structure.
- 3.5.6 As soon as the facility is put into use the employer of the operators becomes responsible for the health and safety of both employees and members of the public using the equipment.
- ### **3.6 Installation and Commissioning**
- 3.6.1 One of the most important periods in the installation of a shore ramp or ship to shore passenger walkway in order to ensure safety in operation is the testing and commissioning period.
- 3.6.2 These operations take place immediately before the equipment is brought into use and there is usually time pressure on these operations.
- 3.6.3 The contract specification should set out the detailed procedures for items to be inspected, tested and commissioned and should provide a programme for the co-ordination of these activities.
- 3.6.4 The recording and handing over of results and measurements should also be covered together with details of notification to interested parties and any third party witnessing required.
- 3.6.5 As part of these operations it is recommended that the lifting equipment be

tested up to its safe working load over the full range of movement to which the lifting equipment could be subjected during the operation of the equipment.

- 3.6.6 Consideration should be given to the dynamic load testing of any slewing or telescoping equipment, mechanically operated flaps and mechanically operated hooks or pins.
- 3.6.7 The extreme geometric movements of the shore ramp or ship to shore passenger walkway should be reproduced in any testing procedure.
- 3.6.8 Before the buyer puts the facility into use adequate and effective training should be provided by the contractor for all personnel involved in the operation and maintenance of the equipment.
- 3.6.9 The technical and safety documentation for the structures and machinery should be handed to the buyer and operator before the equipment is put into use.
- 3.6.10 A maintenance audit should be carried out during the manufacture of the shore ramp or walkway to confirm that hazards have been eliminated and that the draft maintenance instructional manuals are being prepared.
- 3.6.11 This will require co-ordination between the maintenance engineer and the manufacturer.
- 3.6.12 A further maintenance audit should be carried out during the commissioning process in order to identify that the fault reporting system is satisfactory and that access for maintenance is adequate.

4 Operational Practices

4.1 Handover

- 4.1.1 Once the shore ramp or ship to shore passenger walkway is put into use for the first time the responsibility for safety rests with the employer of the operator.
- 4.1.2 In Europe the Use of Work Equipment Directive applies and this requires the owner and operating organisation to carry out an assessment of whether the health and safety risks have been controlled by the manufacturer.
- 4.1.3 This assessment is largely a matter of common sense and observation. However the European Use of Work Equipment Directive provides a list of essential health and safety requirements.
- 4.1.4 In particular the operating organisation should inspect the equipment at hand-over to ensure that there are no exposed or dangerous moving parts, that all the guards are present and in place, that there are no exposed live electrical parts and that the manufacturers' instructions are clear and comprehensive.
- 4.1.5 The port or terminal operator should prepare the operating procedures before taking possession of the equipment. In order to prepare these operating procedures, it will be necessary to have preliminary information from the manufacturer and installation contractor in advance of hand-over.

4.2 Key Issues

- 4.2.1 Shore ramps and ship to shore passenger walkways differ from most other port equipment in that the public uses them.

- 4.2.2 Ship to shore passenger walkways are subject to intermittent movements that can catch people unawares.
- 4.2.3 Particular attention needs to be paid to the guarding or protection of areas where movement can occur to prevent employees and the public from becoming trapped.
- 4.2.4 Some operators do not understand the amount of energy produced by impact with a ship on the structure and the extent of movements that the ship can make alongside the berth (particularly ranging and swaying).

4.3 Operational Roles

- 4.3.1 For each port or terminal operator there are a number of key roles required for operating the terminal.
- 4.3.2 The terminal manager controls all aspects of the shore side of the terminal and is responsible for the operation of the equipment. The terminal manager may be responsible for one or more berthing superintendents.
- 4.3.3 The berthing superintendent organises the mooring of the ship and oversees the operation of the shore ramp or ship to shore passenger walkway. The berthing superintendent controls the mooring gang and manages day-to-day shore ramp and passenger walkway operations.
- 4.3.4 The shore ramp or ship to shore passenger walkway operator is a person specifically trained and authorised to operate a particular shore ramp or passenger walkway.
- 4.3.5 The Harbour Master controls all shipping movements within the harbour. For day-to-day berthing operations these tasks are delegated to duty managers.
- 4.3.6 The port control duty manager issues instructions to the Masters of ships using the port concerning berthing and unberthing procedures. The port control duty manager must have direct contact with the berthing superintendent.
- 4.3.7 These key roles define some essential functions, but at different ports the distribution of tasks will depend on local circumstances.
- 4.3.8 For example the location and frequency of use of the equipment will decide the size of the organisation operating it. A remote shore ramp used infrequently will probably only be managed by one part-time employee. The other functions might have to be carried out by the ship's Master and engineer.
- 4.3.9 Equipment in such locations needs to be designed to be simple to operate under these circumstances.

