



**Bundesstelle für Seeunfalluntersuchung**  
**Federal Bureau of Maritime Casualty Investigation**  
Federal Higher Authority subordinated to the Ministry of Transport,  
Building and Urban Development

Investigation Report 391/09

**Very Serious Marine Casualty**

**Fatal accident on board  
the CMV CCNI GUAYAS  
during Typhoon 'KOPPU'  
on 15 September 2009 in the  
sea area off Hong Kong**

**(Including analysis of  
Serious Marine Casualty 520/09  
Pilot injured on board  
the CMV FRISIA LISSABON  
on 16 October 2009 west of  
Borkum on the Westerems)**

1 June 2011

The investigation was conducted in conformity with the law to improve safety of shipping by investigating marine casualties and other incidents (Maritime Safety Investigation Law - SUG) of 16 June 2002.

According to said act, the sole objective of this investigation is to prevent future accidents and malfunctions. This investigation does not serve to ascertain fault, liability or claims.

This report should not be used in court proceedings or proceedings of the Maritime Board. Reference is made to art. 19 para. 4 SUG.

The German text shall prevail in the interpretation of this Investigation Report.

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## **1 Summary of the marine casualty**

At about 0018<sup>1</sup> on the morning of 15 September 2009, a very serious marine casualty occurred on board the full container vessel CCNI GUAYAS, which was sailing under the German flag. During the accident, the 36-year-old Latvian third officer fell and lost his life on board the vessel at 0500.

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<sup>1</sup> Unless stated otherwise, all times shown in this report are local = UTC + 8.

## 2 SHIP PARTICULARS

### 2.1 Photo



Hasenpusch Photo-Productions

Figure 1: Photo of the CCNI GUAYAS

### 2.2 Vessel particulars

Name of vessel:	CCNI GUAYAS, ex Alianca Hong Kong, ex Helvetia, ex Charlotta
Type of vessel:	Container vessel
Nationality/flag:	Germany
Port of registry:	Hamburg
IMO number:	9149328
Call sign:	DPUA
Owner:	Hammonia Reederei
Year built:	1997
Shipyard/yard number:	Kvaerner Warnow Werft/009
Classification society:	Germanischer Lloyd
Length overall:	208.16 m
Breadth overall:	30.04 m
Gross tonnage:	25,608
Deadweight:	34,014 t
Draught (max.):	11.40 m
Engine rating:	19,810 kW
Main engine:	MAN B&W 7L 70 MC MK6
(Service) Speed:	21.5 kts
Hull material:	Steel
Hull design:	Double hull, double bottom
Minimum safe manning:	16



### **2.3 Voyage particulars**

Port of departure:	Anchored at position 22° 17.2'N λ 114°30.7'E
Port of call:	None
Type of voyage:	Merchant shipping/international
Cargo information:	None, in ballast
Manning:	11
Draught at time of accident:	Fore 4.2 m. Aft: 7.7 m
Pilot on board:	No
Number of passengers:	None

## 2.4 Marine casualty information

Type of marine casualty/incident:	VSMC, fatal injury
Date/Time:	15 September 2009/0018
Location:	Sea area off Hong Kong
Latitude/Longitude:	$\phi$ 21°53.5'N $\lambda$ 114°14'E
Ship operation and voyage segment:	Open sea
Place on board:	On the bridge
Human factors:	Yes, human error
Consequences (for people, vessel, cargo, environment and other):	Fatal injury, damage to the vessel

Excerpt from Chart 2701, BSH, great circle chart of the Indian Ocean

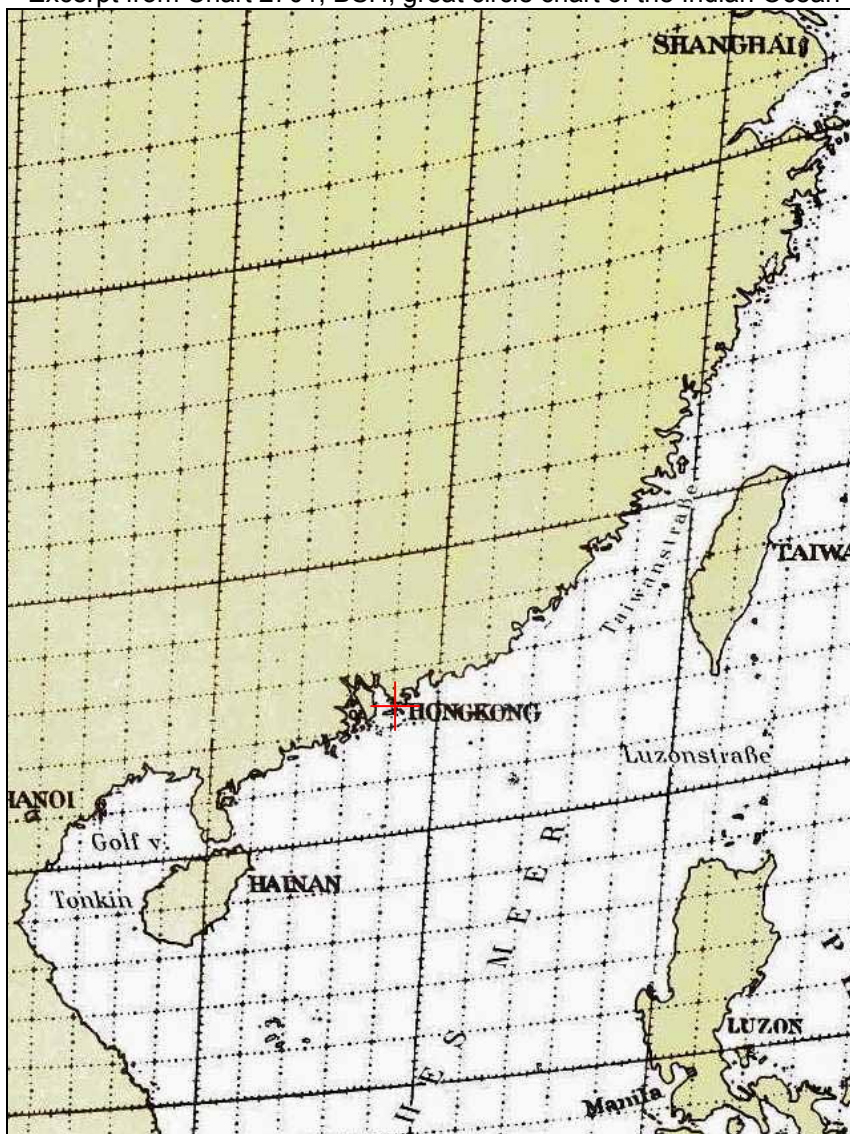


Figure 2: Scene of the accident

## 2.5 Shore authority involvement and emergency response

Agencies involved:	Helicopter from Hong Kong for evacuation
Resources used:	Evacuation of the injured/deceased
Actions taken:	Resuscitative measures
Results achieved:	Injured person lost his life

### **3 COURSE OF THE ACCIDENT AND INVESTIGATION**

#### **3.1 Course of the accident**

The vessel was laid-up at anchor in Hong Kong (HK) waters in accordance with the requirements of the charterer and decision of the owner. According to German law, approval is not required for a vessel to lay-up in this manner and no separate manning certificate is issued. A minimum safe manning certificate was issued by the Ship Safety Division (BG Verkehr)<sup>2</sup> only for single voyages to and from the lay-up position for transferring from the outer HK roadstead to the inner HK roadstead with reduced manning. During the lay-up period, which was prolonged, the vessel never anchored in the outer HK roadstead, but about 1 nm outside HK waters.

The vessel left the anchorage on 14 September 2009 at 1344 due to a typhoon and proceeded to sea.

At about 2000, a heavy storm with wind speeds of 10 Bft and wave heights of 7-8 m prevailed. The vessel rolled violently and the inclinometer on the bridge indicated swings of up to 35°; the vessel was barely able to maintain the course at this time. The heavy rolling resulted in all sorts of objects falling from the shelves on the bridge. This caused the floor to become slippery due to being littered with various papers and objects.

At 0018 after the change of watch, the master and the one deck officer were on the bridge. During the heavy rolling of the vessel, the third officer fell and was thrown across the bridge several times. The third officer was then placed on the watch chair and was still responsive, but subsequently passed away during the night of the accident.

At about 0630, the officer was evacuated by helicopter. The vessel proceeded to HK later on, where during a survey Germanischer Lloyd found considerable damage to the vessel caused by the sea conditions.

#### **3.2 Investigation**

The BSU was immediately informed about the accident by the owner on 15 September 2009. The recordings of the voyage data recorder, a VDR RUTTER 100 G2, and the notes of GL about the damage on board were available for the investigation.

The written statements of the crew made before the Hong Kong Police Force and the death certificate issued by the Hong Kong Births and Deaths General Register Office were handed over to the BSU.

In March 2010, a meeting was held with the master of the CCNI GUAYAS and the trainee ship mechanic at the premises of the owner in Hamburg.

##### **3.2.1 Consequences of the accident**

During the accident, the third officer lost his life as a result of the fall.

The vessel sustained considerable damage. It is clear from the damage report of Germanischer Lloyd dated 22 September 2009 that, for example, the crane hooks of the cranes at Hatch 1 and Hatch 2 tore off and cannot be found and the crane jib storage brackets, the railing, the emergency exit doors in the engine room and

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<sup>2</sup> See-BG until 01/01/2010

workshop and various navigating equipment on the bridge sustained damage. While testing the steering gear it was found that Steering Gear Pump No. 1 is faulty.



Figure 3: Steering gear compartment



Figure 4: Air conditioning systems compartment



### 3.2.2 Weather report

The BSU requested an official report on the wind and sea conditions in the South China Sea between Hong Kong and the scene of the accident from the Maritime Division of Germany's National Meteorological Service (DWD) for the period from 1200 on 14 September 2009 to 1000 on 15 September 2009. The report contains the following summary.

The weather situation was marked by a tropical low pressure system, which on the evening of 13 September 2009, at about position 20° N and 118° E, was referred to as a tropical storm named KOPPU. The path of the intensifying storm system showed west-north-west and typhoon status (mean wind speed >63 knots) was reached during the course of 14 September 2009. At a distance of about 60 nm in a SSW direction, the centre of KOPPU was at its closest to the position of CCNI GUAYAS at about 2000. The typhoon reached its peak just off the coast at a position of about 21.5° N and 113° E at approximately 0600 on 15 September 2009.

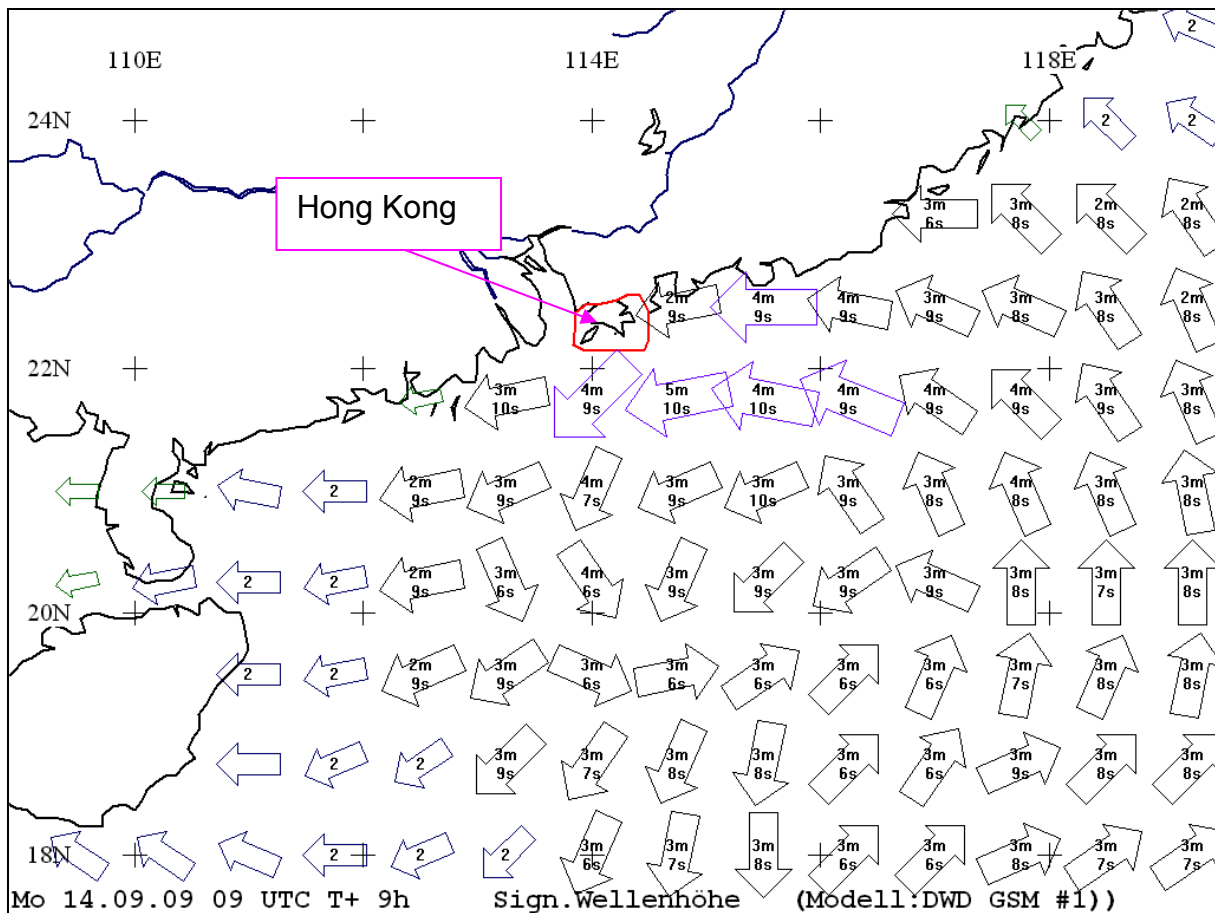


Figure 5: Wave heights and periods

The wave heights and wave periods for the sea area around Hong Kong at 0100 local time on 14 September 2009 are shown on the above chart.

