

Extracted from Attachment 12

If not always behaving appropriately:

① Possible hazards and risk assessment					
Possible hazard (because of~, by doing~, (causing specific trouble))	Frequency of occurrence (a)	Severity (b)		Risk (a × b)	Risk Level
		Accident involving people	Other		
2  Doors of lockers installed in common areas (e.g. mess room) in the accommodation space are left ajar, causing the door to open by hull agitation, pinching fingers and causing injury.  (Hazard) Doors	4	4	–	16	HH



✓ By checking twice:

② Prevention/mitigation measures and post-measure risk assessment					
Prevention/mitigation measures	Frequency of occurrence (a)	Severity (b)		Risk (a × b)	Risk Level
		Accident involving people	Other		
(a. Essential measures)					
(b. Physical countermeasures)					
2 (c. Administrative countermeasures) Locker doors are to be closed, not just in rough weather. Doors that are left open, such as in the mess room, are to always have a door stop applied and are to be lashed.	4	1	–	4	M
(d. Use of personal protective equipment)					

Fig. 35 Risk assessment regarding countermeasures for rough weather: Catering department (Example 2)

In addition to rough weather, it is also important to make it a habit to switch off the stove in the galley at the end of each work session, and to check this with at least two other people in the Catering department without fail. Also, it is important to make sure that doors in mess rooms are always closed on a regular basis, as this can be a problem for fire safety if they are kept open. If there are a large number of crew passing through during the daytime, and there are always crew in the adjacent galley, and the door is left open because there is no risk of fire, it is recommended that a rope be used to lash it as well as a door stopper.



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## 4-4 How to handle risk assessment: summary

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As we discussed countermeasures for rough weather as examples in the previous section, on the vessel, in particular, in the event of carrying out any unusual (unfamiliar) work, it is important that a risk assessment be carried out and that information is shared with all relevant crew members. Because even experienced crew may inadvertently forget or be unaware (error when inputting).

In addition, unlike the manufacturing industry on land, it is difficult for the management at the catering department or the safety department to visit the site to control the work, so most of the work itself must often be carried out under the supervision of a Master/Chief Engineer or Chief Officer/First Engineer.

This means that Essential measures and physical improvement measures are rarely taken. These countermeasures tend to be focused on administrative countermeasures which were established or developed on board and the use of protective wear which are designed to prevent trouble occurring. For the crew, who are a group of highly skilled and professional technicians, it is important to remember that this is where the pitfalls lie.

In addition, the risk assessment should not just be filed away in a document, but should also be used in conjunction with BRM/ERM to increase the effectiveness of the work.

As mentioned above, risk assessments have been introduced mainly from a business management perspective in the manufacturing industry on land, which means that crew members who are used to working on board may find them too time-consuming or too obvious. This is why it has become less effective.

However, as explained in the examples, if we visualise our everyday work in this way, we may find that we see things in a different light, so it is recommended to take this opportunity to feel free to use it. Figure 37 summarises this.

## Summary

### Summary on risk assessment:



Regarding what we normally do without thinking, **write it down in a list.**

Have a meeting with the crew and the company.



Share information about risks to make sure everyone is aware of them.



# Keep it simple!

Fig. 37 Risk Assessment in practice: summary

## § 5 Case Study

### Analysis of an Accident

Let us take the Japan Transport Safety Board Report less severe (keibi) 2019-5 and the decision of the Marine Accident Tribunal (Kobe issued No.11 in 2019), together with a 4M5E analysis and risk assessment to analyse the cause of the accident.

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#### 5-1 Date and time of occurrence and vessel particulars

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Photograph 38 Vessel A

##### Date and time of occurrence

: On a certain day in November 2018, at approximately 12:09 (JST)

##### Vessel specifications

: Vessel A(748 GT) Single-engine, single-shaft stern hull bridge type coal ash and calcium carbonate carrier equipped with bow thrusters and a VecTwin system control unit (hereinafter referred to as “VecTwin system”)

L × B × D : 79.26m x 14.00m x 8.15m

Draft : Bow 2.70m Stern 3.68m

Point accident occurred : Hanshin Port Kobe No. 2 port during entry work

Crew arrangement : Master, with third grade maritime officer (Navigation) and 7 other crew members in total

