Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Federal Higher Authority subordinated to the Federal Ministry
of Transport and Digital Infrastructure

Summary Investigation Report 283/16

Less Serious Marine Casualty

Water ingress in the RoPax ferry BERLIN's forepeak after an allision with the fender system in the port of Gedser (DK) on 30 July 2016

11 December 2020

This summary report within the meaning of Article 27(5) of the Law to improve safety of shipping by investigating marine casualties and other incidents (Maritime Safety Investigation Law – SUG) is a simplified report pursuant to the second sentence of Article 14(1) of Directive 2009/18/EC of the European Parliament and of the Council of 23 April 2009 establishing the fundamental principles governing the investigation of accidents in the maritime transport sector.

The investigation was conducted in accordance with the above legislation. According to said legislation, the sole objective of this investigation is to prevent future accidents. This investigation does not serve to ascertain fault, liability or claims (Article 9(2) SUG).

This report should not be used in court proceedings or proceedings of the Maritime Board. Reference is made to Article 34(4) SUG.

The German text shall prevail in the interpretation of this investigation report.

Issued by:
Bundesstelle für Seeunfalluntersuchung – BSU
(Federal Bureau of Maritime Casualty Investigation)
Bernhard-Nocht-Str. 78
D-20359 Hamburg

Director: Ulf Kaspera
Phone: +49 40 3190 8300
Fax: +49 40 3190 8340
posteingang-bsu@bsh.de
www.bsu-bund.de

Revision Table

Page	Change	Date

Table of Contents

Table of Figures

1 FACTUAL INFORMATION

1.1 Photograph of the ship

Source: Nils Junge

Figure 1: Photograph of the hybrid ferry BERLIN

1.2 Ship particulars

Name of ship:	BERLIN	
Type of ship:	RoPax ferry	
Flag:	Germany	
Port of registry:	Rostock	
IMO number:	9587855	
Call sign:	DKDF2	
Owner (according to Equasis):	SCANDLINES DEUTSCHLAND GMBH	
Shipping company:	SCANDLINES DEUTSCHLAND GMBH	
Year built:	2016	
Shipyard:	P+S Werft Stralsund; Fayard A/S Munkebo (DK)	
Classification society:	Lloyd's Register 100 A1 passenger/vehicle ferry LMC, UMS, ICC, NAV1, IBS, CCS	
Length overall:	169.50 m	
Breadth overall:	25.40 m	
Draught (max.):	6.00 m	
Gross tonnage:	22,319	
Deadweight:	5,088 t	
Passenger capacity:	1,300 people	
Cargo capacity:	Deck 3 – 48 HGVs or 230 cars Deck 5 – 48 HGVs or 230 cars	
Machinery:	Main engines	2 x 4,500 kW

	Hybrid engine[1]	1 x 4,500 kW
	Main diesel generator (MDG)	1 x 4,500 kW
	Harbour diesel generator (HDG)	1 x 1,540 kW
	ESS output[2]	1 x 4,500 kW
	ESS capacity	1 x 1,500 kW
	Controllable pitch propeller (CPP)	1 x 13,500 kW
	Azipull thrusters	2 x 3,500 kW
	Bow thrusters	2 x 1,350 kW
(Service) Speed:	21 kts	
Hull material:	Steel	
Hull design:	Double bottom – yes, double hull – no	

1.3 Voyage particulars

Port of departure:	Rostock (D)
Port of call:	Gedser (DK)
Type of voyage:	Merchant shipping/ international
Manning:	42
Draught at time of accident:	D_f 5.30 m, D_m 5.30 m, D_a 5.30 m
Pilot on board:	No
Canal helmsman:	No
Number of passengers:	659

1.4 Marine casualty or incident information

Type of marine casualty:	Less serious marine casualty, allision
Date, time:	30/07/2016, 0755[3]
Location:	Approach to Gedser port facility
Latitude/Longitude:	φ 54°57.37' N λ 011°92.47' E
Ship operation and voyage segment:	Berthing
Human factors:	Yes
Consequences:	Water ingress in the forepeak

[1] The hybrid engine can run either geared to the CPP directly or as a generator.
[2] ESS: Energy storage system.
[3] All times shown in this report are local = UTC+1.