As a result of the path, the wind turned right in relation to the position 22° N 114.5° E. Based on the reports of a vessel in close proximity and shore stations, the expected significant wave height of the swell was estimated:

Ref.: 391/09 and 520/09

Time HKT	Wind direction	Wind force (Bft)	Sig. wave height
14/9 1200	NE	Around 5, increasing	Around 4 m due to high level of swell
1400	NE	7 to 8 Bft	Around 5 m due to high level of swell
2000	NE	8 to 9 Bft	5 to 6 m
15/9 0200	NE to E	9 to 10 Bft, gusts 12	Around 6 m
0800	SE to S	Around 9, decr., gusts 11	6 m, decreasing to 5 m
1000	S	6, gusts 9 decr. 8	5 m, decreasing to 4 m

In the early morning of 15 September 2009, the heaviest wind forces came from the east at 10 to 11 Bft with gusts of 12 Bft and the highest significant wave height was 6.70 m, with individual waves exceeding a height of 10 m.

The development of the tropical low pressure system to a typhoon occurred in only 24 hours with the storm system covering about 230 nm. Warnings by official agencies in Hong Kong were issued for the city for the first time on 13 September 2009 at 1235.

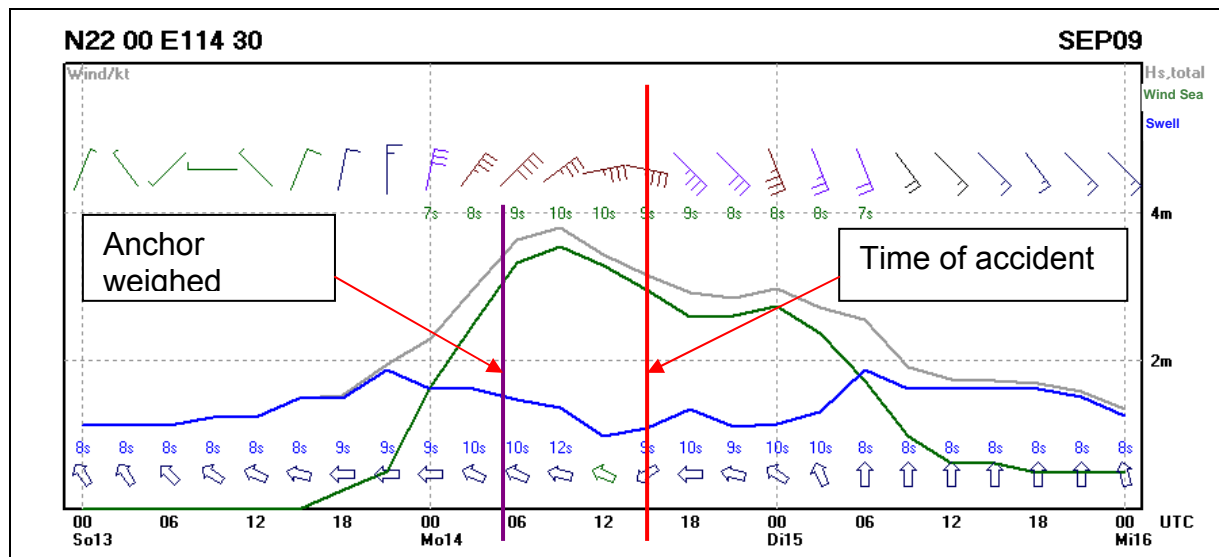


Figure 6: Wind sea, swell and wind speed

The vessel left the anchorage on 14 September at 0544 UTC. The accident occurred on 15 September at 0018 local time = 14 September at 1618 UTC.

### 3.2.3 Recordings of the voyage data recorder (VDR)

The CCNI GUAYAS is fitted with a 100 G2 voyage data recorder made by the company Rutter. The downloaded data were available for the analysis of the accident. The recorded radar images, positions, speeds, headings and the audio recordings are consistent with the witness statements.

From the exported VDR data it is apparent that the vessel was proceeding at a very low speed of about 2 kts over ground at the time of the accident. The times are stored in the VDR in GMT/UTC. The time of the accident 1618 (GMT) is equal to 0018 local time (Fig. 6).

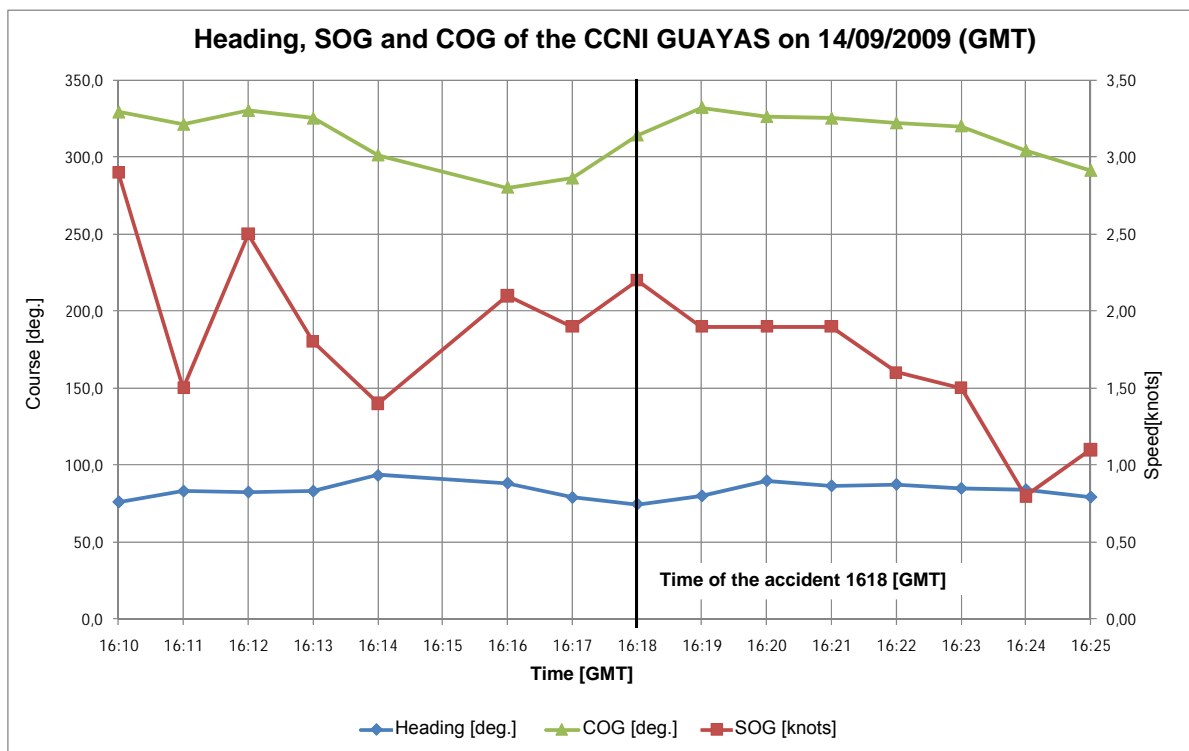


Figure 7: Analysis of the VDR data

The heading and the course over ground (COG) differ substantially from each other, in the order of 90°-100°. This means that the vessel must have had considerable problems in actually keeping her course. On the following chart, Figure 8, the heading is marked as a solid line and the course over ground (COG) as a dashed line. These variations can be explained by the load condition. The vessel had no cargo on board and sailed with ballast; due to the low draught, her immersed surface area was minimal in relation to her windage area. Added to that, due to the immersion of the vessel the semi-balanced rudder offered little effective rudder area, respectively, left the water at times, due to which a propeller flow was virtually absent. It was necessary for the vessel to steer a particular course for practical reasons; however, this was not steerable and could not be maintained.



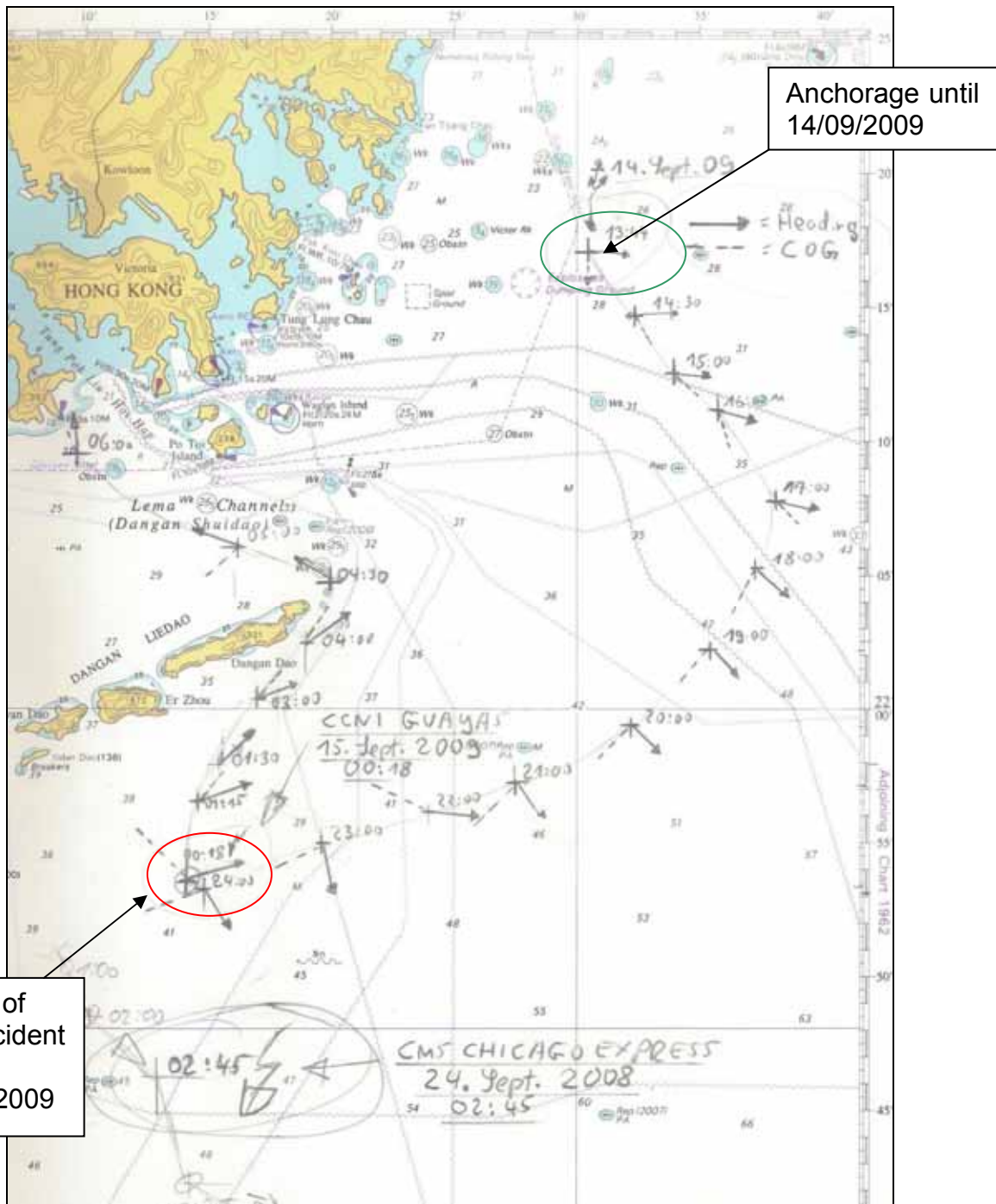


Figure 8: Positions and courses of the CCNI GUAYAS

No irregularities are visible in the recorded data at 0018, the time of the accident. Since no roll angles are recorded in the VDR, the data provide no direct information about the course of the accident. The fact is that the vessel sailed at an extremely low speed, had problems keeping her course and according to statements given rolled very heavily.