Manning system at time of accident

Bridge : Master (Single-handed navigation)

Chief Engineer : Engine control Fore : C/O + 2 crew members

Aft : 2/E + 1 crew member Eng/Room : First Engineer (1/E)

Weather and sea conditions when the accident occurred

: Fine, east-southeasterly wind Wind force of 2

### Vessel movement

On a certain day in November, 2018, the vessel in question set sail at 14:10 from Kanda Port in Fukuoka Prefecture. At 10:40 the following day, she anchored in an offshore area South East of Kobe Airport in Hyogo Prefecture in order to await berthing time. Shortly after, the vessel then set sail for her scheduled 11:30 arrival at the KS1 berth in Kobe Port (now part of Hanshin Port) on her port side.

### Rudder type: VecTwin Rudder (extracted from the homepage of Japan Hamworth & Co., Ltd.)

A New VecTwin Rudder System is a rudder system, in which a pair of Fish Tail Rudders respectively having special sectional profile is arranged symmetrically behind a single fixed pitch propeller, and enables a ship to be maneuvered in any mode of not only forwarding and turning port or starboard, but also going astern with steerability, hovering, extremely slow speed navigation, emergency stopping and head or stern gyrating by means of combining rudder angle positions of the respective rudders, with the propeller being kept rotating in the forward direction.

Such rudder angle combination control is conducted by a single Joystick lever, and a propeller slip stream is directed by the rudders so as to generate thrust in any direction. By virtue of such arrangement that VecTwin Rudders are arranged so as to enclose a propeller slip stream, which brings less propeller thrust fluctuation by wave and excellent course stability of a ship when going straight ahead, a New VecTwin System makes a horsepower loss and ship speed reduction, which are caused by seaway

condition, small. It is appraised that a ship equipped with a New VecTwin System shows less yawing especially when navigating in a condition of following wave, which means safe operation.

This is a system that brings excellent economical effect from the synthetic viewpoint, as a ship equipped with a New VecTwin System can be maneuvered easily and in short time in a harbor and for approaching to and departing from a pier, and mental and physical stress imposed on crew is lightened.

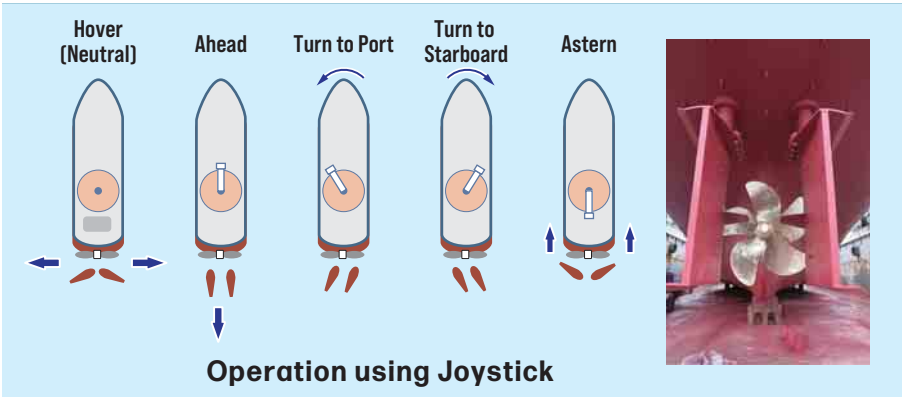
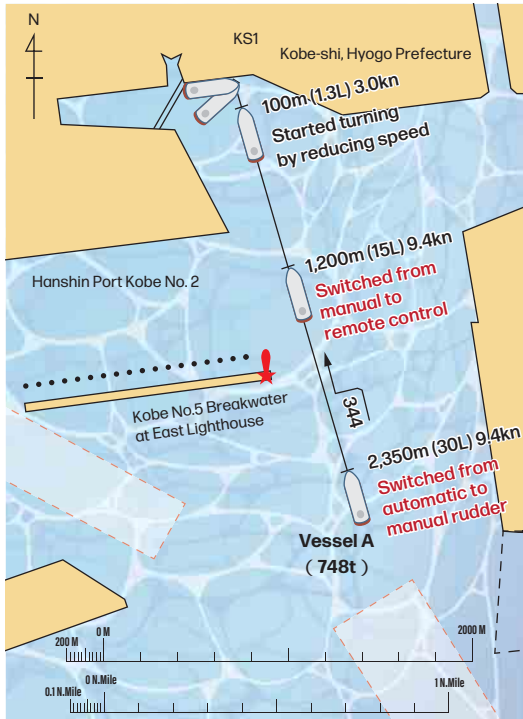