Extract from navigational chart

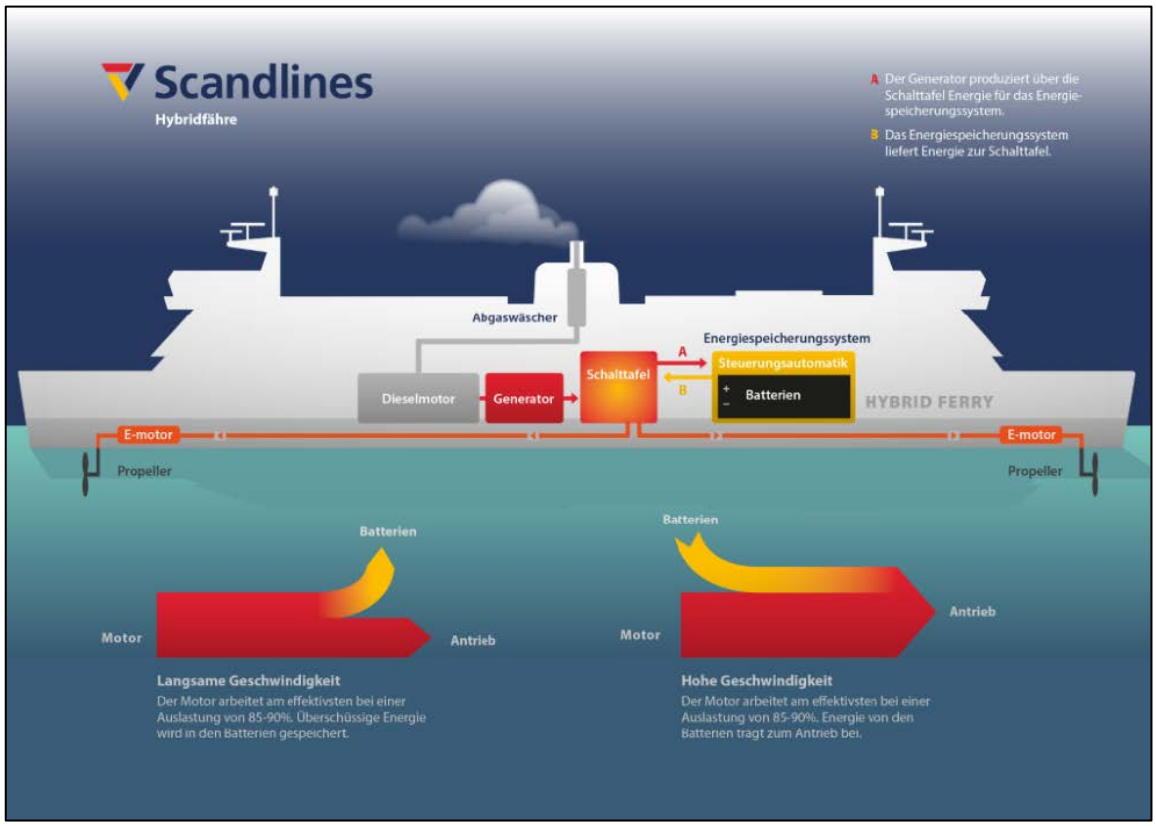
Source: OpenSeaMap

Figure 2: Navigational chart

1.5 Facts about the hybrid ferry BERLIN

The Scandlines shipping company announced the construction of two identical ferries in 2010. The two ferries, the BERLIN and the COPENHAGEN, were scheduled to replace the ferries PRINS JOACHIM and KRONPRINZ FREDERIK on the Rostock-Gedser route two years later. Completion was planned for 2012 but had to be put back several times due to technical problems. The weight of the ferries was actually too high and made calling at the port of Gedser impossible due to the resulting increased draught. As a result, the construction contracts were cancelled at the end of November 2012. At the beginning of 2014, Scandlines purchased the two ferries from the Stralsund shipyard, which had been declared insolvent in the meantime, so as to have them converted at the Fayad shipyard in Denmark, where the two ferries were fitted with the new hybrid propulsion system. The ferry that had been given the name BERLIN was put into service on 23 June 2016.

The hybrid propulsion system is a combination of conventional diesel propulsion and electric battery operation. Scandlines claimed at the time that it was the first company in the world to use such a propulsion system of this size on its ships, which stores excess energy in batteries. According to the shipping company, the system is operated with a 1.9 MWh battery, which is equivalent to the power of some 600 hybrid cars. Fuel consumption can be optimally adjusted according to load, making it possible to cut CO_2 emissions by up to 15%.