### 3.2.4 Course of the accident according to the crew

The vessel had been moored as a hot lay-up<sup>3</sup> at the anchor position outside the Hong Kong roadstead with no cargo and in ballast from 31 July 2009. On 13 September 2009, a tropical storm was forecast with wind speeds of up to 40 kts. When severe gale warnings were issued on 14 September 2009 with the path of the storm predicted to pass west of Hong Kong and swell increasing significantly, the anchor was weighed at 1342. The intention was to proceed to the east away from the path of the storm. Other vessels also weighed anchor and headed east. Due to heavy traffic, it was not possible to steer a course which ran directly to the east. The weather and sea conditions deteriorated continuously; 9 to 10 Bft was measured at 1800 and wind speeds of 65 kts at 2000. It was not possible to maintain the vessel's course; accordingly, the heading deviated from the actual course over ground by more than 100°. The rolling motions increased significantly; at 2100, the pointer on the scale of the inclinometer was at the limit stop at 35° and roll periods of 8 seconds were measured. During this period, all the books, files and papers fell from the cupboards and shelving and slid back and forth on the floor of the bridge.

According to the schedule, the watch was to be taken over by the 36-year-old third officer at midnight. A 29-year-old AB (able bodied seaman) reported to the bridge at 2350 to assist the third officer shortly before the third officer appeared on the bridge. However, the third officer ordered the AB to leave the bridge and don sturdy working shoes because he was only wearing open sandals when he appeared on the bridge. When the AB left the bridge, the third officer was standing amidships on the bridge at the radio workstation and held on firmly with both hands while the 60-year-old master sat on the starboard side in front of the radar equipment and held on to the handrail there.



Figure 9: Bridge after the accident

<sup>3</sup> Hot lay-up = laid-up vessel with main engine at the ready and reduced manning

More and more objects fell to the floor in addition to the items already there, which slid back and forth, and the master said he noticed how the third officer bent down to collect something lying on the ground. Shortly afterwards, he heard a scream and saw the third officer sitting on the floor with his legs forward sliding to the port side, where he struck the radar transponder and a radiator.



Figure 10: Damage on the port side

He tried to hold on to the radiator, but did not succeed and slid across the floor to the starboard side and struck the bridge door unchecked with his face.

As the third officer slid to the port side again while the vessel was rolling, the master grabbed hold of the injured person and secured him in the area of the chair. The third officer was responsive and lay with his legs in the direction of port, but was unable to hold on unaided and said he was in considerable pain. Shortly after the accident, the AB entered the bridge wearing other shoes and had great trouble crossing the bridge to reach the injured person. The third officer believed he had broken one leg and his left wrist. He said he was in severe pain and asked for pain medication. The master and the AB pulled the third officer into the chair on the starboard side that the master had been using previously. The AB secured the third officer in the chair. Later, the third officer laid both legs on the console in front of him, from which the master concluded that his legs could not be broken. The only visible injury was a 15 cm graze on the lower left arm, which was hardly bleeding and did not look very serious. The third officer was able to speak at the time, was able to comprehend what was happening around him and was persuaded to drink a little water.

Later, his face started to lose colour and the AB said that his body became colder. A fire alarm, which was not switched off because the master was afraid of losing control of the vessel, sounded at about 0130. After a while, the 21-year-old trainee ship mechanic (SM trainee) entered the bridge to see why the alarm was still on. After the alarm was switched off, the SM trainee was sent from the bridge to collect the first aid equipment. After returning, the casualty was given two 500 mg paracetamol tablets dissolved in a water bottle. The third officer wanted stronger pain medication, but this was refused by the master because of his condition.

At about 0400, as they drifted close to Dangan Dao Island, the casualty stopped talking, but occasionally made noises with his throat and looked like he was asleep. The AB, who held the casualty on the chair, said that he reportedly became even colder, that his pulse was very weak and that he had reportedly stopped breathing. Since the sea had calmed somewhat, the casualty was laid on the floor and the AB and SM trainee began cardiopulmonary resuscitation.

At about 0500, the master called the Hong Kong Marine Department by radio and sought permission to enter Hong Kong waters. At the same time, a helicopter was requested in order to evacuate the third officer for emergency treatment.

The resuscitation measures carried out on board were unsuccessful. The third officer was evacuated from the port bridge wing at 0639 by the helicopter and the death was officially recorded on 15 September 2009 at 0910.

### **3.2.5 Sailing permit and minimum safe manning certificate**

The CCNI GUAYAS was in possession of a sailing permit issued on 28 January 2008. This is valid until 31 January 2013 for unlimited voyages. When applying for a minimum safe manning certificate for this shipping range, the owner stated that a three-watch system was to be implemented at sea and in port with minimum manning of at least 16 crew members on board. Following that, a minimum safe manning certificate valid until 31 January 2013 for unlimited voyages with a 16 man minimum crew was issued on 4 February 2008.

According to the owner, the vessel was moored as a hot lay-up vessel on 29 June 2009 with reduced manning in the outer Hong Kong roadstead and only moved to the inner Hong Kong roadstead for crew signing-on engagements as well as to take on supplies and fresh water. Minimum safe manning certificates with reduced manning were requested from the Ship Safety Division (BG Verkehr) only for these voyages from the outer roadstead to the inner roadstead and back.

The area of operation in these approved certificates is described as "*Single transfer Hong Kong outer roadstead to Hong Kong inner roadstead and back*" and limited to this short period of shifting. The minimum safe manning certificate for the move on 29 April 2009, validity from 29 April to 1 May 2009, was requested for 11 men. (master, second officer, third officer, chief engineer, electrician, three men with watchkeeping licence (deck), two men with watchkeeping licence (engine), and one cook.)



The last certificate issued for such moves before the accident was valid from 31 July to 2 August 2009 and the vessel was manned with 11 men for this move as follows: master, third officer, chief engineer, electrician, three men with watchkeeping licence (deck), two men with watchkeeping licence (engine), one trainee ship mechanic (2nd year) and one cook.

A minimum safe manning certificate was requested from the Ship Safety Division (BG Verkehr) by fax at 1105 on 15 September 2009 CEST (1705 on 15 September 2009 local time in Hong Kong) for the move in which the accident took place.

### 3.2.6 Working hours

The third officer joined the vessel with a 6-month contract on 28 April 2009. Since he was the only officer in charge of navigational watch on board on the day of the accident, two watches were operated, which he shared with the master. His watch ran from 0000 to 0600 and again from 1200 to 1800. According to the log book and time sheets, the watch and rest periods were routinely observed.

### 3.2.7 Load condition according to the shipboard load computer

The CCNI GUAYAS is equipped with a 'Cargo Assistant' load computer made by the company Clearwater Software & System Service GmbH. According to the printout, the tank list submitted by the owner is from 5 October 2009 and the mass balance from 15 September 2009. Below are four figures with the ballast load condition at the time of the accident:

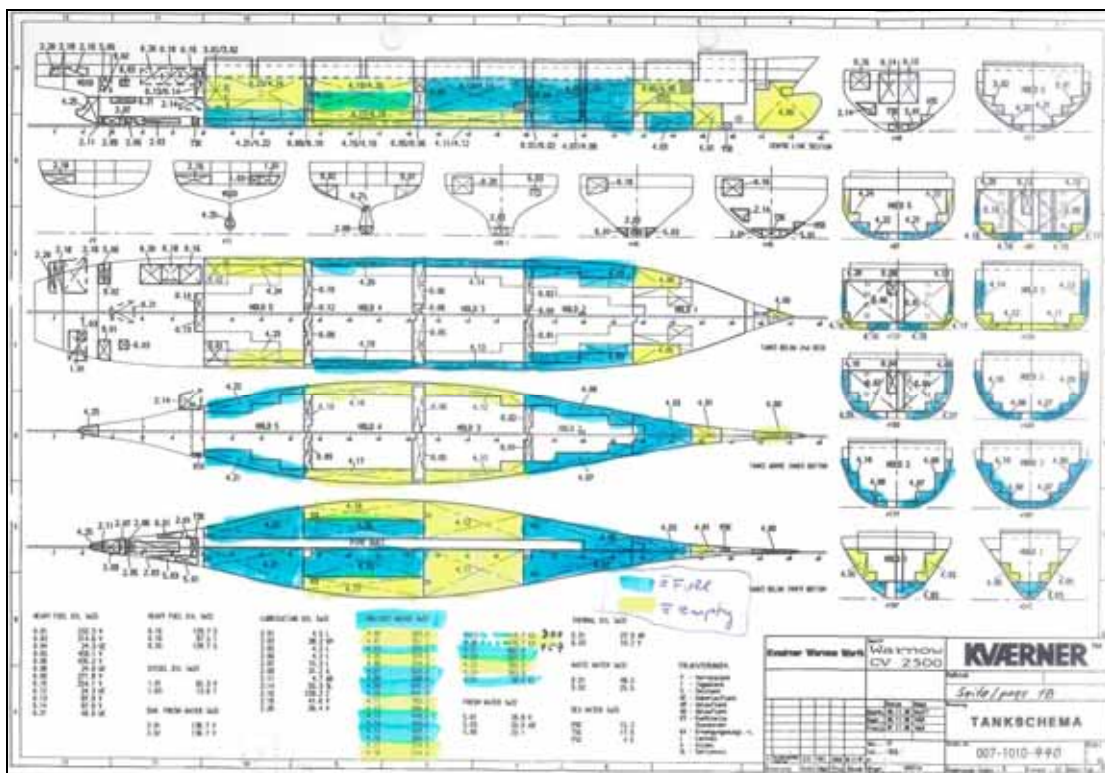


Figure 11: Tank plan; ballast full = blue, empty = yellow

CCNI Guayas; DPUA; 9149328							
Op: Voy. No. 000W from HKHKG to HKHKG				Results & Ship Data			
<b>Weights &amp; Moments</b>							
Item	Weight[t]	LCG[m]	LMom[tm]	VCG[m]	VMom[tm]	TCG[m]	<sup>1</sup> TMom[tm]
Lightship	10500.00	80.32	843348	11.80	123900	-0.02	-161
Heavy Fuel	612.79	65.82	40333	8.20	5023	4.76	2919
Diesel Fuel	47.88	6.03	289	14.08	674	-8.87	-425
Lubrication Oil	75.91	3.66	278	13.84	1050	9.11	691
Fresh Water	200.80	42.34	8502	7.83	1572	4.75	954
Ballast Water	6443.84	108.75	700797	4.63	29865	-0.52	-3347
Miscellaneous	53.64	31.36	1682	2.30	123	-2.14	-115
Container Deck	0.00	0.00	0	0.00	0	0.00	0
Container Hold	0.00	0.00	0	0.00	0	0.00	0
General Cargo	809.00	75.63	61187	16.59	13422	-0.10	-80
Deadweight	8243.86	98.63	813067	6.27	51729	0.07	597
Displacement	18743.86	88.37	1656416	9.37	175629	0.02	436
<sup>1</sup> positive values for port side; negative values for starboard side							
<b>Draught &amp; Trim</b>							
Seawater Density	1.025 t/m <sup>3</sup>	Immersion	40.257t/cm	Keel Plate Thickness	0.0190m		
Relative Propeller Immersion	109%						
	below Keel			moulded			
	aft	mid	fore	aft	mid	fore	
Perpendiculars	7.471m	5.720m	3.969m	7.452m	5.701m	3.950m	
Marks	7.448m	5.971m	4.107m	7.429m	5.952m	4.088m	
Load Line Summer Limit	<=11.438m			<=11.419m			
at LCF	5.760m			5.741m			
LCG	88.37m	LCB	88.49m	LCF	93.46m		
Trim <sup>1</sup>	-3.502m	>=-6.000m*	Trimming Lever <sup>2</sup>	0.000m	MCT	37077.5mt/m	
Visibility Conning Position	at 14.60m from AP, 39.87m above BL			Obstruction Point	Wavebreaker Forecastle at 185.01m from AP, 24.60m above BL		
Blind Length:	267.64m	< SOLAS:	416.22m				
	< Panama: 208.11m						
<sup>1</sup> negative (-) by stern; positive by head <sup>2</sup> applies to fixed trim calculations only							