Fig. 39 VecTwin Rudder

## Standard docking procedures



- After passing breakwater No.5 (approximately 1,200m from the quay), the VecTwin system manual control is switched to remote before making a final approach whilst also reducing speed.

- At a slow speed ahead and approximately 100m from the quay, the 2 rudders should be closed (put into neutral) by pulling back on the joystick.

- At approximately 80m from the quay, the joystick is pulled back further and with the propeller set in forward rotation, the vessel is brought to a halt. Docking then takes place with the use of the bow thrusters.

Fig. 40 Standard docking procedures





Fig. 41 Remote operation unit

Rudder control switch

Moving in a clockwise direction, the rudder control switch has 4 settings: Automatic, Manual, Non-follow up, and Remote Control. The joystick can be operated when this switch is in the remote-control mode.

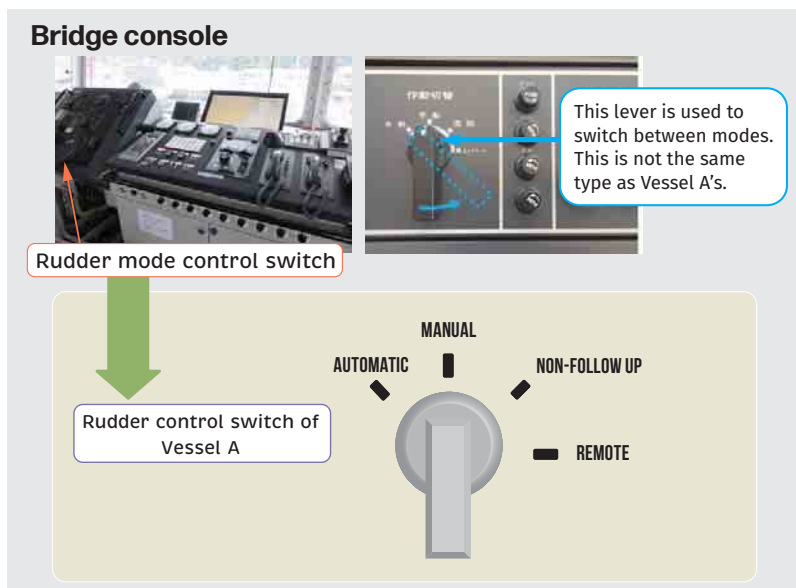


Fig. 42 Steering operation settings Rudder control switch

**In the event of turning the switch to remote mode, if the rudder switch on the control stand is not set to "Remote Control", the VecTwin Rudder will not move when trying to operate the joystick.**

## 5-2 Timeline of events leading up to the accident

Let us take a closer look at the timeline of events leading up to the accident. For a full list, please see Attachment 15. All crew members were already engaged in the S/B (stand-by) operation for the entering of port to dock; the crew arrangement at the time was as follows.

Bridge :	Master (Single-handed navigation)	
	Chief Engineer (Engine status monitoring and engine room control at engine console)	2 personnel in total
Fore :	C/O, Bsn and OS	3 personnel in total
Aft :	3/O and 2/E	2 personnel in total
Eng.Room :	1/E	1 personnel in total

