

# **Final Report**

## **DEATH OF CREW DANUM 175 AT PASIR PANJANG TERMINAL, SINGAPORE ON 21 DECEMBER 2020**

TIB/MAI/CAS.098

Transport Safety Investigation Bureau  
Ministry of Transport  
Singapore

20 September 2021

## **The Transport Safety Investigation Bureau of Singapore**

*The Transport Safety Investigation Bureau (TSIB) is the air, marine and rail accidents and incidents investigation authority in Singapore. Its mission is to promote transport safety through the conduct of independent investigations into air, marine and rail accidents and incidents.*

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## GLOSSARY OF ABBREVIATIONS

2O	Second Officer
ASD	Able Seafarer Deck
CO	Chief Officer
CP	Cargo Planner
CCTV	Closed-Circuit Television
D175	Danum 175
DART	Disaster Assistance and Rescue Team (SCDF)
ERT	Emergency Rescue Team
LF	Lashing Foreman
LS	Lashing Specialist
PCG	Police Coast Guard
POCC	Port Operations Control Centre
PPE	Personal Protective Equipment
PPT01	Pasir Panjang Terminal 1
SAR	Search and Rescue
SCDF	Singapore Civil Defence Force
SMS	Safety Management System
SOLAS	International Convention for the Safety of Life at Sea
STCW	Standard of Training, Certification and Watchkeeping for Seafarers, 1978
TEUs	Twenty-Foot Equivalent Units

## SYNOPSIS

On the morning of 21 December 2020, in fine weather and good visibility, Danum 175 loaded with 3,222 metric tonnes of general cargoes in 803 TEUs, arrived Singapore and was moored port side alongside to its assigned berth at Pasir Panjang Terminal 1.

On completion of arrival formalities, the Chief Officer was informed by the Lashing Foreman that the shore stevedores would only do the lashing/ unlashings of the inboard containers at bay 18, citing PSA's two-man requirement which could not be achieved due to inadequate space on the pedestal platform to perform the work safely for the containers at the outboard rows. The Chief Officer then arranged for the ship's crew to remove the lashing of containers at the outboard rows.

At about 0300H, two deck crew were assigned for the task, wearing their standard personal protective equipment comprising safety helmet, safety shoes and gloves, and proceeded to bay 18 port side. A few minutes later, one of the deck crew fell overboard while removing the long lashing rod from the 3<sup>rd</sup> tier container at the outboard row. The fallen crew was later retrieved by divers at about 0615H and pronounced dead.

The Transport Safety Investigation Bureau classified the occurrence as Very Serious Marine Casualty and launched a marine safety investigation.

The investigation revealed that although the Company's SMS required the conduct of a Job Safety Analysis and Risk Assessment, there was no documentary evidence to indicate that these had been carried out for the lashing/ unlashings activities prior to the task being allocated to the ship's crew.

The investigation also determined that neither of the crew donned a safety harness (secured with a line taut to strong point) to mitigate the risk of falling overboard or a floatation device to mitigate the risk of drowning, considering the work location to be near the shipside.

## VIEW OF THE SHIP



## DETAILS OF THE SHIP

Name	Danum 175
IMO Number	9248930
Flag	Malaysia
Classification society	Bureau Veritas
Ship type	Cargo ship (Container)
Year Built	22 May 2003
Company/ Operator	Shin Yang Shipping Sdn Bhd <sup>1</sup>
Gross tonnage	14,308
Length overall	154.49m
Breadth	25.00m
Designed Draft	8.985m
Summer Freeboard	5.215m
Main engine(s)	1 Diesel Engine 7S50MC-C MAN B&W Diesel (11,060Kw@127rpm)

Table 1

<sup>1</sup> The Company is the holder of the Document of Compliance for the safe operation of the ship under the International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code).

## 1 FACTUAL INFORMATION

All times used in this report are Singapore Local Time (H) unless otherwise stated. Singapore Local Time is eight hours ahead of Coordinated Universal Time (UTC).

In addition to the information gathered from an on-site assessment, the investigation team gathered information from the ship, the Company and reviewed the CCTV<sup>2</sup> recording obtained from the container terminal.

### 1.1 Sequence of events

1.1.1 On the early morning of 21 December 2020, Danum 175 (D175), loaded with 3,222 metric tonnes (MT) of various types of cargoes in 803 TEUs<sup>3</sup>, arrived Singapore from Kuching, Malaysia<sup>4</sup>. By about 0215H, D175 was moored port side to its assigned berth at Pasir Panjang Terminal 1 (PPT01).

1.1.2 At about 0240H, after the ship's gangway was lowered to the berth, the Cargo Planner (CP) and Lashing Foreman (LF) boarded the ship. The CP went to the ship office for a discussion with the Chief Officer (CO) on the cargo operation while the LF carried out safety checks (as per PSA<sup>5</sup> Singapore terminal requirements) on deck for the cargo working areas.

1.1.3 After the discussion with the CO, the CP left the ship office and disembarked D175. The CO, while still in the office, was then told by the LF, who had returned from the deck after carrying out a safety inspection, that due to some safety concerns the terminal's Lashing Specialist (LS)<sup>6</sup> would not unlash<sup>7</sup> containers at the outboard rows of the bay.

1.1.4 Although the CO was informed by the LF that the lashing/ unlashing in port of Singapore is normally done by shore stevedores, in this case, there was inadequate space on the pedestal platform at bay 18 for two LS to perform the work safely<sup>8</sup>. To this, the LF cited that unlashing at the outboard rows was

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<sup>2</sup> CCTV recording from the shore gantry crane No. QC 104 at the terminal.

<sup>3</sup> TEUs – Twenty-Foot Equivalent Units are used to measure a ship's cargo carrying capacity. The dimensions of one TEU are equal to that of a standard 20ft shipping container of 20ft long x 8ft wide x 8.5ft tall.

<sup>4</sup> 18 Dec 20: Departure Kuching, 19 Dec - 20 Dec 20: At sea, 21 Dec 20: Arrived Singapore.

<sup>5</sup> PSA operates four container terminals with a total of 52 berths at Tanjung Pagar, Keppel, Brani and Pasir Panjang as one seamless and integrated facility.

<sup>6</sup> Referred to as shore stevedores within the report.

<sup>7</sup> Unlashing of containers – to remove the portable lashing arrangement comprising turnbuckles and lashing rods, as well as the unlocking of semi-auto twist-locks.

<sup>8</sup> It is PSA terminal's policy for this task to be carried out by two persons.

dangerous, shore stevedore would not do it and requested ship's crew to do it. The LF also cited PSA's requirement of Safe Working Procedure (Resource Service Department) – Doc LS-SWP-23, "Title: Safe Working Procedure for two-man Lashing/ Unlashing of Containers".