Source: Scandlines

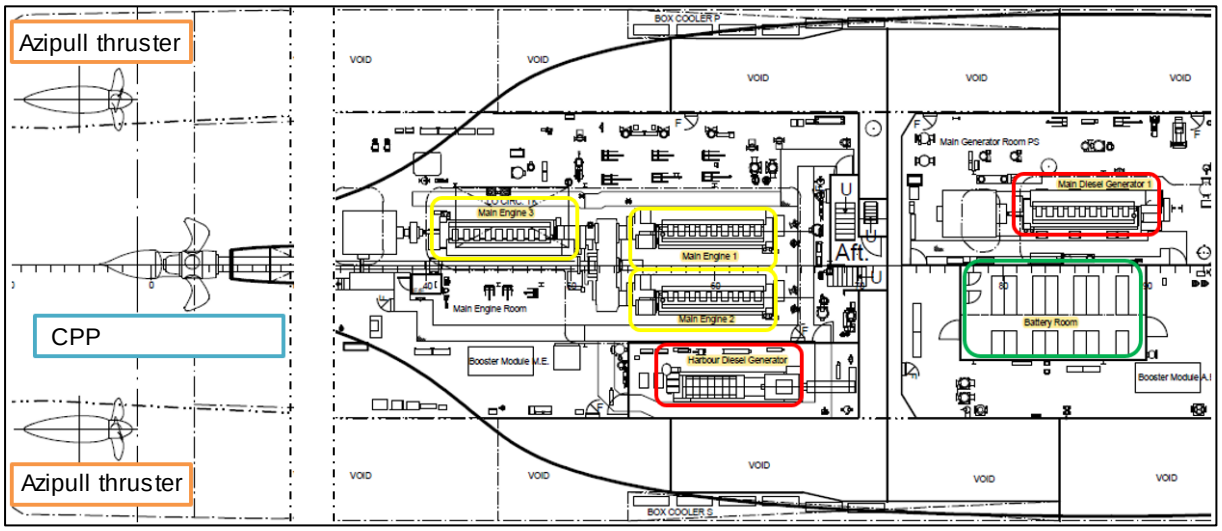
Figure 3: Schematic of the hybrid drive system

2 COURSE OF THE ACCIDENT AND INVESTIGATION

2.1 Description of the hybrid propulsion

Hybrid propulsion is a combination of different propulsion technologies. This is often achieved in ferries by combining modern diesel engines with battery-powered generators. Such batteries are charged by the main generating station during a voyage and then available for use when manoeuvring in ports, for example.

The BERLIN's two 4,500 kW main engines achieve their best efficiency when running in the upper speed range and operate a generator. Any electrical energy then generated that is not needed to drive the ship's propellers is stored in batteries. Any additional energy required for propulsion is fed from the batteries (or ESS). The rapid availability of full power is needed during manoeuvres in a port, in particular. The batteries are charged in the period between arrival and departure.



Source: Scandlines

Figure 4: Principle of propulsion

Yellow: Main engines
Red: Diesel generators
Green: ESS

2.2 Course of the accident

The BERLIN is one of two hybrid ferries operated by Scandlines and services the Rostock-Gedser route jointly with the COPENHAGEN. A ferry casts off approximately every two hours and then arrives in Gedser two hours later. On the morning of 30 July 2016, the BERLIN left the port of Rostock on schedule at 0600. One main engine (MDG 3) and the ESS[4] were in operation at the time. The autopilot was switched on, she was being sailed in cruise mode and only the wing thruster (Azipull) was in operation. The chief mate and second officer were on the bridge. Approximately 30 minutes after departure, the engine-room personnel advised by phone that due to maintenance works on MDG 3, they reportedly planned to shut it down. The main engine MDG 1 was then started to maintain speed in conjunction with the CPP. The

[4] n/a

second officer took charge of the helm in manual steering and the ship continued her voyage in individual mode.

15 minutes before reaching the 10-metre depth contour, the bridge requested the HDG. The controls were returned to cruise mode and autopilot seven minutes later at a reduced speed. Between buoy pair 1/2, the speed was reduced further to 12 kts and switched from cruise mode to manual steering. Shortly before reaching buoys 7/8, the helmsman was given the ten minute notice so as to prepare the bridge wing. The chief mate then took command of the bridge wing and switched to tandem mode[5] at a speed of 11 kts. They then switched to individual mode[6] and reduced the Azipull to 30% in the turning basin at 8.5 kts.