Vessel A Quay collision accident Accident timeline

CREW ARRANGEMENT	STANDARD DOCKING PROCEDURES	TIME	SPEED	DISTANCE FROM THE QUAY (SHIP LENGTH RATIO)	ACTUAL ACTIONS TAKEN	WHO
Bridge Master • C/E  Fore C/Off • Bsn • O/S  Aft 2/AE • 3/Off  Eng. Room 1/AE	Engine in neutral position	11:55	9.4 kts	2,350 m (30 L)	At 2,350m before the quay (30L), engine half speed to neutral operation. Speed of 9.4 knots and switched from automatic to manual rudder	Master
	D.Slow Ahead  Used VecTwin rudders for speed control both sternway and headway	12:00	9.0 kts	1,160 m (15 L)	The Master intended to use the joystick device to control the VecTwin Rudder system to manoeuvre the ship to the shore, and switch the rudder control to remote control. D.Slow Ahead	Master
					However, he did not realise that the rudder switch was stuck in the non-follow-up position and moved to the port side of the bridge in front of the remote control stand. He believed that it had switched to remote rudder control by only operating the one lever.	Master
		12:06	5.0 kts	317 m (4 L)	Distance to the quay was approximately four times the length of the vessel	Master
	D.Slow Ahead He made a sternway manoeuvre.  Turned using bow thruster and joystick	12:08	3.1 kts	100 m (1 L)	At 100m before the quay, he thought he had tipped the joystick backwards and made a sternway manoeuvre, but in fact it was in neutral (hover).	Master
					He was too preoccupied with the distance to the quay that he did not look at the rudder angle indicator on the VecTwin rudders to notice that the rudders were heading sternway.	Master
					As the speed to fetch headway was not decreasing, he tried to make sternway by increasing engine speed (not effective as it was in neutral (hover) and anchored.	Master
		12:09	4.3 kts	0 m (0 L)	Collided with the quay at almost a right angle, maintaining a speed of 4.3 knots	Master

Table 43 Vessel A Timeline of events leading up to the accident

11 : 55 (approx.)

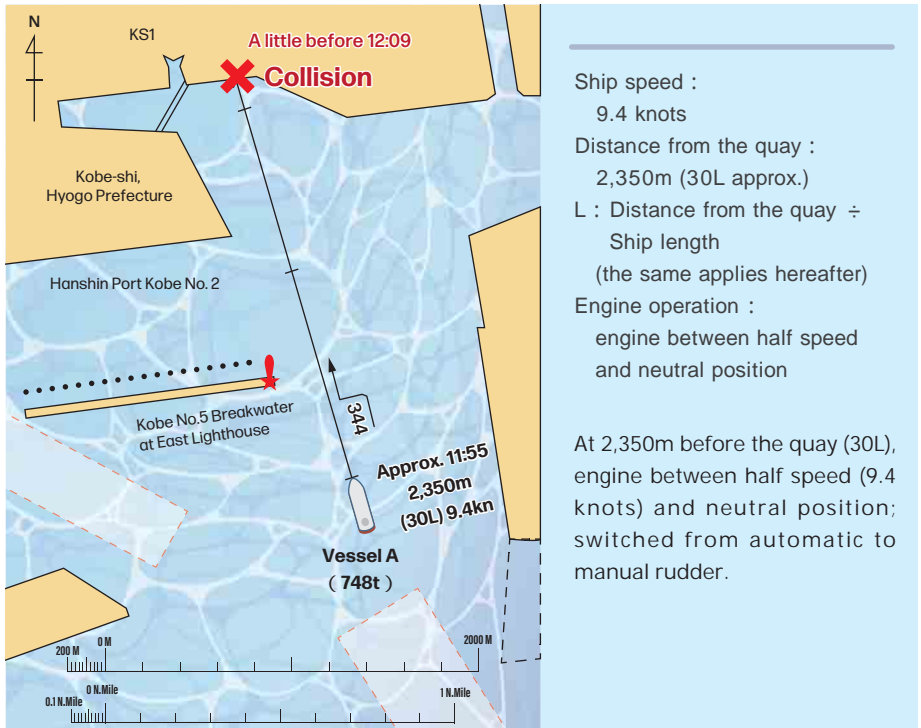


Fig. 44 Vessel A at 11:55 (approx.)