Figure 12: Tank content and draughts

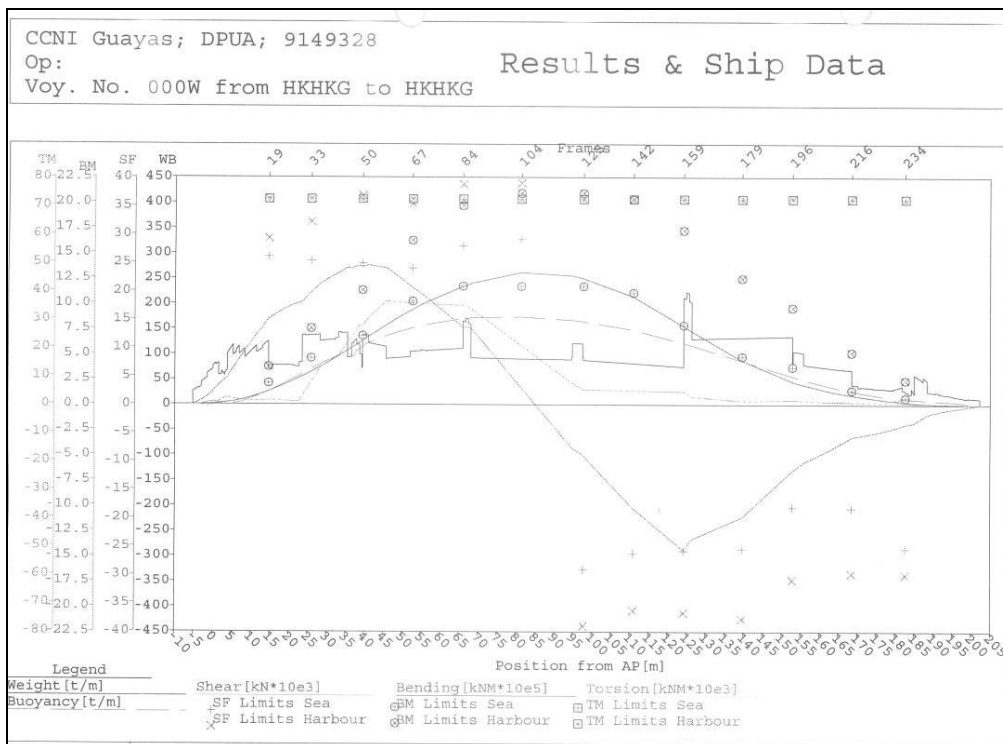


Figure 13: Longitudinal strength and bending moments



Ref.: 391/09 and 520/09

- Is the strategy of steering into the typhoon feasible, respectively, how could one have avoided it with preventive hurricane navigation?
- Is the ballast load condition for today's container vessels actually conceived for operating on unlimited voyages or only for shifting near the coast?
- Are today's bridges set up for short roll periods and high roll angles in terms of handrails, lashing points, etc.?

In addition, the longitudinal bending moments were to be recalculated and checked. The excerpt of the ballast load case from the shipboard load computer, tank plan, general arrangement plan and lines plan were available for the calculation at the TUHH.

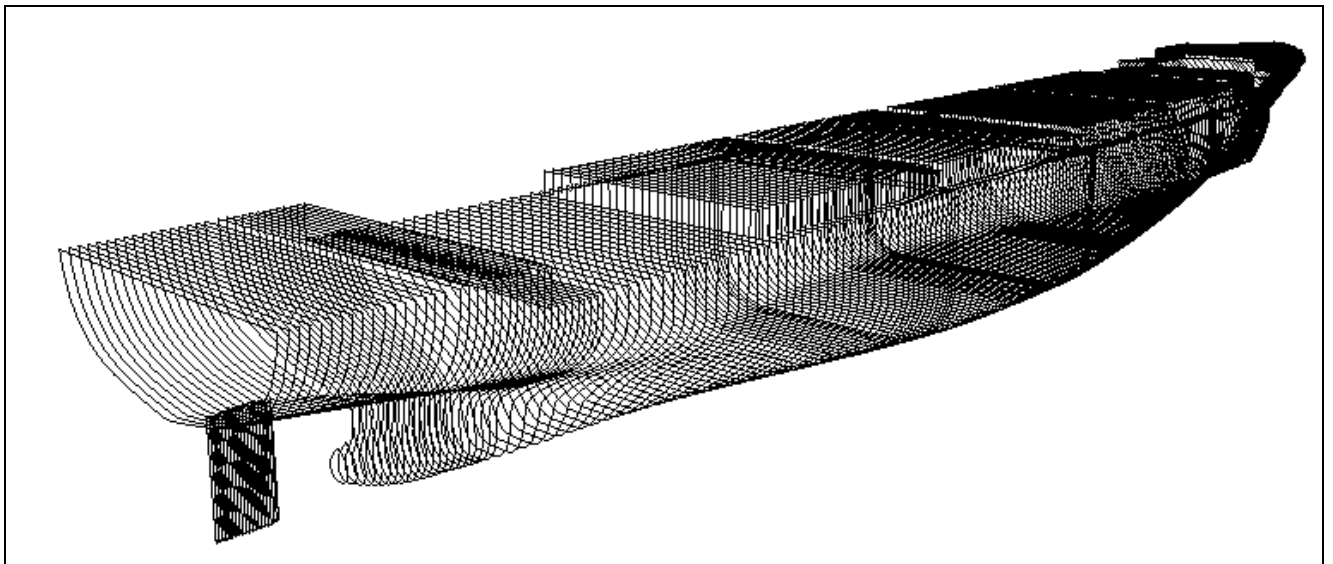


Figure 15: Calculation model for the CCNI GUAYAS



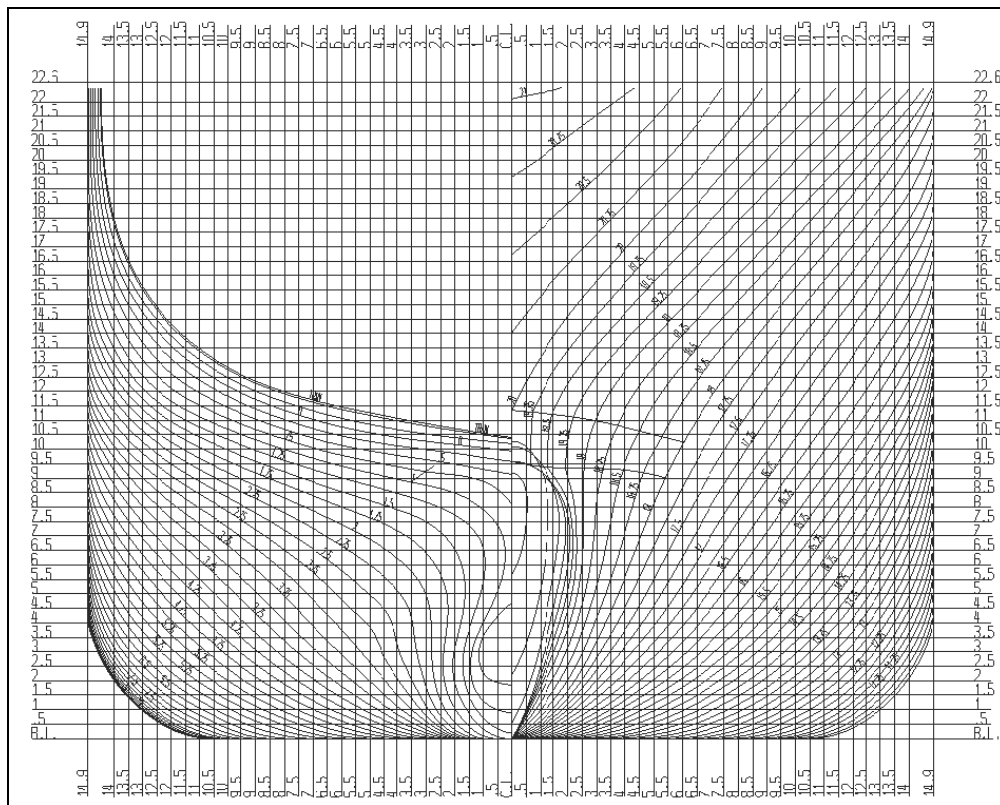


Figure 16: Framing plan

The calculations at the TUHH were made using the E4 calculation software. Deviations from the shipboard computer on the basis of the different software in the order of 2 cm for the draught and 4 cm for the GM are negligible.

### 3.2.8.1 Calculation of the longitudinal strength and stability

The accuracy of the shape of the vessel and load condition were recorded sufficiently via the simulation and, as with the load computer, the calculations of the TUHH have revealed that the longitudinal bending moments at frames 104 and 125 are significantly exceeded. Accordingly, in formal terms the vessel should not have set sail. The permissible loads were adhered to for the port condition, but not for the so-called 'sea-going condition'. To maintain the longitudinal strength, the vessel should have taken on additional ballast water; however, this would have meant that her stability would have been even higher. During the calculation, special emphasis was placed on the interaction between longitudinal strength and stability, especially when the vessel was moving with ballast. At the same time, an examination was to be made on whether practicable technical possibilities exist at all for ballasting a modern container vessel without cargo so that a seaworthy condition is established from the perspective of stability.

The righting levers curve calculated by the TUHH with the load condition 'Ballast and little cargo' on the day of the accident is shown below in Figure 17:

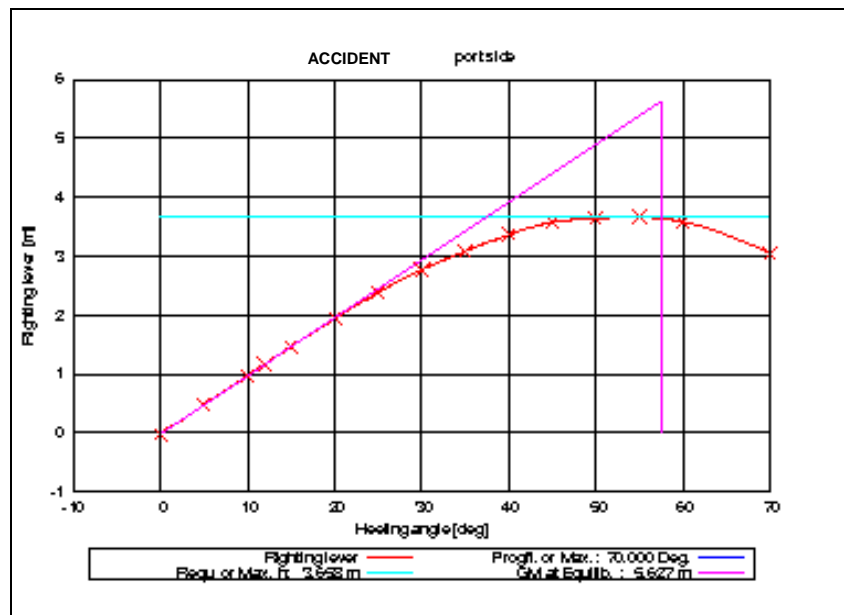


Figure 17: Righting lever curve

With a GM of more than 5.60 m, the vessel's stability in smooth water is more than adequate.

To examine the overall risk of parametrically excited roll oscillations, too, by way of example the righting levers were calculated at the midship section for the conditions 'trough' and 'crest' using an equivalent wave. For an equivalent wave which corresponded approximately to the wave on the day of the accident, a sine wave of 140 m in length (about 9.5 s) and 7 m in height was chosen. The calculations revealed that the differences between the crest and trough situation and also the comparison with the smooth water calculation were very low and the curves do not differ considerably. These slight variations are caused by the fact that the vessel was underway with a draught which was much shallower than the moulded draught. In the case of the crest, this results in a degree of additional hydrostatical stability; on the other hand, this floating condition coupled with a prominent bow flare causes the vessel to become prone to the effect of direct swell moments especially in the aft area. However, the result shows that the parametrically induced roll moments are relatively low. Therefore, the direct exciting moments from the swell in conjunction with the particular sea-going behaviour of modern container vessels at very shallow draught can be viewed as the actual cause of the accident.

### 3.2.8.2 Investigation of the roll oscillation

Based on witness statements, the vessel must have experienced a roll angle of 35° and thus considerable transverse accelerations on the bridge. Therefore, in addition to the present stability analysis, the roll behaviour was considered with the E4ROLLS simulation program at TUHH. Based on the shape of the hull and the distribution of ballast, the linear transfer functions were calculated. The cuboid in the diagram below corresponds to an equivalent that has the same mass inertia.