Source: Scandlines

Figure 5: The BERLIN docking in Gedser

As they were passing the jetty with the speed reducing further to 7.5 kts, the stern veered eastwards (to starboard) at 1.3 kts due to the current. As a countermeasure, a further reduction in speed was initiated with the port Azipull and the stern was pushed to port simultaneously with the starboard Azipull. After the ship's bridge wing had passed the central pier, the two Azipulls were stopped at a speed of 5 kts. The two bow thrusters were operating in a starboard direction. Immediately afterwards, the chief mate set the two bow thrusters to hard to starboard to counteract the increasing rate of turn to port. Against all expectations, the ship's speed reduced only very slowly.

[5] Tandem mode involves combining the two Azipull thrusters via their control unit so that it is possible to operate them synchronously.

[6] Individual mode involves operating the two Azipull thrusters separately in their control unit.

The second officer communicated the distances to the quay from the port wing. At 0755, the ship struck the diagonal fender at about 2.5 kts.

Source: Scandlines

Figure 6: Ferry terminal in Gedser

After the ship rebounded from the fender, attempts were made to stabilise her by means of the Azipull with only moderate success. The ahead speed increased again. It was only then that the chief mate realised that the main engine ME 1 and the CPP were still engaged. The CPP was then disengaged immediately, the engine was stopped and the master was informed.

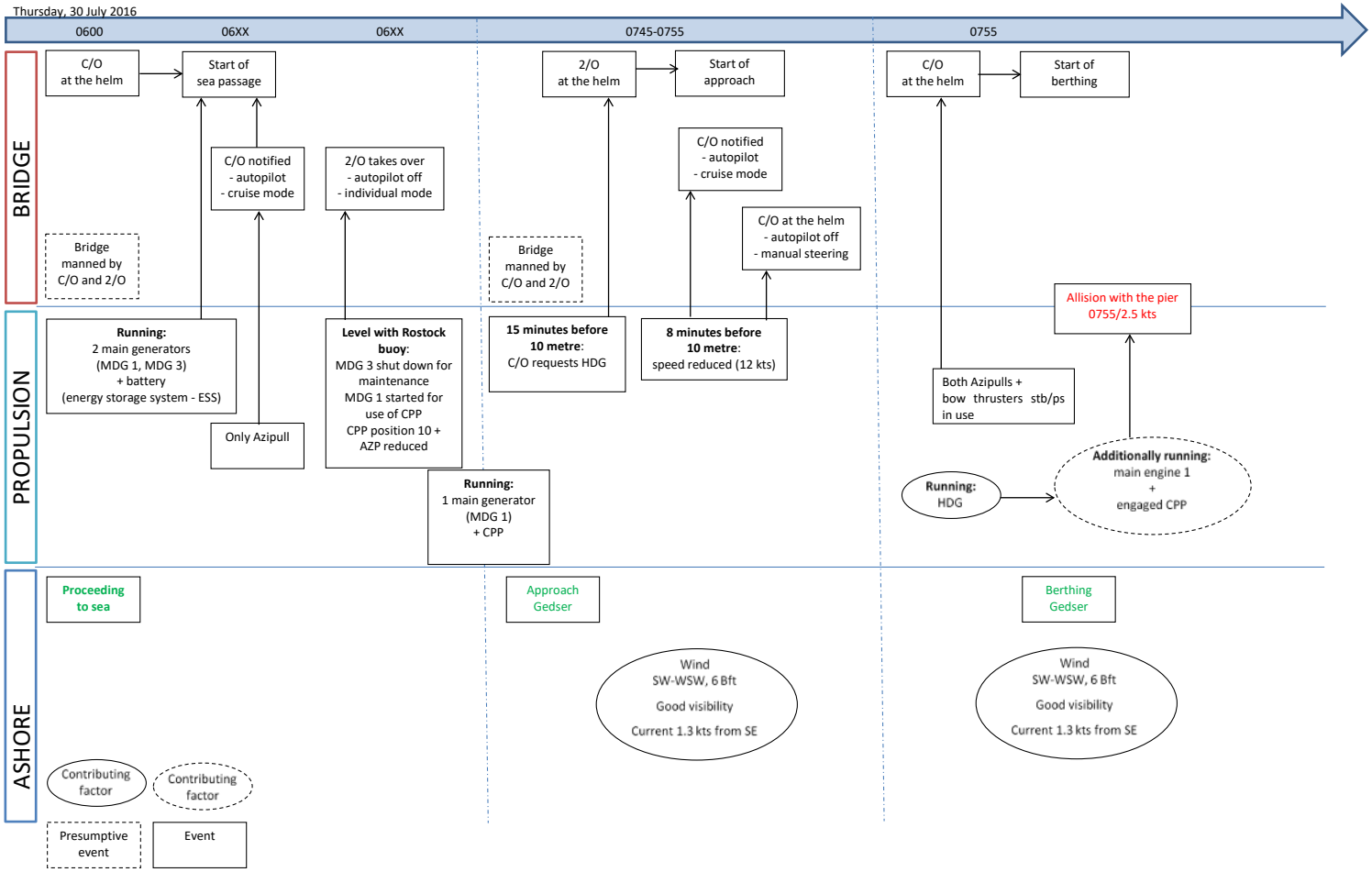
A damage survey was carried out after docking and revealed that the bulbous bow was buckled. No water ingress was detected at this point in time. After consulting with the shipping company, the decision was made to return to Rostock in accordance with the schedule so as to carry out any repairs there. In the meantime, the shipping company contacted the classification society and reported the damage.