- 1.1.5 In response, the CO mentioned that in other ports in Malaysia, the stevedores carried out the lashing/ unlashing even at the outboard rows without any involvement of the ship's crew.
- 1.1.6 On being asked what would happen if the ship's crew did not carry out the task, the CO recalled the LF saying that it would affect unloading/ loading of cargo<sup>9</sup>.
- 1.1.7 In view that the shore stevedores were not unlashing the outboard rows containers, the CO called the Second Officer (2O) and Bosun to the ship office and informed them to get the ship's crew to assist with the unlashing of containers at the outboard rows. The CO recalled mentioning that the crew should take care of themselves as it was dangerous. Two Able Seafarer Deck (ASD)<sup>10</sup> i.e. ASD-1 and ASD-4, were then assigned to unlash the containers at the outboard rows of bay 18 port and starboard side. Meanwhile, the Bosun continued securing (housekeeping) the forward and aft mooring station and upon completion, intended to join the two ASDs for the unlashing task.
- 1.1.8 At about 0300H, the 2O left the ship's office for the port side gangway. The 2O then relieved the ASD-1 performing the gangway security watch and instructed him together with the ASD-4, to unlash the outboard containers at bay 18. Both the ASD-1 and ASD-4 were wearing their respective personal protective equipment (PPE) which comprised safety helmet, safety shoes and gloves proceeding towards bay 18.
- 1.1.9 A couple of minutes later, the two ASDs arrived at bay 18 port side, see **figure 1** showing the location of the two ASDs.

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<sup>9</sup> When asked by the investigating team about informing the Master, the CO indicated, that thought did not cross his mind as he could handle the situation by assigning the crew accordingly, since the crew had done some lashing/ unlashing in other ports where stevedores were not available.

<sup>10</sup> The ASD-1 was performing the 1200-0400 watch while the ASD-4 was on daywork duties and tasked to assist the watchkeeper during cargo operation.





Figure 1 - Image captured by the terminal crane's CCTV showing the position of the two ASDs at about 0302h.

- 1.1.10 The ASD-1 began loosening the inner turnbuckle of the lashing rod, while the ASD-4 ascended to the pedestal platform to loosen the outer turnbuckle of the lashing rod. See **figure 2** – illustration of the position of the two ASDs.

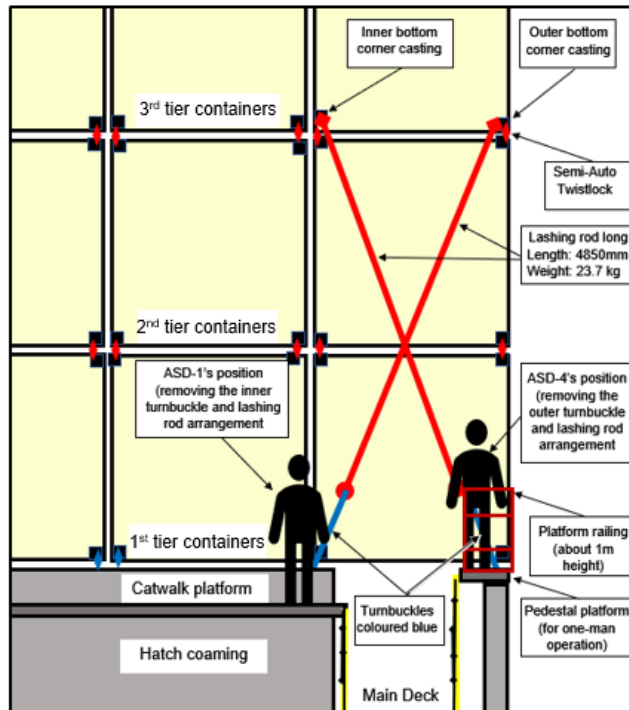


Figure 2 - Illustration showing the positions of the two ASDs as viewed from the forward section of D175.

- 1.1.11 After both turnbuckles had been loosened, the two ASDs removed the lashing rod from the turnbuckle and passed the bottom end of their respective lashing rod to the other (the swivel head, which was the upper end of the lashing rod was still latched at the bottom corner casting of the 3<sup>rd</sup> tier container).
- 1.1.12 On exchanging the lashing rod with ASD-4, the ASD-1 moved further inboard, staying clear of the area (to avoid being hit by the lashing rod handled by the ASD-4 should it fall inboard), while waiting for the ASD-4 to complete the removal of swivel head of his lashing rod.
- 1.1.13 From the CCTV footage it was established that at about 0304H, after exchanging the lashing rod, the ASD-4 could be seen struggling to remove the swivel head from the bottom corner casting of the 3<sup>rd</sup> tier container. In doing so, the ASD-4 was continuously looking upwards and manoeuvring the swivel head to unlatch it from the container bottom casting. According to the ASD-1, it took ASD-4 several<sup>11</sup> minutes before the swivel head was unlatched.
- 1.1.14 The CCTV footage further revealed that at about 0307H, the ASD-4 managed to remove the swivel head of the lashing rod (see **figure 3**).

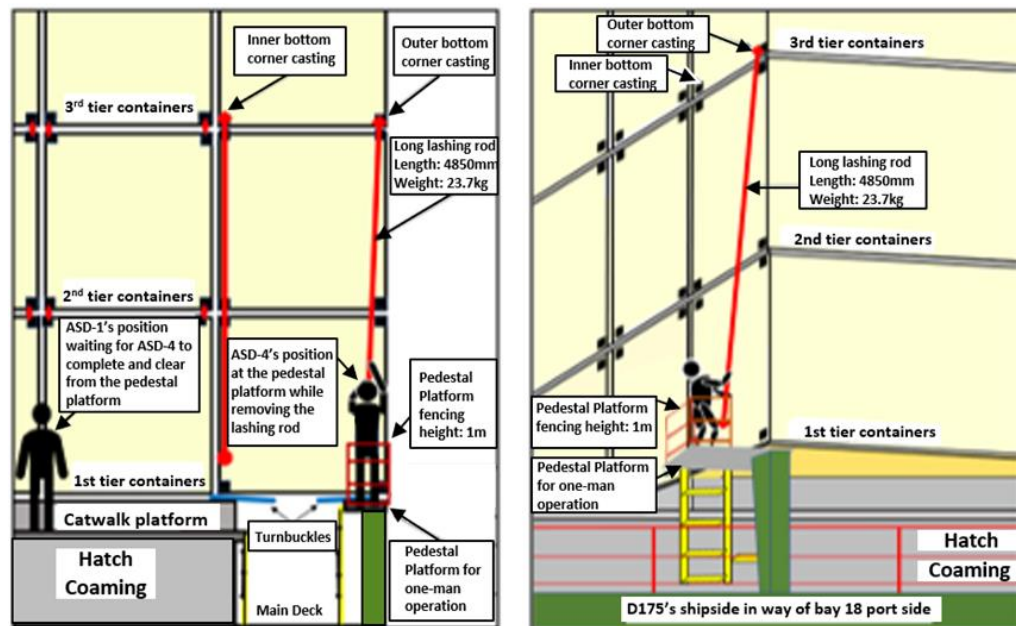


Figure 3 - Illustration showing the removal operation of the lashing rod viewed from different angles.