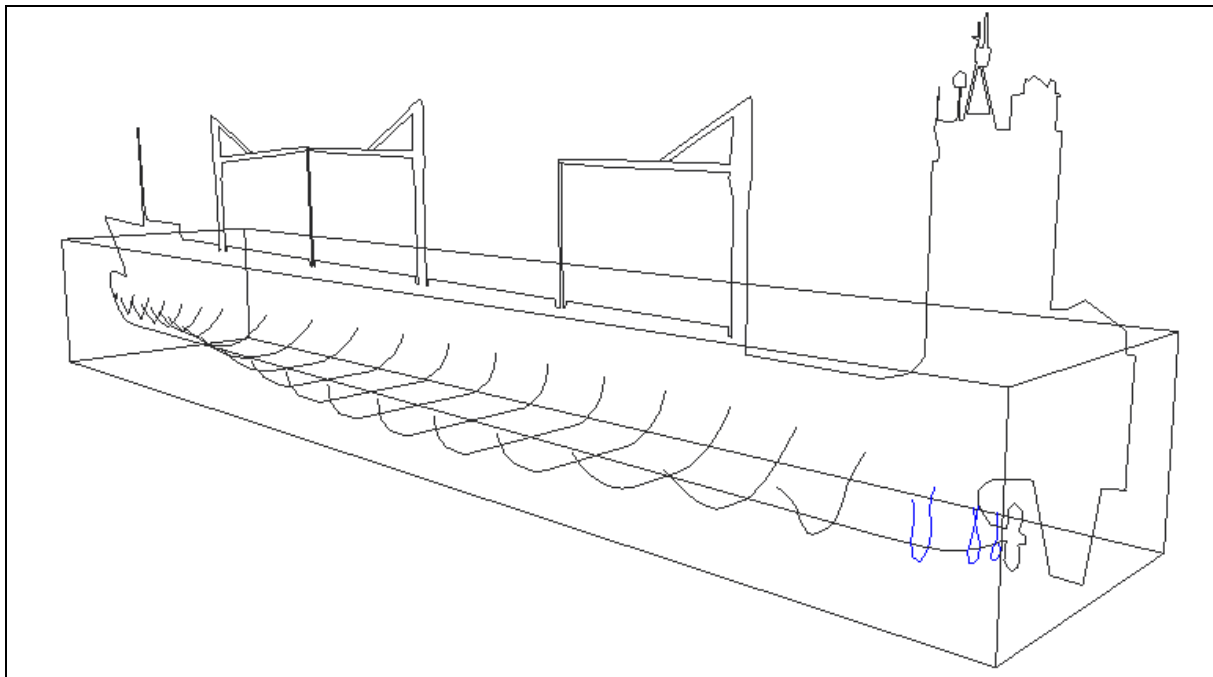


Figure 18: Model for determining the linear transfer function

To calculate the mass moments of inertia of the empty vessel, the longitudinal grid was used differentiated by the bending moments. Consequently, a roll inertia radius was determined for the CCNI GUAYAS of  $0.39 \times$  breadth when in dry condition without the proportion of hydrodynamic masses and  $0.44 \times$  breadth with the hydrodynamic proportion. These values are feasible due to the distribution of mass and especially the cranes on deck. This gives a roll period in smooth water of about 10.7 s, which, due to the lever arm characteristics of the vessel, is valid up to about  $20^\circ$  and the roll period then increases above  $20^\circ$ .

The roll angle on board is not recorded on the voyage data recorder, or otherwise. Only a non-calibrated inclinometer is available on the bridge. The information given by the crew that roll angles of  $35^\circ$  were present was calculated and reviewed for various situations. Significant wave periods of 9.5 s, 9.0 s and 8.5 s were used for the calculation; these correspond to the range of swell conditions on the day of the accident specified by the DWD. To being with, a calculation was made of the conditions under which roll angles of  $35^\circ$  would have occurred at a speed of less than 7 kts.

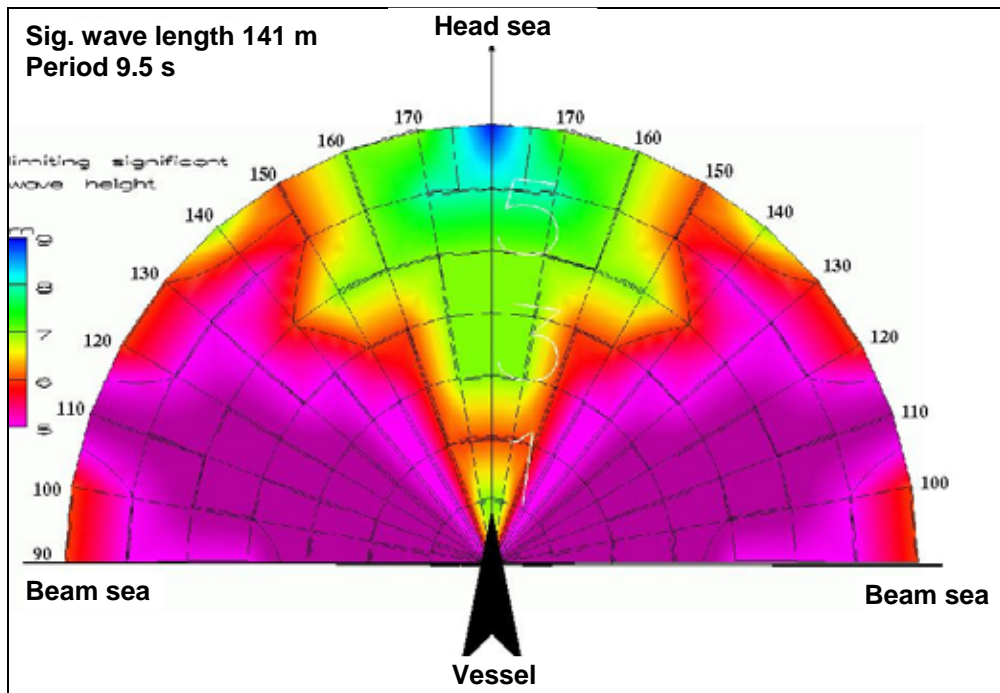


Figure 19: Sea state polar coordinate diagram, 141 m wave length and 9.5 s period

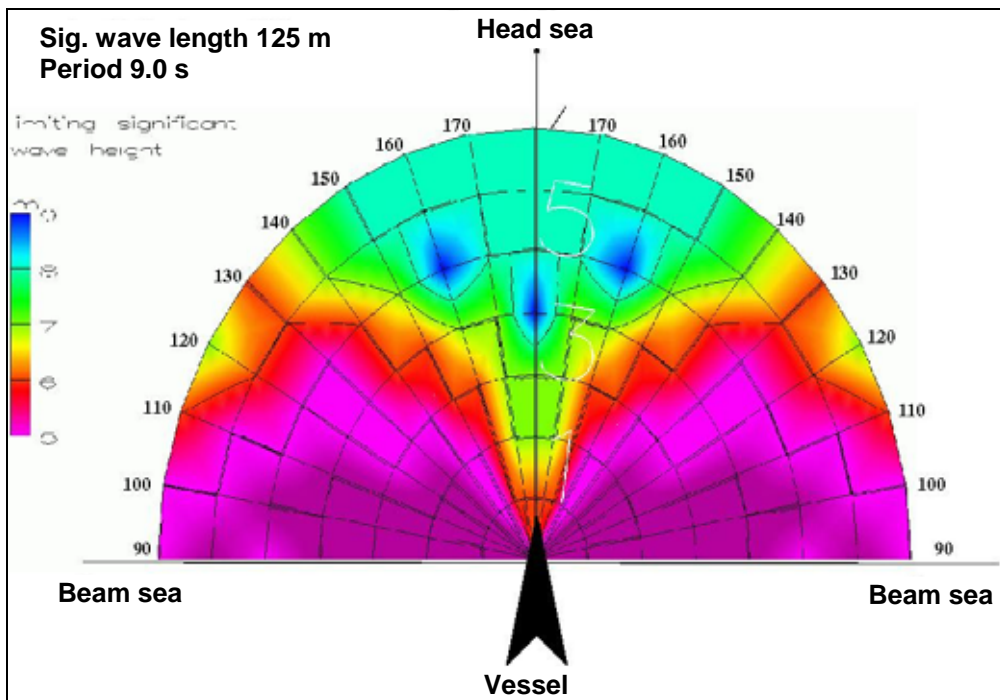


Figure 20: Sea state polar coordinate diagram, 125 m wave length and 9.0 s period

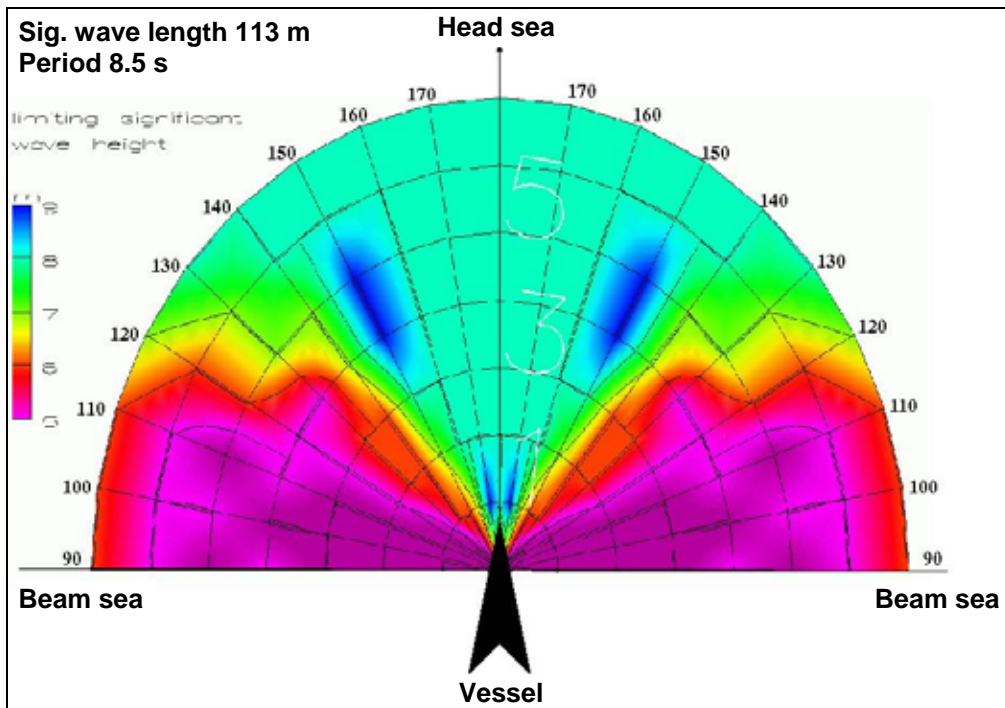


Figure 21: Sea state polar coordinate diagram, 113 m wave length and 8.5 s period

The above three polar coordinate diagrams show the calculated significant wave height [m] necessary for the occurrence of a roll angle of  $35^\circ$  with a characteristic period [s] and the significant wave length [m]. The vessel is steering to the north. The waves are approaching from the direction indicated by the radial axis. The rings indicate the speed of the vessel [kts] and the coloured legend shows the significant wave height [m].

The result of all three calculations show that as long as the crew sailed the vessel in stern seas, the wave heights required for reaching a roll angle of  $35^\circ$  are relatively high (greater than 8 m). However, if the waves come from a sufficient incident angle transverse to the longitudinal direction, larger roll angles of more than  $35^\circ$  would definitely be caused by wave heights of 5 to 6 m, as was the case on the day of the accident. The severe rolling motion is caused by the considerable roll moments applied to the vessel; here, resonances or parametric excitation have no effect. The slow speed on the day of the accident of about 2 kts also appears to play a role. To illustrate that, a higher speed of up to 15 kts is considered for the period 9.5 s.



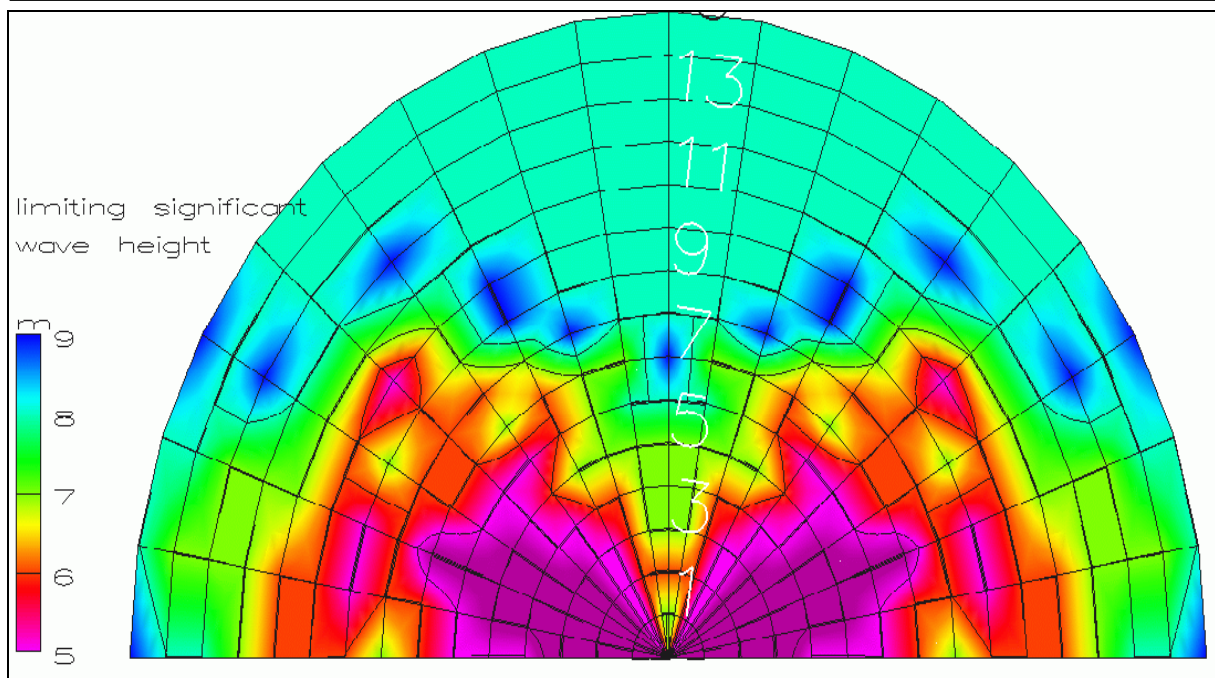


Figure 22: Polar coordinate diagram up to 15 kts

This calculation shows clearly that severe roll angles occur only below a certain speed.