The BERLIN cast off at 0900. 30 minutes later, a *high level alarm* went off for the forepeak. The forepeak was sounded manually and no ingress of water could be confirmed, however. The audio recordings from the VDR revealed that several people were discussing the fact that the sounding tube had often clogged up in the past and this might explain why no water was detected. The possible water ingress was also reported to the classification society, which did not identify any risk to the ship during a computational check of the damaged stability. The forepeak was then to be opened and inspected at the pier in the port of Rostock.

A breathalyser test carried out on board during the crossing revealed no evidence of alcohol consumption by any of the people involved.

The BERLIN made fast at Pier 54 in Rostock at 1100. A preliminary inspection by the chief mate and the chief engineer officer revealed that the starboard side was significantly deformed about 40 cm behind the draught mark, as well as water ingress in forepeak 1. The classification society then issued a prohibition on continuing and arrangements were made for a survey of the underwater hull to be performed. Baltic Taucherei- und Bergungsbetrieb Rostock GmbH, a diving services and salvage company, was requested to assess the damage and make provisional repairs to the cracks in the shell plating through which the water had entered. These works took place on 30/31 July 2016. Measures that once implemented would allow the ship to continue her voyage by the end of 2016 were then planned in consultation with the class with a view to then having the damage repaired properly during a call at the shipyard.