4.4 Operating Procedures

- 4.4.1 The operating organisation needs to convert the information provided by the manufacturer and contractor into safe operating instructions, standing orders, training procedures and emergency plans.
- 4.4.2 It is suggested that the responsibility for producing the operational risk assessments should lie with the terminal manager. The production of risk

assessments requires a high degree of technical awareness and it may be that the advice of the facility maintenance engineer will also be required.

- 4.4.3 It is important that when preparing risk assessments, the unthinkable should be considered. Scenarios include risks from major structural failure and control system failures. This will allow these risks to be controlled by preventative inspections.
- 4.4.4 Emergency scenarios should also be considered and used to create emergency training exercises. Such emergencies could include failure of one side of the lifting equipment or major twisting of the structure due to failure of levelling control systems.
- 4.4.5 The operators should receive regular training in emergency procedures, as these tend to occur in situations that lead to pressure on the operator.
- 4.4.6 The emergency plan for the equipment needs to be co-ordinated with the overall emergency planning for the terminal or port.
- 4.4.7 The operating instructions and training schemes for the operators are prepared after the preparation of comprehensive risk assessments.
- 4.4.8 It is important that the operator of a shore ramp or ship to shore passenger walkway has sufficient training and knowledge to operate that equipment and that the operator should hold an authorisation from his employer. Proper authorisation may involve periodic medical examination of operators.
- 4.4.9 Every operator of a shore ramp or ship to shore passenger walkway should receive a written authorisation to operate the equipment, which is valid for a defined period of time – say one year.

4.5 Connection and Disconnection

- 4.5.1 Before using a shore ramp or ship to shore passenger walkway, a pre-use routine inspection should be carried out, preferably by the operator. This inspection should include checking for obstructions and should ensure that the area is clear of unauthorised persons.
- 4.5.2 The operator should witness the ship berthing and record any unusual incidents particular ship impact with the structure. However the location of the operator should be safe and away from any area likely to be damaged by such impact.
- 4.5.3 Before connecting the ship ramp or ship to shore passenger walkway to the ship, it is necessary that the ship should be safely moored and that authorisation is received from the berth superintendent or port control duty manager to operate finger flaps, mooring eyes or connecting hooks.
- 4.5.4 When the connection is safely made to the ship, then barriers, gates or traffic lights can be operated to allow unloading of the ship. The operator should then observe the interfaces and adjust the position of the shore ramp or walkway to maintain safe transitions.
- 4.5.5 At the end of the operation, the barrier, gates and stoplights are operated and preparations are made for disconnecting from the ship.

- 4.5.6 Once permission is given to disconnect the operator should disconnect the equipment and report this fact to the port control duty manager.
- 4.5.7 The operator must then witness the ship unberthing and record any further unusual incidents.
- 4.5.8 The operator will then move the equipment to the parked position, secure it and turn off the power.
- 4.5.9 Finally, the operator should complete a daily log for the shore ramp or walkway, recording the facts of the operations and giving information about any unusual events. Any activities carried out during the shift and any problems with the performance of the machinery should also be recorded.

4.6 Safe Access

- 4.6.1 Operators should be provided with a safe means of access to control stations and to any safety critical parts that need to be inspected before the equipment can be started up.
- 4.6.2 Because the public have access it is important to prevent unauthorised and inappropriate access to moving or dangerous parts.
- 4.6.3 Safe access should also be provided to all places to which access is necessary for routine maintenance purposes.

4.7 Operating Documents

- 4.7.1 Operating manuals should be available to the operator in their own language. The manufacturer should provide operating manuals.
- 4.7.2 Operating manuals should cover the safe start-up, running and closedown of all systems and they should be written specifically for that particular equipment.
- 4.7.3 It is important that essential instructions covering safety critical items for a particular shore ramp or ship to shore passenger walkway should be issued in the form of clear work instructions.
- 4.7.4 These work instructions can cover particular operational procedures such a connection and disconnection to the ship. There may also be a specific work instruction covering procedures for closing down and making secure the equipment.
- 4.7.5 Standing orders may also be required to set out any limiting operating conditions for the shore ramp or ship to shore passenger walkway including limiting wind or sea conditions for berthing or for the operation of the equipment.
- 4.7.6 Incident report forms should be provided for the operator to complete in the event of a breakdown, failure, damage or other unusual occurrence.
- 4.7.7 Daily logs and incident reports should be reviewed by the terminal manager and acted upon.

4.8 Inspections

- 4.8.1 Any lifting equipment, machinery or structures that have been involved in an

accident or dangerous occurrence must be examined before being put back into use.

- 4.8.2 Persons that are competent to carry out such an inspection should carry out this examination.