<sup>11</sup> According to the CCTV footage, this duration lasted about 3-4 minutes.

1.1.15 The ASD-1 recalled that, immediately after the swivel head of the lashing rod had been removed, the ASD-4 was seen lowering the lashing rod. From the CCTV footage it was established that as the rod was removed, it swayed sideways towards the berth, and in a quick succession, the lashing rod gathered a downward momentum (inertia) pulling the ASD-4 (who was still holding the lashing rod) overboard<sup>12</sup>, through the gap between the pedestal platform fencing<sup>13</sup> (railing) and the container. See **figure 4** showing the illustration of the fall.

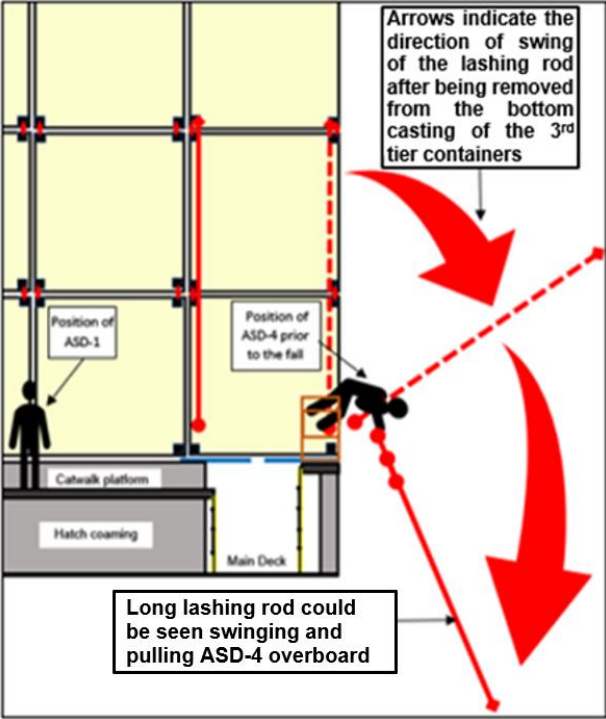


Figure 4 - Illustration showing the ASD-4's falling overboard holding the lashing rod. (Not to scale)

1.1.16 Seeing that the ASD-4 had fallen overboard, the ASD-1 shouted and rushed to the shipside railing and saw the ASD-4 lying motionless on top of the fender briefly before slipping into the sea between the berth and the shipside (see **figure 5**)

<sup>12</sup> Estimated height of the pedestal platform to the berth fender was about 8.5m (based on information provided by PSA).

<sup>13</sup> Fencing (as per the CSS Code) is a generic term for guardrails, safety rails, safety barriers and similar structures that provide protection against the falls of persons.



Figure 5 - Illustration showing the ASD-4's position after falling overboard before slipping into the sea as indicated by the direction of the red arrow (*Not to scale*)

- 1.1.17 The ASD-1 reported the occurrence to the 2O who informed the CO and Master accordingly. At about the same time, the LSs, who were in the vicinity and witnessed the fall, reported the matter to the PSA Terminal. Subsequently, search for the ASD-4 began in the area around the ship and the berth.
- 1.1.18 At about 0350H, the Master informed the Port Operations Control Centre (POCC)<sup>14</sup> that a crew had fallen overboard at PPT01. The POCC immediately deployed<sup>15</sup> a patrol boat, notified the Police Coast Guard (PCG) and Singapore Civil Defence Force (SCDF). By about 0615H, the ASD-4 was retrieved from the water and pronounced dead.
- 1.1.19 According to the ASD-1, the area of operation was sufficiently lit by the shore crane which was ready to discharge containers from bay 18. Due to rain prior (on passage), the area near the pedestal platform was slightly wet.

<sup>14</sup> POCC – Managed by the Maritime and Port Authority of Singapore (MPA), the POCC operates a shore-based Global Maritime Distress and Safety System facility and Maritime Safety Coordination Centre to monitor distress alerts and calls from ships/crafts, and co-ordinate SAR operations (within the port of Singapore and over the South China Sea Search and Rescue Region). It also disseminates Maritime Safety Information through the VHF, NAVTEX and Safety NET systems.

<sup>15</sup> Assets deployed included two MPA patrol craft, One PCG craft (PT27) and one SCDF craft (Red Swordfish).

## 1.2 Information from PSA Terminal

- 1.2.1 There were two LSs (LS-1 and LS-2) unlashng the inboard containers at bay 18 at the time of the occurrence. Around 0310H, the LS-1 witnessed the ASD-4 fell overboard while lowering the lashing rod. The LS-1 rushed to the shipside and saw the ASD-4 lying motionless on top of the fender before slipping into the sea area between the berth and the shipside. The LS-1 immediately reported the occurrence to the LF and ran down to the berth to throw a lifebuoy from the berth into the sea.
- 1.2.2 The LSs recalled seeing the ASD-1 and ASD-4, prior to the occurrence, at the forward section of bay 18 but could not recall whether they donned a safety belt/ harness or a floatation device.
- 1.2.3 The Quay Crane Operator (who was waiting inside the crane cabin for commencement of the discharging operation), witnessed the occurrence and reported to PSA Control Centre. The PSA Terminal's Emergency Response Team (ERT) was dispatched to the scene, arriving PPT01 at about 0320H.
- 1.2.4 At about 0336H, the ERT personnel searched but failed to locate the ASD-4 in the sea area along the berth, called and requested for SCDF to carry out the SAR operations. The Disaster Assistance and Rescue Team (DART) team, comprising divers from the SCDF arrived the scene at about 0415H, and eventually recovered the body of the ASD-4 from the water at about 0615H.

## 1.3 Crew's qualifications, roster and roles

- 1.3.1 There were 18 crew<sup>16</sup> of different nationalities<sup>17</sup> on board D175. All the crew held valid STCW<sup>18</sup> competency certificates and endorsement from the flag Administration, required for their respective positions on board and the working language was English. The qualification and experience of the Master, relevant officers and crew are tabulated in **table 2**:

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<sup>16</sup> STCW requires the crew's function in cargo handling and stowage at the support level to have the knowledge, understanding and proficiency to carry out the work effectively and safely. STCW further requires method for demonstrating competences – assessment of evidence obtained from one or more of the following: 1 - approved in-service experience, 2 – practical training, 3 – examination, 4 – approved training ship experience and 5 – approved simulator training, where appropriate.

<sup>17</sup> Crew nationalities comprised five People's Republic of China (PRC), five Myanmar, five India, one Indonesia and one Malaysia.

<sup>18</sup> The International Convention on Standards of Training, Certification and Watch keeping for Seafarers (or STCW), 1978 sets qualification standards for masters, officers and watch personnel on seagoing merchant ships.