2.3 Sequence of events



2.4 Extent of damage to the ship and pier

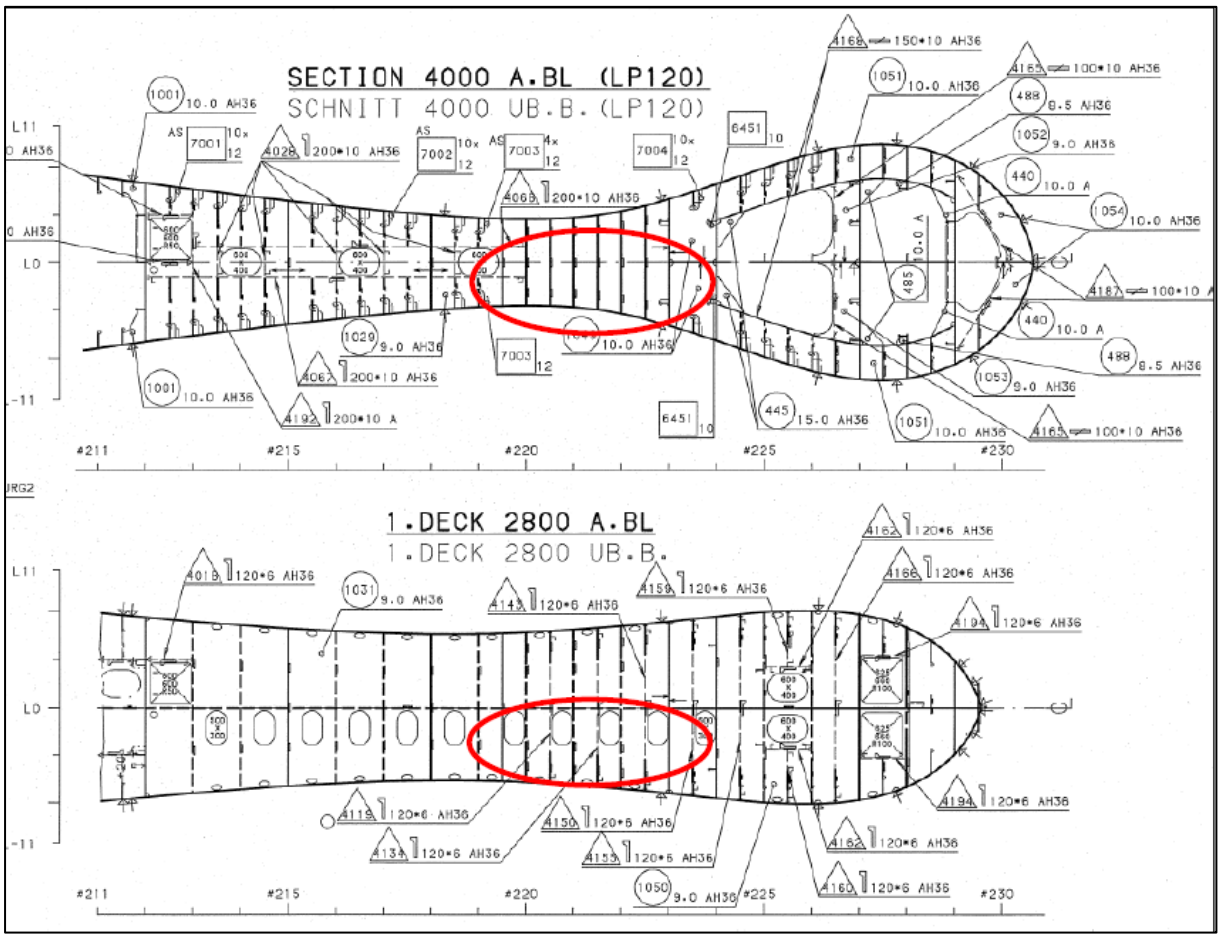


Figure 7: Bulbous bow (longitudinal section)

The indentation on the port side of the bulbous bow had a diameter of about 1.65 m in the area of frames 229/230 and a maximum penetration of 35 cm. The bulbous bow was bent about 2-3° to starboard when viewed from the longitudinal axis. On the starboard side there was buckling at a height of about 4 m in the area of frame 220. Two other cracks also found there were provisionally welded from the outside. This damage pattern resulted in the following repair area: the damage to the ship was limited in the area of the bulbous bow, frame 219.5-223 level with the keel to stringer 1.5.

Specifically, it included

- damage on the starboard side between frame 220 and 220.5; above and below stringer 1;
- damage on the starboard side between frame 220 and 220.5; above stringer 1.5;
- stringer 1 deformed between frame 219.5 and 221.5, and
- stringer 1.5 deformed with longitudinal stiffener between frame 219.5 and 221.5.

A total of three box structures were installed in the area of the cracks and then filled with concrete. Moreover, stiffeners were attached to the deformed stringers.

Source: BALTIC

Figure 8: Deformation of the bulbous bow to port

Source: BALTIC

Figure 9: Box structures in the area of the cracks

3 CONCLUSIONS

3.1 Cause of the allision

According to the analysis of the VDR files and the facts as reported by the chief mate and second officer, the allision with the fender system in the port of Gedser was the result of human error. Due to a constant reduction in the speed of the ship, the fact main engine 1 was still operating and the CPP was still engaged was erroneously overlooked. This accident would not have happened if the checklist for the berthing manoeuvre had been adhered to.

3.2 Closing remarks

The BSU's investigators believe that an accompanying if not even a contributory factor in the accident was the somewhat unconventional arrangement made between the engine-room and the bridge personnel with regard to the maintenance of an engine. The shutdown of MDG 3 followed an altered setup in the overall propulsion system of the ship, which had not been discussed in sufficient detail beforehand. Proactive planning and/or sharing information before setting sail could thus have been incorporated into the voyage planning. The shipping company has undertaken to do this for future cases.

The publication of safety recommendations is not necessary.

4 SOURCES

- Information from the BERLIN (witness testimonies, documents)
- Recordings from the BERLIN's VDR
- Alarm log from the BERLIN
- Photographs from SCANDLINES
- Final report from Baltic Taucherei- und Bergungsbetrieb Rostock GmbH
- Information from inspection of files of the flag State/Ship Safety Division (BG Verkehr)
- Information from the classification society (Lloyds Register)
- Activity reports from Waterway Police Rostock