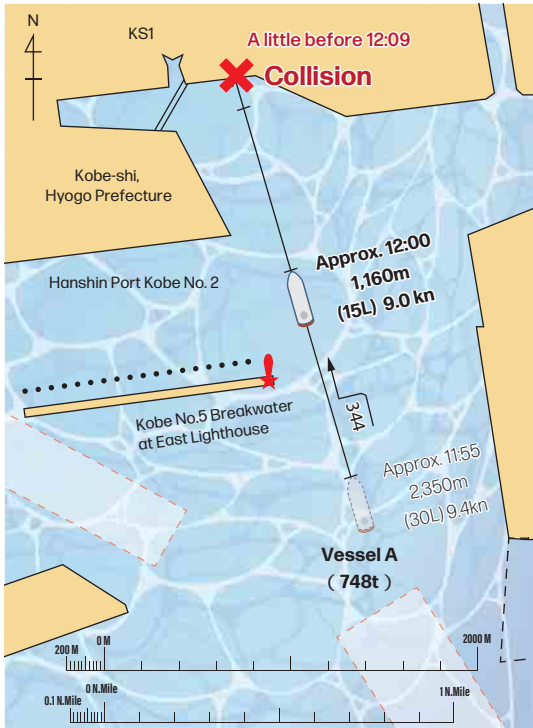
### First human error

This operation itself was in accordance with standard docking procedures, but the rudder angle indicator was not checked during manual operation.

Furthermore, as there was no altered angle to the quay, and no wind tide effect, although the Master moved the steering wheel somewhat, each time he thought the rudder was moving as he operated it; he did not check the rudder angle indicator.

(Human characteristics of moments of inattention and Human beings sometimes forget, Human beings have moments of inattention and Human beings are sometimes lazy (See Figure 52) will be applicable.)

12 : 00 (approx.)



Ship speed :  
9.0 knots  
Distance from the quay :  
1,160m (15L approx.)  
Engine operation :  
from neutral position to D.Slow Ahead

The Master intended to use the joystick device to control the VecTwin Rudder system to manoeuvre the ship to the shore, and switch the rudder control to remote control. He also set the speed for D.Slow Ahead.

Fig. 45 Vessel A at 12:00 (approx.)

### Second human error

However, he believed that it had switched to remote rudder control by moving it by only one notch. Actually, the rudder switch was stuck in the non-follow-up position (human characteristics: Human beings sometimes make assumptions).

While he did not realise this, he moved to the port side of the bridge in front of the control stand. At this time, the VecTwin Rudder was in the neutral (hover) position (human characteristics: Human beings sometimes do not notice).

At 12 : 08 (approx.)

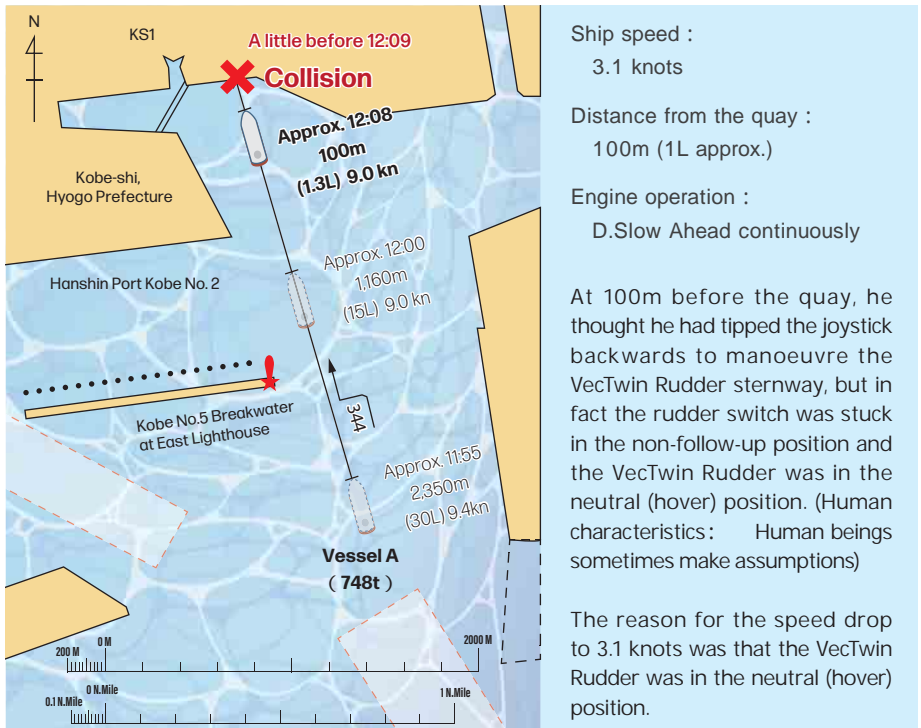


Fig. 46 Vessel A at 12:08 (approx.)