Rank	Nationality	Date Joined D175	Service with Company (Years and Months)	In-Rank experience (Years and Months)	Sailing Experience (Years and Months)
Master	PRC	24 Nov 20	13 Years	18 Years	29 Years
CO	PRC	01 Nov 20	2 Months	8 Months	9 Years
2O	Myanmar	24 Nov 20	1 Month	16 Years	32 Years
Bosun	Indonesia	24 Nov 20	1 Month	5 Years	22 Years
ASD-1	Myanmar	24 Nov 20	1 Year	1 Year	1 Year
ASD-4	India	24 Nov 20	1 Month	1 Month	9 Months

Table 2

- 1.3.2 The Company took over the management of D175 on 24 November 2020. After taking over the management, the deck officers and crew on board D175 had undergone a training<sup>19</sup> for lashing/ unlashings of containers conducted by the Company's Superintendent at the Port of Penang and shore stevedores at the Port of Kuching, Malaysia. The CO had been on board D175 with the previous Company and transferred appointment to the new Company. The crew's individual lashing/ unlashings experience on previous ships was not available for the investigation.
- 1.3.3 The CO informed the investigation team that all the crew involved in lashing/ unlashings activities had also been made aware of the safety procedures and the importance of donning the PPE, since they joined the new Company.
- 1.3.4 The ASD-4 was declared medically fit for service at sea by a medical centre which was approved by the Director General of Malaysia Marine Department, dated 4 November 2020, which was valid for two years, without any medical restrictions and was not under any prescribed medication.
- 1.3.5 According to D175's work/ rest hour records, the ASD-4 had 16 hours of rest on the previous day (20 December 2020). The ASD-4 was a dayworker and was not involved in any bridge watchkeeping duties. As per the bridge logbook,

<sup>19</sup> Training on lashing/ unlashings containers done at Penang on 7 Dec 20 and at Kuching on 16 Dec 20.

- on 20 December 2020 at about 2330H, the dayworkers were called on deck to prepare the pilot ladder. Thereafter, the dayworkers remained on deck until the ship was moored at the berth and were required to assist in preparing the gangway, secure the mooring stations and stand-by to assist the cargo watchkeeper for any cargo operation task.
- 1.3.6 The ASD-4 had a total of 109 hours of rest in the last seven days period from 14 to 20 December 2020, indicating compliance (as documented) with the STCW and MLC Convention's requirements concerning the hours of work and rest.
- 1.4 Autopsy report
- 1.4.1 The investigation team noted the following from the autopsy report by the Health Sciences Authority (HSA) dated 26 December 2020 –
- The ASD-4 was about 175cm tall and weighed about 65kg.
  - Abrasion of size 5cm x 2cm was present on the back of the left elbow and there were no significant external injuries to the skull or the neck.
  - The cause of death determined by the forensic pathologist was drowning.
- 1.5 The ship
- 1.5.1 D175 was built at Peene-Werft GmbH, Germany. The ship's design, construction requirement for structure, subdivision and stability, machinery, and electrical installations were as per SOLAS, 1974, as amended.
- 1.5.2 D175 was a gearless container ship with a standard aft accommodation block and can carry a total of about 1200 TEUs, with 744 TEUs on deck while the remaining 456 TEUs inside the four cargo holds. See **figure 6** showing the port side view of the vessel.

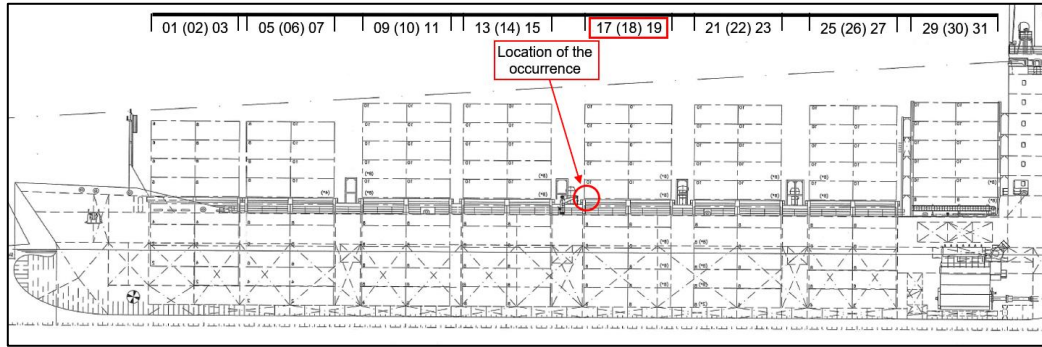


Figure 6 – Port side view of the vessel showing the location of the occurrence circled in red. (Not to scale)

1.5.3 D175 was a dedicated feeder<sup>20</sup> class container ship, serving the following fixed port rotation. The voyage history is in **table 3**.

Port	Arrival	Departure
Penang	7 December 2020	8 December 2020
Port Klang (West)	9 December 2020	12 December 2020
Port Klang (North)	13 December 2020	14 December 2020
Kuching	16 December 2020	18 December 2020
Singapore	21 December 2020	

Table 3

1.6 Company's safety management system (SMS)

1.6.1 A Document of Compliance certificate was issued to the Company by the Surveyor General of Ships, Malaysia on 24 May 2016 based on the verification completed on 23 May 2016 and it was valid until 20 June 2021. The last verification audit for this issuance was carried out on 28 July 2020.

1.6.2 An Interim Safety Management verification was completed, and certificate issued by Bureau Veritas on 26 November 2020 and was valid until 25 May 2021.

<sup>20</sup> Feeder services play an important role as logistics service provider in global shipping because of considerable benefits resulting from an increased port range, elimination of port restrictions, small sized ships with increased service frequency, savings in network cost, and decreased inland traffic and air-pollution.



- 1.6.3 The Company managed a fleet of feeder container ships that call ports where the lashing/ unlashings of containers were carried out by the ship’s crew. According to the CO, the ship’s crew were expected to carry out lashing/ unlashings of containers only at the Ports of Penang and Kuching.
- 1.6.4 According to the Company, during the ship’s call at the Port of Penang, a training for lashing/ unlashings of containers was carried out for the crew by the Company’s representative. During the ship’s call at the Port of Kuching another training was conducted, but this time by engaging shore lashing personnel. In total, three deck officers and nine crew (five deck and four engine) were involved with the training for lashing/ unlashings of containers. For Singapore, neither the crew nor the Company was aware of the PSA’s requirement of “Safe Working Procedure for two-man Lashing/ Unlashings of Containers”.
- 1.6.5 To assist the ship in conducting its shipboard operation safely, the Company provides lists of completed operational Risk Assessment (RA) in the Company’s SMS Section 2.1 which identified falling overboard as one of the hazards with associated mitigating procedures (defences) to reduce the overall risk. See **table 4** showing the Company’s Risk Assessment matrix.