### 3.2.8.3 Investigation of the transverse acceleration

It was found while reviewing the stability book on board the CCNI GUAYAS, which was approved by Germanischer Lloyd on 26 August 1998, that the classification society had appended the following remark:

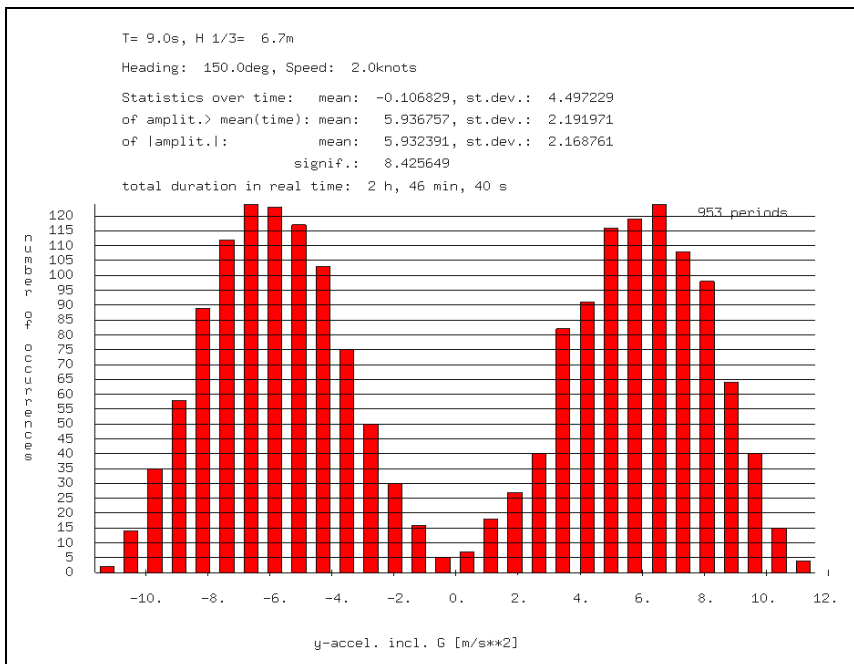
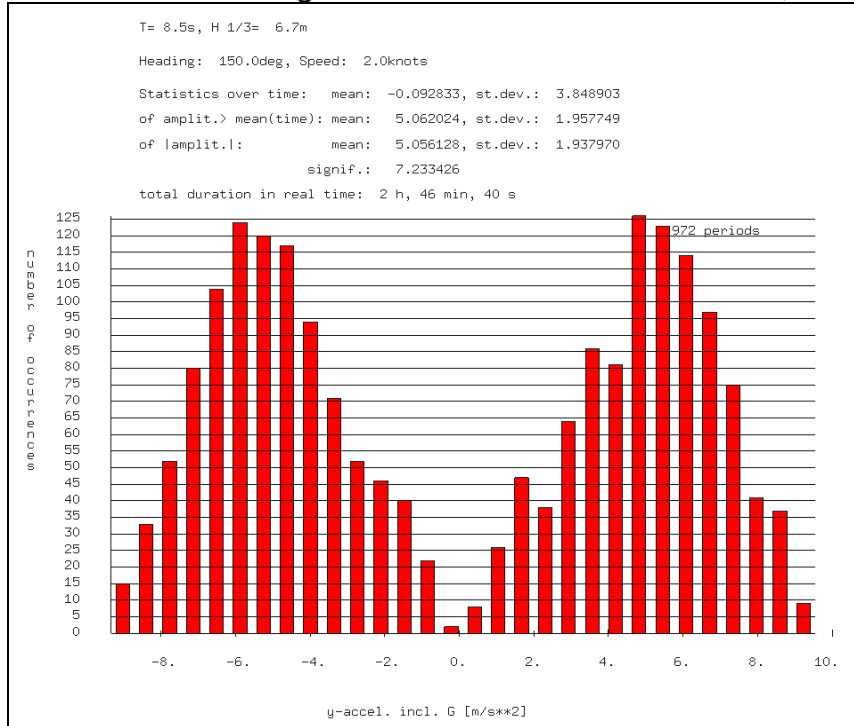
"REMARK: SEVERAL STABILITY CASES ARE NOT COVERED BY APPROVED LASHING SYSTEM. FOR CONTAINER STOWAGE THE APPROVED CONTAINER SECURING MANUAL IS TO BE OBSERVED"

The accompanying letter made explicit reference to this remark when the stability book was re-submitted due to the addition of supplementary load conditions.

To the expert, it is unequivocally clear from this that the institution that approved the stability book made an indirect reference to the fact that the vessel could be subjected to accelerations in certain stability cases, which are not covered by the approved lashing system. These stability cases are not mentioned explicitly and the stability book was approved without limitations immediately recognisable for the crew. Therefore, it seems to be important to determine the accelerations on the bridge for the ballast case (Ship without cargo, end of voyage) identified by the approved stability book for guidance for the crew. Since it can be presumed that in addition to the severe roll angles calculated above, considerable transverse accelerations must have also acted on the vessel on the day of the accident, the transverse accelerations acting on the bridge are looked at below.

According to the general arrangement plan, the floor of the bridge deck is located 37.92 m above the base/keel. The centre of gravity for the crew members on the bridge is assumed to be 1 m above the floor of the bridge deck.

The accelerations acting on the people on the bridge were calculated for the significant roll periods 8.5 s, 9.0 s and 9.5 s at a vessel speed of 2 kts and an encounter angle of 150° (waves approaching at a 30° angle from ahead), which corresponds to the accident situation. Calculations with waves approaching from further abeam brought no fundamental changes. In the following three figures, the accelerations are shown as histograms with a simulation time of 10,000 s:



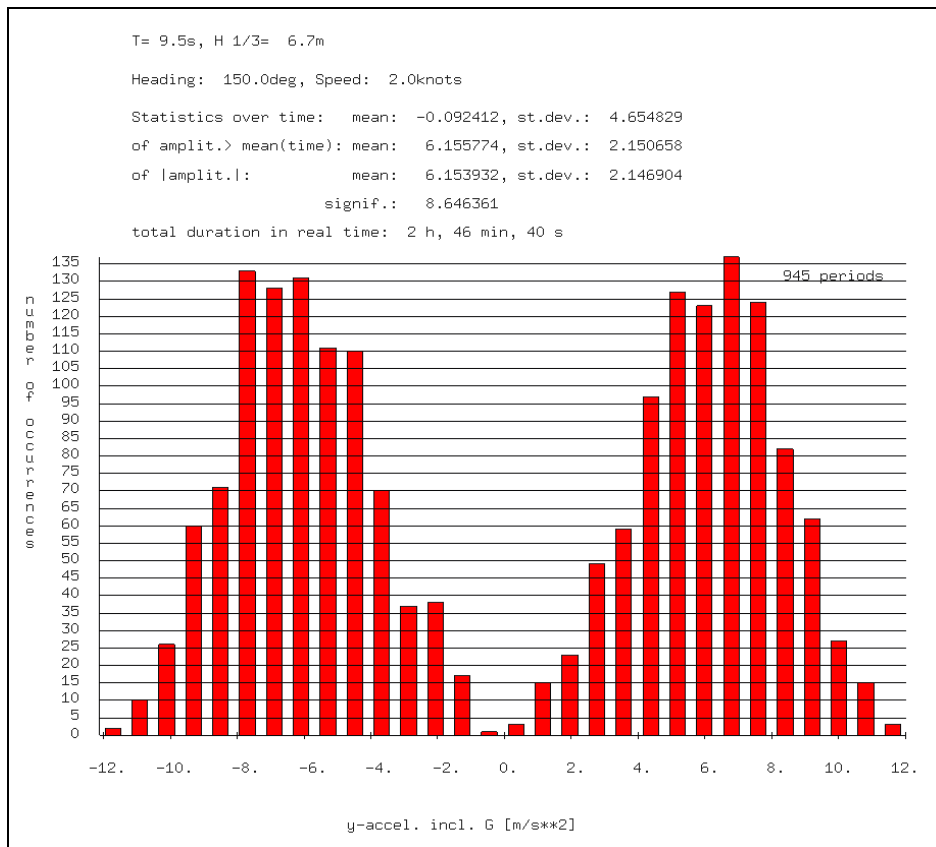


Figure 23: Frequency distribution of transverse accelerations on the bridge

The calculations show that considerable transverse accelerations must have acted on the bridge. In the case of the period of 9.5 s which probably applied on the day of the accident, transverse accelerations of more than 12 m/s<sup>2</sup> are reached, which corresponds to about 1.3 g. Even when looked at more favourably, 10 m/s<sup>2</sup>, respectively, more than 1.0 g is reached. For comparison: the load on typical lashing equipment is dimensioned with 0.5 g transverse acceleration.

At this high acceleration, the question of whether the existing bridge design is adequate in terms of hand bars and lashing points for reducing the high accident risk arises.

### 3.2.8.4 Effect of the high GM on the accident

The CCNI GUAYAS was proceeding with ballast, with no cargo and with few supplies on the day of the accident. The vessel would have needed to carry less ballast water to reduce stability and in the theoretical worst case she would have proceeded with no ballast whatsoever.



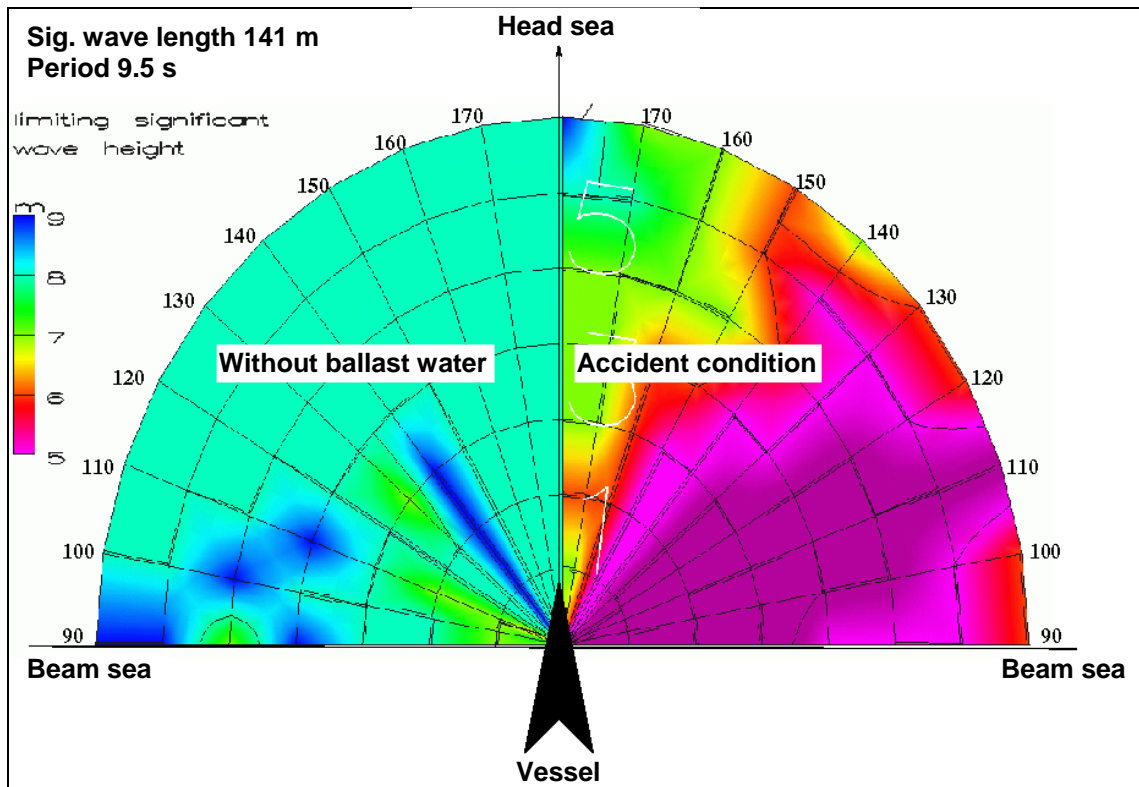


Figure 24: Polar coordinate diagram with/without ballast water

Included in the analysis were the significant wave length at 141 m, the roll angle at 35°, and the significant period at 9.5 s that prevailed on the day of the accident. On the top polar coordinate diagram the condition without ballast water is shown on the left and the condition of the vessel on the day of the accident on the right. The results of the calculations show that for the load condition 'Without ballast water', both the roll angle (Fig. 24 above, left of polar coordinate diagram) and the accelerations (Fig. 25 below) decrease very significantly.