5 Maintenance Systems

5.1 Maintenance Procedures

- 5.1.1 Shore ramps and ship to shore passenger walkways operate in a marine environment and have relatively arduous working conditions with multiple start-ups and relatively low levels of maintenance.
- 5.1.2 Shore ramps in particular are a critical item of port equipment for a RoRo or ferry terminal. Therefore consideration should be given to providing secondary or back up equipment and control systems.
- 5.1.3 It is essential that maintenance work on shore ramps and ship to shore passenger walkways can be carried out safely. The ability to maintain the equipment safely is dependent on the adequate provision of access stairs, ladders and catwalks.
- 5.1.4 Items that need frequent maintenance should be sited in places that are easy to reach and are not potentially hazardous (such as confined spaces).
- 5.1.5 Maintenance personnel should be properly trained. Specifically prepared training courses and capability assessments are vital for specialist maintenance personnel.
- 5.1.6 Maintenance personnel should have general practical experience and specific specialist training in particular maintenance tasks.
- 5.1.7 The initial training should relate to the maintenance of shore ramps and ship to shore passenger walkways and periodic refresher training should be provided.
- 5.1.8 Maintenance contractors that are normally commissioned on a 'term' contract basis maintain many ramps and walkways. The personnel provided by maintenance contractors should be properly trained and competent. In order to ensure that the maintenance contractor invests in a proper system, the term contract should be for a reasonable period and have a mechanism for periodically assessing performance.
- 5.1.9 Maintenance personnel for shore ramps and walkways should be retained on a long-term basis.
- 5.1.10 In Europe the requirements of the Use of Work Equipment Directive apply to maintenance. This requires equipment to be maintained in efficient working order and good repair and that a maintenance log is kept up to date.
- 5.1.11 The Directive also requires that maintenance operations can be carried out in such a way that the maintenance personnel are protected from risk.
- 5.1.12 It is strongly recommended that those responsible for planning and implementing the future maintenance work on the facility be involved in the creation of the project brief and in the technical specification of the maintenance

requirements for the facility.

5.1.13 There are a number of different approaches to maintenance management including:

- breakdown maintenance
- planned preventive maintenance
- planned condition-based maintenance
- planned modification
- periodic surveys.

5.1.14 The frequency of replacements and adjustments will be determined by risk assessments and the experience of breakdowns, or would be specified by the manufacturer.

5.1.15 Under planned preventive maintenance systems, faults and failures that have been reported but do not require immediate maintenance are scheduled for inclusion in later planned maintenance work schemes.

5.1.16 Where faults or failures present an immediate risk and require immediate remedial action they should be rectified straight away.

5.1.17 If, as a result of monitoring breakdowns and the planned preventive maintenance scheme, items are shown to be wearing or unreliable then modifications should be planned to upgrade the items concerned.

5.1.18 A number of equipment manufacturers now offer remote monitoring systems with data being collected from sensors on the critical components and transmitted via a plc and the internet to the manufacturers monitoring servers. The monitoring can also be carried out by the maintenance organisation.

5.1.19 In particular floating types of shore ramp should be subject to periodic surveys of the buoyant structures usually at a maximum of five yearly intervals.

5.1.20 The frequency of such periodic surveys depend on whether or not the floating facility is in 'Class' or what period is stated by the supplier.

5.1.21 Inspection and testing may be required if there is a change of use of the installation or modifications are carried out.

5.2 Maintenance Documents

5.2.1 The best-planned maintenance systems utilise maintenance logs that are fed into a database together with information from daily logs. This database is used to create work instructions for maintenance and to identify regularly occurring faults. This identification can then be used to plan modifications or replacement.

5.2.2 Before carrying out repairs, adjustments or examinations, a safe system of work must be established and documented.

5.2.3 The primary purpose of the safe system of work is to prevent the shore ramp or ship to shore passenger walkway machinery from being activated in such a manner as to put personnel at risk.

- 5.2.4 A widely used technique is a documented permit-to-work system, which is an effective way of creating a safe system of working.
- 5.2.5 Such permit-to-work systems should identify a nominated person to isolate the power supply and the means of access to any unsafe areas.
- 5.2.6 This nominated person will then issue a permit-to-work to the individual who is going to carry out the maintenance.
- 5.2.7 On completion of the work, the permit-to-work holder signs that all personnel have left the shore ramp or passenger walkway, all systems have been reinstated and that any relevant tests have been successfully completed.
- 5.2.8 The nominated person can then restore power to the equipment.
- 5.2.9 The permit-to-work system should be monitored and integrated into any management systems.
- 5.2.10 Attention should be paid to the schedule of shipping services so that these form part of the permit-to-work system.
- 5.2.11 The port or terminal operator should prepare a maintenance report form for completion by the maintenance personnel when a particular item of maintenance work is carried out. There should be a series of forms that cover the planned maintenance schedule requirements, provide a work specification and result in a maintenance report on completion of the work.
- 5.2.12 Much of this documentation can be included in the maintenance instructional manual supplied by the manufacturer, provided that the maintenance engineer is involved in the preparation of the technical specification

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