Priority	Hazard	Events	Consequence	Hazard Classification before Preventive/ Mitigation Measures		Mitigation/ Preventive Measures (Measures Planned for Project)	Hazards Classification After Preventive/ Mitigation Measures	
				Consequence <sup>21</sup>	Probability <sup>22</sup>		Consequence	Probability
6	Man overboard	Falling overboard	Lack of training, Lack of PPE Improper Work Procedure – Lack of JSA	1	C	Awareness through Safety Meetings, etc Job Specific Training. Correct use of PPE <sup>23</sup>	3	C

Table 4

<sup>21</sup> Consequence categories to Health/ Safety are, 1-Major impact e.g. Fatalities/ Very serious injury, 2-Moderate impact e.g. Serious injury, 3-Minor impact e.g. Less serious injury and 4-Insignificance impact.

<sup>22</sup> Probability categories are: A-Possibility of repeated incidents, B-Possibility of isolated incidents, C-Possibility of occurring sometime, D-Not likely to occur, E-Practically impossible.

<sup>23</sup> Prior to the occurrence, besides the typical PPEs which comprised safety helmet, safety shoes and gloves, also included a safety belt. A safety belt is a device that is worn around a person’s waist to serve as a direct connection point to a lifeline. It is worn to prevent fall or to arrest a fall. Amend must be made to keep the line taut at all times.

- 1.6.6 In addition, for any event or task that carries certain level of risks and which is not included in the prepared list of operational RAs, the ship's crew<sup>24</sup> are required to carry out a job analysis by completing the Job Safety Analysis (JSA). There was no evidence that a RA, JSA<sup>25</sup> or toolbox meeting<sup>26</sup> related to task of lashing/ unlashng containers had been considered prior to the occurrence. There was also no evidence that a RA or JSA had been done for the two lashing/ unlashng operations carried out by the ship's crew in other ports.
- 1.6.7 The Company's SMS provided guidance as indicated above (see **table 4**) on the correct use of PPE. On being asked, the CO and the 2O indicated that each and every crew had recently been trained and briefed on the importance of personal safety, which included appreciating the challenges and likely hazards associated with performing the tasks of lashing/ unlashng of containers.
- 1.6.8 The Company's SMS indicated that all crew were required to familiarise themselves with the requirements of the SMS within three months of joining. In its interaction with the investigation team, it was established that the crew were still in the process of familiarising themselves with the requirements of the SMS.
- 1.7 Code of Safe Practice for Cargo Stowage and Securing (CSS Code)
- 1.7.1 Annex 14 Section 4.4 of the CSS Code, among others, provides guidance<sup>27</sup> on Training and Familiarisation as follows:
- Personnel engaged in cargo securing operations should be trained in the lashing and unlashng of containers as necessary to carry out their duties in a safe manner. This should include the different types of lashing equipment that are expected to be used.
  - Personnel engaged in cargo securing operations should be trained to develop the knowledge and mental and physical manual handling skills that they require to do their job safely and efficiently, and to develop general safety awareness to recognise and avoid potential dangers.

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<sup>24</sup> Analysed by the CO, reviewed by the Master and approved by the Company.

<sup>25</sup> According to the CO, no JSA was carried out for the unlashng operation in Singapore as the crew had been trained about the safe working procedure for lashing/ unlashng of containers, as such, they were fully aware about the PPEs that they needed to use before starting the operation.

<sup>26</sup> Toolbox meeting is a safety talk involving all the affected crew performing the task before commencing the work.

<sup>27</sup> The Company was not aware of the guidance contained in the CSS Code.

- Personnel should be trained in safe systems of work. Where personnel are involved in working at heights, they should be trained in the use of relevant equipment. Where practical, the use of fall protection equipment should take precedence over fall arrest systems.
- Personnel engaged in containership cargo operations should be familiarised with the ship's unique characteristics and potential hazards arising from such operations necessary to carry out their duties.

## 1.8 Code of Safe Working Practice (COSWP)<sup>28</sup>

1.8.1 As part of the Company's SMS, D175 was provided with a copy<sup>29</sup> of COSWP<sup>30</sup>. The COSWP is a widely used reference publication by the industry for safe working practices on board ships. Its safety practices were encouraged within the Company's fleet of ships. The Code, among others, provides guidance on the protection from falls and drowning (relevant sections of the Code included below) as follows:

### 1.8.1.1 Protection from falls

- (i) All personnel who are working at height (i.e. in any position from where there is a risk of falling) should wear a safety harness (or belt with shock absorber) secured by a lifeline as a protection from falls, and from being washed overboard, or against the ship's structure.
- (ii) In addition, Section 17 of COSWP provides guidance for work at height should be subject to risk assessment, and suitable control measures should be taken to protect those who may be put at risk. Depending on the severity of the risk, a permit to work may be required (e.g. for working aloft).
- (iii) Where work must be carried out at height, the Company must ensure that such work is properly planned, appropriately supervised and carried out in as safe a manner as is reasonably practicable. Planning should include the carrying out of a risk assessment, which may include consideration of potential risks from falling objects or fragile surfaces and planning for

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<sup>28</sup> The COSWP is published by the Maritime and Coastguard Agency (MCA) and endorsed by various agencies such as the National Maritime Occupational Health and Safety Committee, UK Chamber of Shipping, Nautilus International and the National Union of Rail, Maritime and Transport Workers (RMT) as best practice guidance for improving health and safety on board ship. It is intended primarily for merchant seafarers on UK-registered ships.

<sup>29</sup> D175 had on board the latest edition – 2015 edition amendment 4 (October 2019).

<sup>30</sup> Publications to be maintained on board the Company's fleet (SMS List 11.5).

emergency situations.

- (iv) Only competent<sup>31</sup> persons should engage in any activity relating to work at height, or use of equipment for work at height, including the organisation, planning and supervision of such activities. Where seafarers are being trained to undertake such work, they must be supervised by another seafarer who is competent to supervise and undertake that activity.
- (v) Personnel working at a height may not be able to give their full attention to the job and, at the same time, guard themselves against falling. Proper precautions should, therefore, always be taken to ensure personal safety when work has to be done aloft or when working outboard. It must be remembered that the movement of a ship in a seaway and poor weather conditions, even when alongside, will add to the hazards involved in work of this type.
- (vi) Personnel working aloft should always wear a safety harness with a lifeline or other arresting device.

#### 1.8.1.2 Protection against drowning

- (i) Where work is carried out over-side or in an exposed position where there is a reasonably foreseeable risk of falling or being washed overboard, a personal flotation device or a buoyancy aid should be worn.

### 1.9 The pedestal platform

- 1.9.1 The incident occurred at the pedestal platform located at the forward section of bay 18 on the port side. **Figure 7** indicates the approximate dimensions<sup>32</sup> of the platform and its fittings.

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<sup>31</sup> COSWP defined 'Competent person' as someone who has sufficient training and experience or knowledge and other qualities that allow them to carry out the work in hand effectively and safely. The level of competence required will depend on the complexity of the situation and the particular work involved.

<sup>32</sup> Obtained by the investigation team on-site and confirmed by the Company.