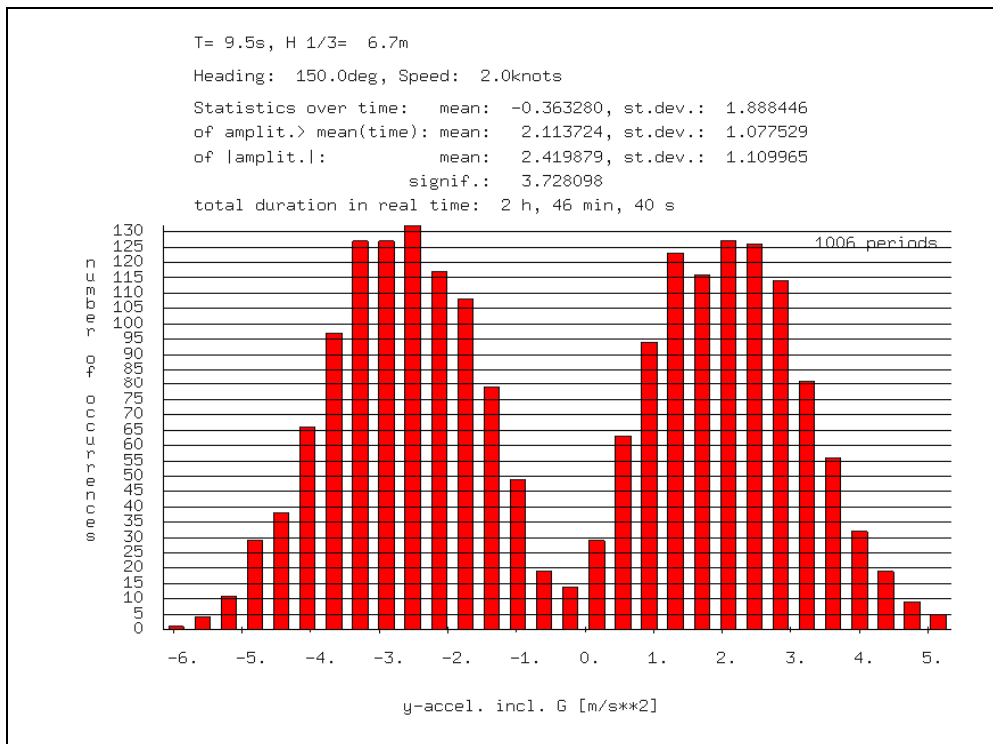


Figure 25: Vessel without ballast

For the presumed speed of 2 kts with swell approaching at a 30° angle from ahead, the maximum accelerations calculated according to the histogram are between 0.53 g and 0.66 g, with roll angles of between 18° and 23°. In the case of the vessel without ballast water, the values are significantly lower than on the day of the accident and can certainly be regarded as normal for a bad weather situation.

The following floating conditions arise from a comparison of the vessel without ballast water and the condition on the day of the accident:

	Without ballast water	Condition on the day of the accident
Draught aft	7.35 m	7.45 m
Draught midships	3.86 m	5.70 m
Draught fore	0.37 m	3.95 m
GM	5.75 m	5.63 m

The stability comparison shows that both cases have about the same GM. The following stability comparison of the righting lever curves shows that the initial stability is almost identical up to about 15°. The righting lever curves do not differ significantly until 20°. However, the generally enormous change in stability at larger heeling angles does not explain the obvious change of roll behaviour with regard to the condition of the vessel on the day of the accident. According to the calculation for the stability case 'Without ballast water', the roll angles are only about 20°, at which the stability difference is only marginal. The true reason for the marked change in roll behaviour, and thus also the reduction of risk to which the crew is exposed, results from the fact that the vessel now has virtually no forward draught, is no longer immersed.

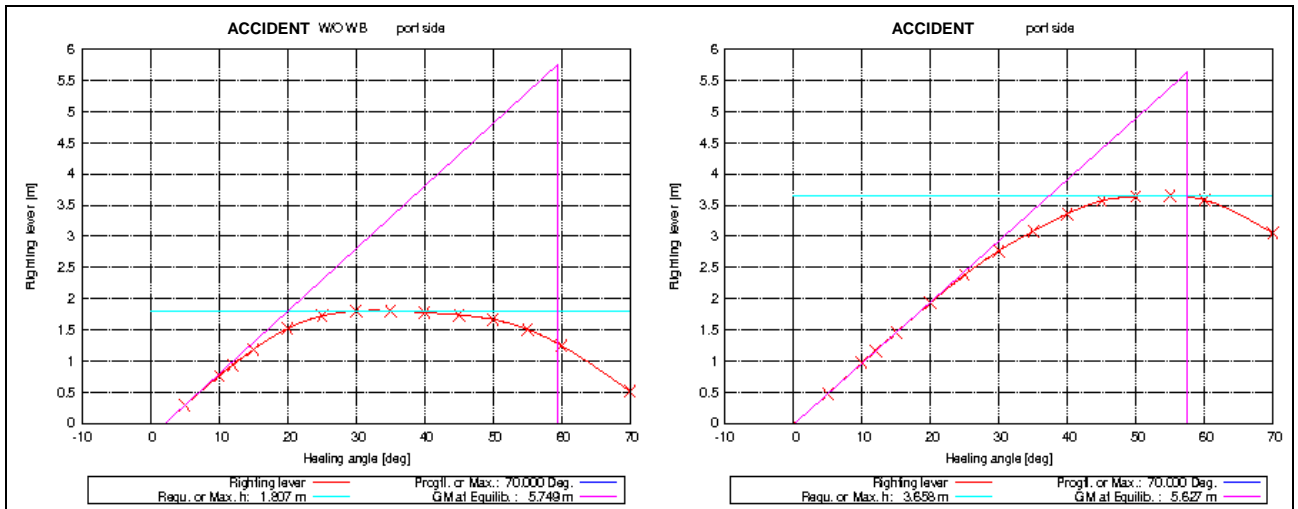


Figure 26: Stability comparison without ballast water left, accident condition right

The analyses show that because of the only marginal immersion at the forward perpendicular, the prominent bow flare is no longer wetted in swell, either. This means that the roll moment applied to the vessel by the swell reduces significantly, and that is the true reason for the significant improvement in the rolling behaviour.

When considering the longitudinal bending moments, the two cases are to be regarded as being of equal value:

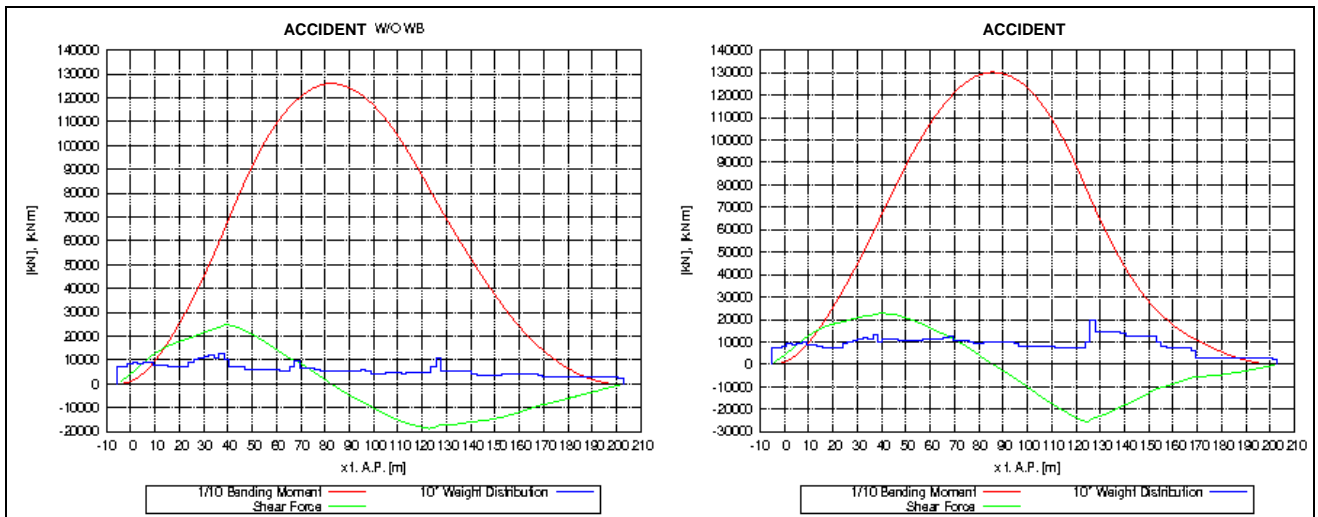


Figure 27: Longitudinal strength without ballast water left, accident condition right

The maximum longitudinal bending moment becomes slightly less in the 'Without ballast water' case, but is still markedly higher than the permissible longitudinal bending moment. In the case of 'Without ballast water', the permissible longitudinal bending moments are just exceeded by 1-2% in some places. In the calculation case 'Without ballast water', it should be noted that the minimum permissible draught was not reached at the forward perpendicular; this must be observed according to the class rule in order to avoid a slamming hazard to the bottom. Therefore, to prevent slamming damage and thus also avoid endangering the vessel's structure, she may

not sail without any ballast water at all, even if the bending moments were maintained. It is likely that the accident could have been prevented in theory through not carrying any ballast water, but precisely this condition is explicitly prohibited by the existing rules.

Both of the load conditions examined, vessel 'Without ballast water' and vessel on the day of the accident, contravene the requirements of the stability book. To that end, the TUHH examined another case from the stability book, Case '3 B – Ballast at the end of the voyage', to establish how the vessel would have reacted with this specified load situation. The crew would have needed to refer to this load case when ballasting the vessel. The approved stability book on board should provide typical load cases that meet all legal requirements as a guide for daily practical use on the vessel. Due to the larger amount of ballast water in Case 3 B, distributed in the double bottom, the metacentric height now rises to 6.65 m and compared to the GM on the day of the accident (5.63 m) is greater by 1.02 m.

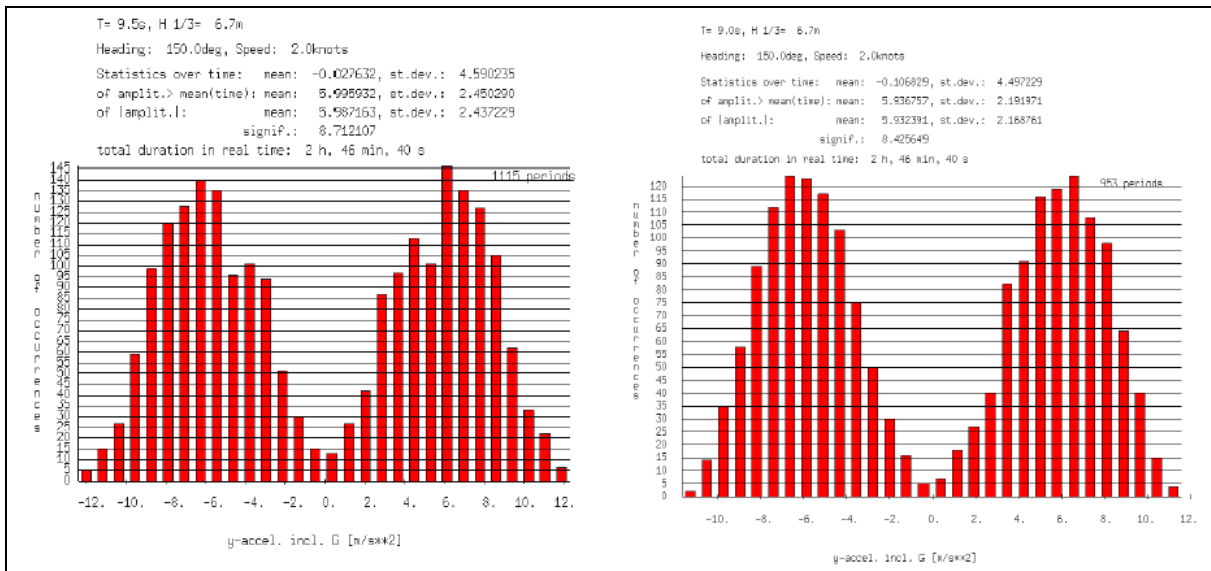


Figure 28: Transverse acceleration in Case 3 B left, accident condition right

The frequency distribution of the transverse acceleration on the bridge, simulation time 10000 s, period 9.5 s is left for Stability Case 3 B according to the stability book and right for the load condition on the day of the accident. It can be seen clearly that there is no fundamental improvement in conditions from the Stability Case 3 B and that the accelerations are comparable to those of the accident.