### Third human error

He thought he was steering the vessel with the joystick of the remote-control unit, but in fact the vessel was naturally slowed down while heading straight ahead with no wind tide effect, because the VecTwin Rudder was in the neutral (hover) position.

He was too preoccupied with the distance to the quay that he did not look at the rudder angle indicator on the VecTwin Rudder to make sure the rudders were heading sternway, but rather assumed that he could control the vessel's headway speed.

(Human characteristics : Human beings sometimes make assumptions, Human beings are sometimes only able to see or think about one thing at a time and Human beings sometimes panic)

But at last, the quay was in sight, and as the speed to fetch headway was not decreasing, he tried to make sternway by increasing engine speed (not effective as it was in neutral (hover)). Then, he ordered the Bows'C/O to anchor, but the timing was too late. At this point, the Master was probably in a panic and unable to calmly judge the situation.

12 : 09 (approx.)

Collided with the quay at a right angle with a speed of approx. 4 knots.

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### 5-3 Determination of accident cause by the Japan Transport Safety Board and Japan Marine Accident Tribunal

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#### The Japan Marine Accident Tribunal

**Negligence in the performance of his duties** in failing to look at the rudder angle indicator and checking that the two rudders were closing. Accordingly, the Master's third grade maritime officer (Navigation) certificate was suspended for one month.

#### Japan Transport Safety Board

It is considered that the Master of the vessel, during docking work, **continued to manoeuvre without realising that the rudder switch on the control stand was not switching to remote rudder** and that the joystick device could not control the speed to fetch headway which caused the collision with the quay.

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## 5-4 Countermeasures to prevent recurrence by shipowners and the Japan Transport Safety Board

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Improvement measures taken by the shipowner following the accident  
The shipowner has implemented the following countermeasures.

- The operating instructions are to be clearly shown on the control stand and a switching procedure manual is to be created.
  - ▷ A method of instructing crew members to comply with compliance regulations by creating procedures, which is referred to as “c. Administrative countermeasures” in Attachment 4.
- The rudder switch on the control stand has been improved so that it emits an electronic tone for a few seconds when it is in the remote position.
  - ▷ This is referred to as “b. Physical countermeasures” in Attachment 4.

Japan Transport Safety Board Report: Preventive measures

- When switching to joystick steering, (1) visual confirmation shall be made that the rudder mode control switch has been switched to the appropriate position, and (2) a joystick activation test shall be carried out prior to berthing manoeuvres to confirm that the switch has been successfully operated.

Like the shipowner’s countermeasure, the main focus is to be on the creation of the procedures and crew training compliance. This is referred to as “c. Administrative countermeasures” in Attachment 4.

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## 5-5 4M5E Analysis

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Let us apply the 4M5E Analysis introduced in Loss Prevention Bulletin Vol.50.

### 1 Summary of related facts (Fig. 47 Attachment 16)

From “5-2 Timeline of events leading up to the accident”, extract the causes behind the accident and enter them in the “Summary of related facts” table in the 4M5E analysis



table, starting with the major causes first then completing the others in sequence. In this case study, the following five possible accident causes have been identified.

Attachment 16

## Vessel A Quay collision accident

### Maritime Accident Summary of Related Facts

[illegible]

Accident cause assessment: Prioritized according to the scale of the cause

Fig. 47 Vessel A Summary of related facts (Attachment 16)

## Master

The Master intended to turn the rudder control switch to remote control but did not verify that this had indeed been done. (Unsafe behaviour) and (Unsafe conditions)

He did not realise that the rudder switch was stuck in the non-follow-up position (not switching to remote control) and moved to the port side of the bridge in front of the control stand (Unsafe behaviour).

He was too preoccupied with the distance to the quay that he did not look at the rudder angle indicator on the VecTwin Rudders to notice that the rudders were heading sternway (Unsafe behaviour).

As the speed to fetch headway was not decreasing, he tried to make sternway by increasing engine speed (ineffective as it was in neutral (hover))