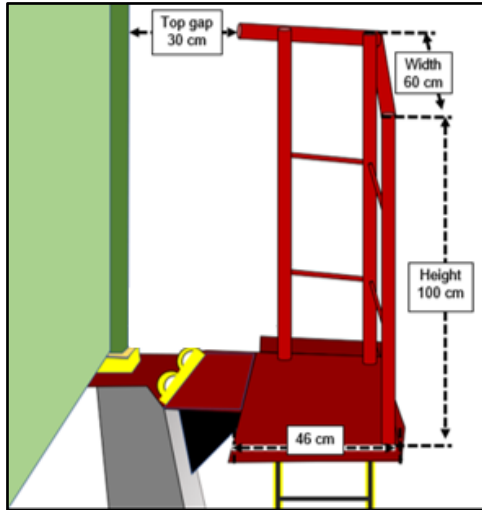


Figure 7 – Illustration showing the dimensions of the pedestal platform and its fencing at bay 18 port side (*Not to scale*)

1.9.2 The Company confirmed that since taking over the safe management of the ship<sup>33</sup>, there were no records of modification to the design or damage to the pedestal platform or its fencing.

1.10 Cargo securing devices

1.10.1 D175's portable lashing arrangement for the containers at the 3<sup>rd</sup> tier, besides the semi-auto twist-lock, include the following:

1.10.1.1 Long lashing rods

1.10.1.1.1 Lashing rods, made of hot treatable steel with hot dip galvanised finish, are devices used in combination with turnbuckles, to lash the cargo containers on deck. The swivel head is made to fit into the end of the container corner casting. The other end is attached to the appropriate turnbuckle (secured to the welded ship lashing plate). The type used on board D175 was of the 'knob and swivel head type' lashing rod which was used with the knob turnbuckle. See **figure 8** for the image with specifications of the long lashing rod.

<sup>33</sup> The ship was bought second-hand, the 'top gap' of about 30cm at the railing was as at the time of taken over.

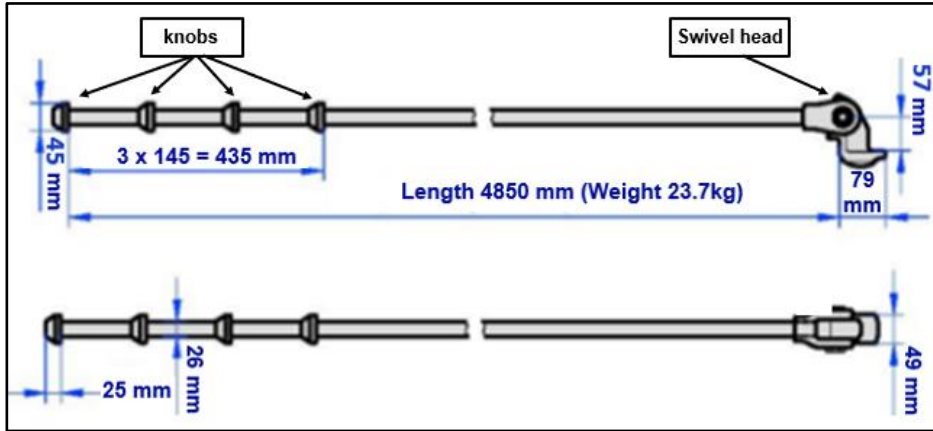


Figure 8 – Image of long lashing rod used on board D175. (Not to scale)  
 Source: Cargo Securing Manual of D175

### 1.10.1.2 Turnbuckles

1.10.1.2.1 Turnbuckles, also made of hot treatable steel with hot dip galvanised finish, are used to tension a ship's cargo container lashing. The securing device has two screw ends, of which one is connected to the lashing plate welded to the ship's deck, while the other screw end is attached to a lashing rod, secured to the container corner casting. By rotating the frame of the turnbuckle, the tension can be adjusted. The type used on board D175 was of the knob (attached to the lashing rod) and the open body jaw type (which fits in the eye of a lashing plate). The turnbuckle can be tightened with a turnbuckle key. See **figure 9** for the image with the specification of the turnbuckle.

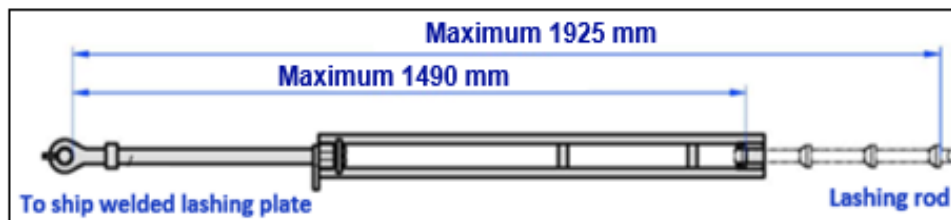


Figure 9 – Image of turnbuckle used on board D175. (Not to scale) Source:  
 Cargo Securing Manual of D175

- 1.11 PSA Safe Working Procedure (SWP)
- 1.11.1 In order to reduce the risks of injuries such as pinching<sup>34</sup> and incidents/ near misses involving LS during lashing/ unlashings of containers, the PSA Safety Department had recognised the importance of lashing/ unlashings operations to be done in a team of two. The objective was for the pair to assist each other when handling long lashing rod, particularly during lashing/ unlashings of the 3<sup>rd</sup> tier containers.
- 1.11.2 As a result, the two-man requirement was considered as one of the control measures to be incorporated in the RA for lashing/ unlashings operations. The other control measures included the wearing of full PPE comprising body harness (to hook the lanyard to firm anchor point) and life jacket for working near the extreme rows to mitigate the risks of falling and drowning. This RA was used by the LS.
- 1.11.3 PSA Terminal, besides having a team of LS under its own employment, also engages a third-party Stevedoring Company which provides LS for carrying out cargo related work for ships at the terminal. One of the requirements of this engagement is for compliance with PSA's SWP which indicates two-man lashing/ unlashings requirements.
- 1.11.4 According to information obtained by the investigation team from the LF who attended D175 on the day of the occurrence, due to inadequate space at the outboard rows at bay 18, the terminal's SWP requirement was communicated to the CO and acknowledgement obtained from the CO for the task of unlashings of containers in that area to be done by the ship's crew instead.
- 1.11.5 The investigation team also obtained additional information from the terminal on what constituted an adequate space for two-man to perform the lashing/ unlashings of containers. The following picture is provided as an example of the space, which also indicates how the LS typically perform the task at the outboard row (see **figure 10**).

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<sup>34</sup> To avoid the risk of pinching caused by the long lashing rod when the turnbuckle is loosened, it is a good practice for one person to hold on to the long lashing rod while another person loosens the turnbuckle.



Figure 10 – Pictures showing two-man operation for unlashings the containers  
(Source: PSA Singapore)

- 1.11.6 According to the terminal, in situations where the LSs cite safety reasons for not being able to carry out the tasks, the options that the ship can adopt are:
- to rectify the risks identified (e.g. by providing additional standing platform), so that the stevedoring company can perform the lashing/ unlashings operation according to the PSA SWP; or
  - to carry out the lashing/ unlashings by ship's crew (with their own control measures).
- 1.11.7 When asked, whether any "Stop Work Order" or intention to stop the work, was communicated to the ship considering the risk to personnel safety for unlashings the containers at the location of concern, the terminal confirmed that the safety concerns were highlighted to the CO as per typical practice but there was no instruction to stop the work. The terminal also noted that the CO had acknowledged the safety concerns and informed the attending LF that the ship's crew would undertake the work at the rows of concern.
- 1.11.8 When asked whether the ships arriving at its terminals with similar hazards (inadequate space on the pedestal platform to accommodate two-man



operation) which do not meet the SWP requirements are informed before arrival, the terminal responded that agents for the various ships which call the Port of Singapore are typically familiar with requirements for safe access at work. The terminal added that, as this was the first time D175 had berthed at this terminal, the constraints and risks would only be known after the checks by the LS upon berthing.

## 1.12 Environmental condition

1.12.1 The incident occurred in the early morning at about 0310H, after the ship had been secured at berth. According to the crew the weather was fine with good visibility, the sky was partly cloudy with light wind of about five knots. There was also no report of ship's movement (heeling or listing) prior to the occurrence.

1.12.2 The ship's log recorded the weather experienced by D175 while on passage on 20 December 2020 at 2000H, encountered rain with north-easterly wind of about 25 knots and on 20 December 2020 at 2400H, was partly cloudy sky with north-easterly wind of speed of about 15 knots. The air temperature was recorded at constant 29°Celsius.

## 2 ANALYSIS

The investigation looked into the following:

### 2.1 The Occurrence

2.1.1 The process of unlash the 3<sup>rd</sup> tier containers involves the removal of the swivel head of a long and heavy lashing rod from the bottom corner casting of the container in question, be brought down from its vertical position to a horizontal position and placed on deck/ platform. The ASD-4 was last seen standing on the pedestal platform at bay 18 port side, removing one of the long lashing rods.

2.1.2 At this time, the weather at the Port of Singapore was fine and D175 was secured to the berth and cargo operations (that could cause sudden movements) had not commenced. There was also no report of any heeling or listing of the ship at the time of the incident. Seven hours prior to the ship's arrival into Singapore, the ship had encountered rain during its passage. As a result, the main deck, including some locations of the working areas (pedestal platform) could have been wet and slippery.

2.1.3 The investigation team recognised that removal of the long lashing rod from the bottom corner casting of the 3<sup>rd</sup> tier containers can be challenging and requires skill, effort and strength. It was also recognised that the process of bringing down the lashing rod from its vertical position to the horizontal position in a controlled manner after removing the swivel head can be equally challenging before the rod is rested on deck/ platform. This challenge was also noted in TSIB's investigation into a similar MOB occurrence that took place on 19 May 2019<sup>35</sup>.

2.1.4 To exacerbate the difficulty in removing the lashing rod from the bottom corner casting of a container at the 3<sup>rd</sup> tier which is about 5m high, the person has to manoeuvre the lashing rod with both hands to move the swivel head out of the casting. In doing so, the person has to constantly look upwards and focus at the swivel head of the lashing rod. Once the rod has been removed, because of its weight, it would require a counter force to be applied to ensure that it is brought down in a controlled manner. It is evident that the ASD-4 had been

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<sup>35</sup> The investigation report into Maersk Patras can be found at the following link – <http://www.mot.gov.sg/about-mot/transport-safety-investigation-bureau/msib/investigation-report..>

- struggling to remove the lashing rod for about 3-4 minutes. This continued effort may have contributed to tiredness, which likely included weakening of the ASD-4's arms. When lowering down the lashing rod, the weakened arms may have caused the ASD-4 to lose control<sup>36</sup> of the lashing rod's downwards momentum.
- 2.1.5 The gap<sup>37</sup> of 30cm between the railing of the pedestal platform and the container, although within the designed specification allowed in the Code of Safe Practice for Cargo Stowage and Securing (CSS Code), was sufficiently wide for a person to fall through.
- 2.1.6 A body restraint, such as a safety belt<sup>38</sup> or full body harness<sup>39</sup> could have prevented the fall.
- 2.1.7 The ASD-4 was also not wearing a personal floatation device. After the fall he was sighted to be on top of the berth fender for a brief duration, before slipping into the sea. Although the fall from the pedestal platform to the berth fender of about 8.5m did not result in serious injuries (as noted in the autopsy report), the ASD-4 may have been unconscious as a result of the fall, which affected his ability to stay afloat. A floatation device could have improved his chance of survival when he slipped into the water.
- 2.2 Company's SMS and risk assessment for the unlashng tasks
- 2.2.1 The Company's SMS had identified man overboard as a hazard and provided mitigating measures such as raising the awareness through safety meetings, job specific training and the correct use of PPE (see table 4), in which a safety belt had been identified as the PPE to prevent fall.
- 2.2.2 The SMS also requires that for any event or task that carries certain level of risks and which is not included in the prepared list of operational RAs, the ship's crew are required to carry out a job analysis by completing the JSA. The investigation team noted that the crew did not conduct a RA or JSA for the lashing/ unlashng operations.

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<sup>36</sup> A slippery surface on the pedestal platform may have contributed to the loss of bodily control.

<sup>37</sup> CSS Code Annex 14 Section 6.2.3.2 – Fencing design

<sup>38</sup> A safety belt, worn at the waist with a safety line secured to a strong point, can prevent the wearer from falling, but does not offer as good protection as the full body harness after the fall (wearer would be hanging from the waist).

<sup>39</sup> A full body harness, worn on the body, instead of waist, with a safety line secured to a strong point, besides preventing the wearer from falling, also provides better protection after the fall (wearer would be hanging from the body in an upright position).

- 2.2.3 Based on its interaction with the investigation team, it was likely that the crew of D175 were still in the process of being conversant with the requirement of the SMS, in particular regarding the conduct of RA or JSA. Considering that RA or JSA may be used for any tasks that pose a risk to the safety of persons or the ship during the ship's operations, the investigation team held the view that the timeline for the crew to be conversant with these requirements should be reduced and prioritised, so that the crew get familiar with the SMS requirements as soon as possible for ensuring safe operations.
- 2.2.4 The pedestal platform was designed for a single man operation and unlashing at the location was deemed unsafe by the LF, the specialist in lashing/ unlashing operation. When the LF told the CO that it was dangerous to unlash containers at the outboard rows and communicated the terminal's SWP to the CO, it should have triggered the CO, and the ship's crew, of the need to conduct a JSA. Accordingly, a JSA/ RA to address the need for donning the appropriate PPE such as the safety belt/ harness (secured with a line taut to strong point) and floatation device would have been identified.
- 2.2.5 Even if a RA or JSA had been done in the past, the investigation team opined that a review of the RA or JSA should still be carried out to check if there were changes to the hazards and risks identified in the past. In this case it was particularly important when safety concerns were communicated by the LF. The incident highlighted the importance of not rushing into a job without properly assessing the risks involved and the appropriate mitigating measures. The Company could have within its SMS, asserted the importance of completion and reference to the RAs and JSA for such tasks.
- 2.3 Lashing/ unlashing operations and training
- 2.3.1 The investigation team noted that lashing and unlashing tasks are commonly performed by stevedores in most parts of the world. These stevedores are specifically trained for physical manual handling to carry out the task in a safe manner, by being able to recognise associated risks.
- 2.3.2 The investigation team gathered that such a physical skill requires time and practice to develop and the ship's crew may have their limitations to perform such tasks as these are not their primary roles.
- 2.3.3 The Company managed a fleet of feeder container ships that call ports where

- the lashing/ unlashng of containers could be required to be carried out by the ship's crew. To cater for such situations, the Company's SMS procedures allowed the ship's crew to perform lashing and unlashng tasks for ports where there was insufficient support of stevedores.
- 2.3.4 The Company had just taken over the management of D175 for less than a month and had provided the ship's crew (regardless of their experience) on board with two sessions of on-the-job training for lashing/ unlashng of containers, one by the Company's Superintendent and the other by shore stevedores.
- 2.3.5 Although the training had been conducted, and the crew had successfully completed two lashing and unlashng operations before the incident at PSA terminal, the effectiveness of this training could not be established as there was no detailed evidence of its scope and programme. There was also no evidence to show that the crew having undergone the training had been made aware of the importance of personal safety to mitigate against the risk of falling when handling the heavy lashing rod near shipside and its subsequent consequences such as falling into the sea.
- 2.3.6 The investigation team thus held the view that where possible stevedores should be used for lashing/ unlashng tasks. In the event of unforeseen circumstances, if ship's crew are required to carry out the task as an interim measure, appropriate framework which includes providing the physical hands-on training and skill set supplemented by appropriate supervision, taking reference from the CSS Code (see paragraph 1.7) should be implemented within the Company's SMS.

### 3 CONCLUSIONS

*From the information gathered, the following findings are made. These findings should not be read as apportioning blame or liability to any particular organisation or individual.*

- 3.1 The lashing/ unlashng operations at PSA terminal are normally done by shore stevedores. The inadequate space of the pedestal platform on D175 at the outboard rows of bay 18 did not meet the PSA's requirement of Safe Working Procedure for two-man lashing/ unlashng of containers. As a result, two ASDs were assigned to assist with the unlashng of containers at the affected outboard rows.
- 3.2 Although ship's crew were assigned to unlash the containers, there was no RA, JSA or toolbox meeting, as required by the Company's SMS, carried out prior to the allocation. The two ASDs did not don a safety belt/ harness or a floatation device while unlashng containers at the outboard rows of bay 18.
- 3.3 The ship's crew were likely not familiar with the need to conduct RA or JSA, as they were still being conversant with the SMS requirement after the Company took over the safe management of the ship about a month prior to the incident.
- 3.4 Prior to the fall, the ASD-4 struggled to remove the swivel head of the long and heavy lashing rod from a 3<sup>rd</sup>-tier container for about 3-4 minutes. The process could have weakened the ASD-4's arm. When the swivel head was removed, the rod swayed sideways while it was being lowered. As a result, the ASD-4 was pulled by the momentum of the lashing rod and fell overboard through the opening between the pedestal platform fencing and the container.
- 3.5 Although, the ship's crew had been trained to perform lashing/ unlashng operations, details of the scope of the training could not be established to ascertain its effectiveness.
- 3.6 Lashing/ unlashng operations are not only physically demanding, there are risks associated in performing such tasks, and developing the necessary skills needs time. As far as possible, the lashing/ unlashng operations should be done by well-trained shore stevedores. If ship's crew are expected to carry out lashing/ unlashng operations, a structured training programme, taking reference from

the guidance contained in the CSS Code, should be implemented within the Company's SMS.

## 4 SAFETY ACTIONS

*Arising from discussions with the investigation team, the Company took the following safety actions.*

4.1 The Company had taken the following safety actions.


1. Sharing of Company's investigation report and findings with all its fleet ships about the importance of donning the appropriate PPE for the task.
2. Issued instructions to all Company's feeder ships, to carry out Job Safety Analysis/ Job Hazard Analysis' (JSA/ JHA) and conduct training on 'Lashing/ Unlashing of containers on board'. D175 carried out the JSA/ JHA on 21 December 2020.

Task	Task Hazards/ Risks	Mitigation Procedure
Working at extreme platform where danger of trip/ slip or fall from height existed	<ol style="list-style-type: none"><li>1. Injuries due to falling object</li><li>2. Trip/ slip or fall from height</li><li>3. Risk of drowning when fall into the sea</li></ol>	<ol style="list-style-type: none"><li>1. Proper training and toolbox meeting for the task conducted regularly to raise safety awareness.</li><li>2. Proper planning before commencement of job like selection of crew for the job and area of work.</li><li>3. To don proper PPE, including personal floatation device (working lifejacket<sup>40</sup>) and full body harness with safety line secured to strong point before commencement of task at the extreme platform.</li><li>4. Platform or area of work to be cleared of any loose lashing gears.</li><li>5. Implement buddy system (working in team of at least 2 persons)</li><li>6. Crew familiarity with the location and use of Life Saving Appliances.</li></ol>

<sup>40</sup> As a result of the conduct of a JSA (after the incident), D175 was provided with working lifejackets (similar to those used by PSA terminal) for its crew performing lashing/ unlashing operations.



3. Reviewed the SMS and included the JSA/ JHA on 'Lashing/ Unlashing of containers on board'. As a result of the JSA/ JHA, the Company had, in addition to the safety belts and lifejackets on board, equipped the ship with work vest (working lifejacket) and full body harness. The Company also required the donning of complete PPE, including work vest and full body harness, for lashing/ unlashing of containers on board.

<ol style="list-style-type: none"><li>1. For lashing/ unlashing of containers - Crew are required to don complete PPE, including a work vest and full body harness.</li><li>2. The modified pedestal platform with space adequate for two-man operation.</li></ol>	 A photograph showing two crew members on a ship's deck. They are wearing bright red safety vests and full-body harnesses. They are positioned on a modified pedestal platform, which is a raised area with railings. In the background, there is a white shipping container with some text and weight markings. The sea is visible in the distance.
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4. Changes and modification to the design of the pedestal platform to provide an adequate and safe standing area for two-man operation to carry out lashing/ unlashing of containers completed on the 2 Feb 21.

## 5 SAFETY RECOMMENDATIONS

*A safety recommendation is for the purpose of preventive action and shall in no case create a presumption of blame or liability.*

For the Company

- 5.1 To establish a structured training programme on lashing/ unlashings operations for its crew, taking guidance from Annex 14 Section 4.4 of the Code of Safe Practice for Cargo Stowage and Securing (CSS). **[TSIB RM-2021-32]**.
- 5.2 To review the timeline of SMS familiarisation for ensuring safe operations on its fleet of ships, in particular the conduct of toolbox meetings, JSA and RA. **[TSIB RM-2021-33]**