The problem of increased roll angles and accelerations for vessels in ballast was examined closely in the course of a thesis<sup>4</sup> at the TUHH which involved 15 different container vessels. It was found that this concerns a general safety issue with container vessels in ballast and that it is likely that under similar circumstances such accidents would be repeated.

<sup>4</sup> Nicolas Rox, Examination of the intact stability and the seakeeping behaviour of container vessels within the ballast condition, Hamburg-Harburg University of Technology, December 2010

### **3.2.8.5 Effect of free surfaces of liquid on stability**

During the course of the investigation, the question of whether it would have been possible to make the vessel softer by partly filling some of the ballast water tanks was raised. A reduction in stability usually occurs due to the free surfaces of liquid and the liquid in the tank can generate additional roll damping when the tank's natural frequency approaches the roll period of the vessel. This is the principle on which the so-called anti-rolling stabilisers work successfully when they are adapted to the vessel's shape in the design process. However, by installing such stabilisers the operator of the vessel subjects itself to disadvantages from a formal perspective because the effect of the free surfaces, which are regarded as static, is deducted from the stability calculation and a dynamic consideration of the positive effect of the roll damping is not included in the conventional stability assessment. In the present case, the vessel did not have any anti-rolling stabilisers and the only option was to partly fill some of the ballast water tanks. However, since there were problems with the longitudinal strength in any case, removing ballast was not an option. The flooding of additional ballast tanks to partly fill them would not have achieved anything in terms of stability because the GM correction via the free surfaces is compensated by the fact that the centre of gravity shifts downward due to the additional ballast. The calculations relating to partly filling tanks 4.11 and 4.12 also delivered no meaningful result since the true tank geometry with all fittings cannot be logged sufficiently accurately with the calculation software. It was possible to discern that the water in the tanks ran back and forth, but that the energy was lessened by local effects without bringing about any significant roll damping. To achieve a measurable effect, the tanks would have had to cover the entire breadth of the vessel. Such tanks are not available and in structural terms cannot be retrofitted due to the continuous pipe tunnel amidships. Therefore, in the course of the calculations it was assumed theoretically that a bottom tank without fittings ran from one side of the vessel to the other in order to estimate what effects can actually be achieved by free surfaces. To that end, a cuboid bottom tank from Frame 84 to Frame 125 with a length of 32 m and a breadth of 24 m was modelled. The height of the tank corresponds to the height of the double bottom (1.80 m) and with a permeability of 98%, in the case of sea water, a water mass of 1,398 t is obtained when completely filled. The moment of inertia of such a tank would be 36,864 m<sup>4</sup> with a theoretical reduction of the initial GM of about 1.90 m. However, this reduction in GM is only relevant at small angles as long as water does not hit the top of the tank, which would definitely be the case with a heel of about 4.2°. In formal terms, the influence of the free surfaces on the GM reduction would be the same at each stage of partial filling. However, the effect diminishes as the tank fills because the total mass rises and at the same time the centre of gravity moves downward. The effect the partly filled tank has on the static stability is shown in Figure 29. Here, 'Fill Step 11' corresponds to 100% filled, i.e. 1,398 t. It is also evident from the figure that the hydrostatic effect of the partly filled tank does not have any material influence on the stability.

Although the initial GM becomes lower, the tank has hardly any hydrostatic effect even at angles of 15°. On the contrary, more ballast leads to an increase in stability because the centre of gravity shifts downward. It is also very clear that the pure effect of the reduction of stability cannot come into play because hardly any shifting moments can form due to the low tank height. The basis of the calculations is the existence of a hydrostatic equilibrium position, i.e. that water in the tank has run in the direction of the heel. However, a phase shift forms dynamically between the rolling motion of the vessel and the movement of water in the tank;

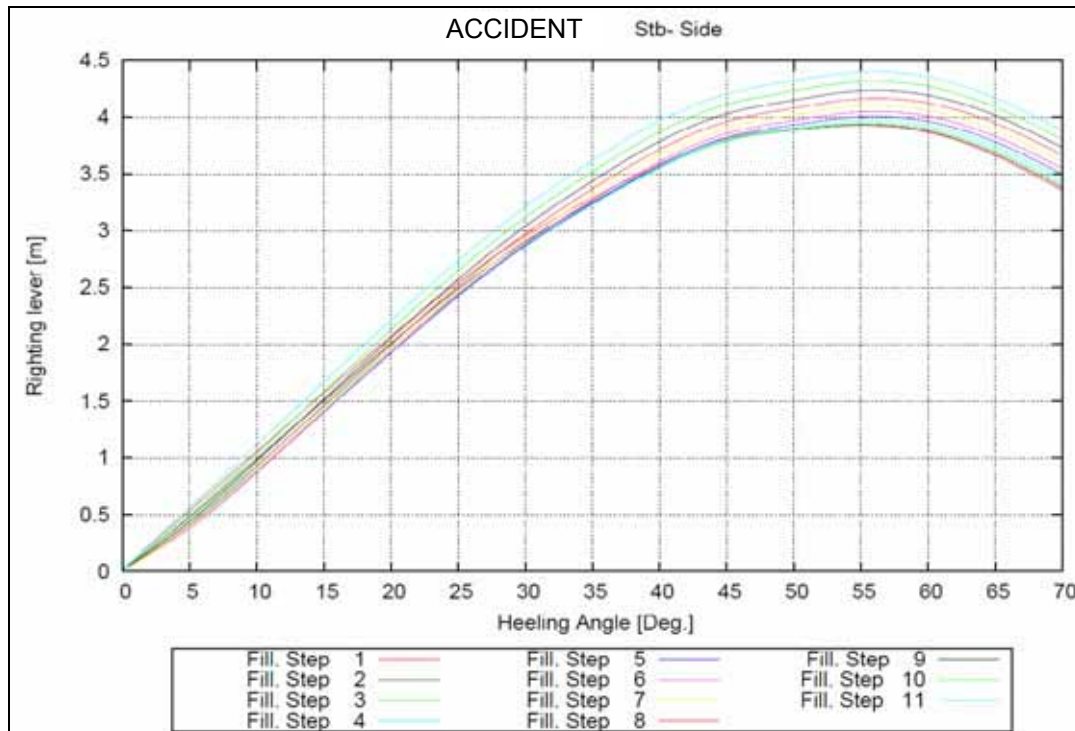


Figure 29: Righting lever partially filled tank

this leads to the liquid effecting a counter-moment, which can minimise the roll motion. With this effect it is actually physically incorrect to speak of roll damping, but rather a moment forms which can counteract the rolling motion.

In the simulation of the accident situation, the resulting maximum roll angle for different tank fillings was calculated in consideration of the roll moments caused by the tank. For comparability, statistical effects were filtered out, as it were, by randomly applying the same sea states on each occasion. With respect to the influence of the tank, there were two opposing effects: the smaller the tank filling, the greater the possible shift lever but the smaller the moment. If the tank is filled further, the mass increases but the shift lever reduces. The reason for this is that the theoretical tank under consideration is equal to the double bottom height, as opposed to constructed roll damping tanks on ro/ro ferries, for example, which have a sufficient height.

The following table shows the respective tank fillings and the resulting maximum roll angle:

Filling in t	10	50	100	150	200	250	300
Roll angle in degrees	38.0	37.2	36.9	36.3	35.9	35.5	35.0

Filling in t	350	400	450	500	550	<b>600</b>	650
Roll angle in degrees	34.7	34.3	34.0	33.8	33.1	<b>32.6</b>	33.4

Figure 30: Roll angle depending on the tank filling

The maximum effect is achieved with a filling of 600 t. This is equivalent to a reduction in roll angle of about 2-3° compared to the roll angles present on the day of the accident. Overall, with a partial tank filling the roll angle reduces up to that point and then starts to increase again. The 600 t of ballast water would cause the centre of gravity to shift downward by 28 cm, due to which the stability would increase. The acting accelerations were calculated for this maximum reduction in roll angle with ballast water of about 600 t:

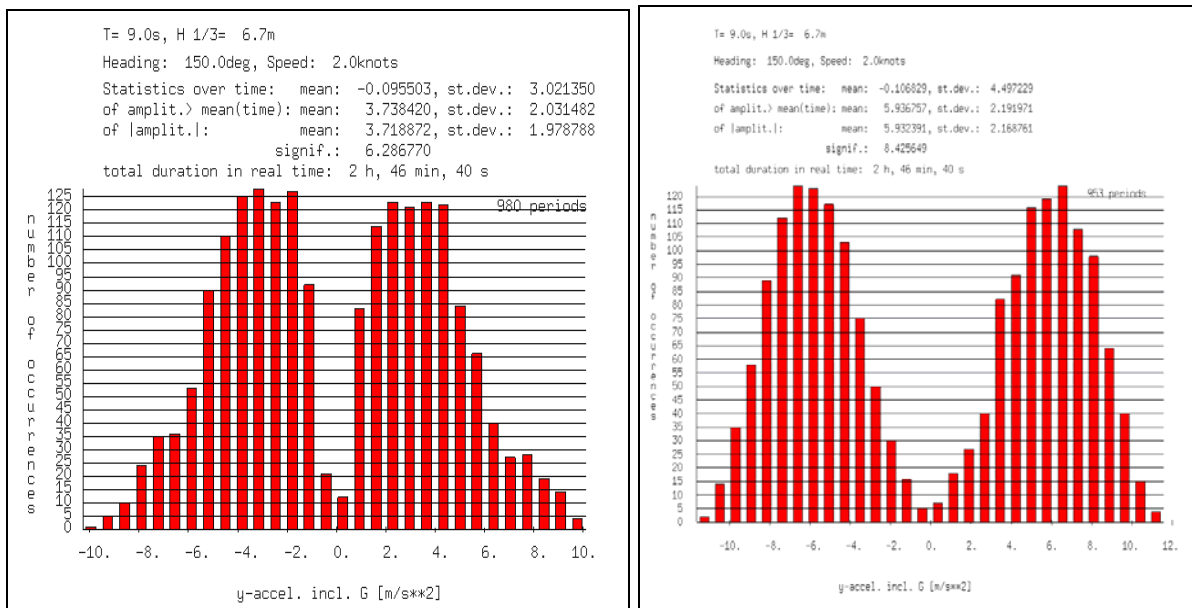


Figure 31: Transverse accelerations on the bridge influenced by the tank

The histogram on the left shows the influence of the partially filled tanks and the one on the right without a tank. It can be seen on the left histogram that the calculated maximum accelerations decrease to about 10 m/s<sup>2</sup> compared to that of the accident of 12 m/s<sup>2</sup>. This is also equal to the reduction in roll angle calculated above in qualitative terms. Furthermore, it can be seen clearly how a shift in the frequency distribution of the accelerations to overall smaller values occurs, the larger acceleration values are now reached in much fewer cases.

On the whole, this is logical because the tank can only minimise certain exciting moments. If these are exceeded, in somewhat higher waves for example, then high



accelerations will still occur, but no longer quite so high. Consequently, the partial filling of the tank makes a generally positive contribution to safety.

With that being said, the calculations also show that it would not have been possible to prevent the accident by filling tanks partially. While the effect of the tank considered above can be quantified physically and also makes a discernible contribution to safety, the accelerations are still very high and with the effect of the tank are also on a scale that is not acceptable. With pipe tunnels and divided tanks, the vessel's real tank geometry means that partially filling the real tanks would not have achieved any measurable success because the moments are too low.

### 3.2.9 Condition of the bridge

Based on the testimony of the crew and photos, the whole of the bridge floor was covered with papers, folders and various material. These objects had fallen out or off of the bridge cabinets (see Fig. 9). On the one hand, this is an indication of improperly secured equipment on the bridge; on the other hand, some of the cabinet doors may not have been suited to the sea conditions from a structural perspective and did not close sufficiently. On the bridge, there were only four hand bars mounted with sufficient strength at the ship's conning position (marked in green on the following sketch). No hand bars or the like are fitted at the radio workstation or, in particular, the cabinet at Pos. I.

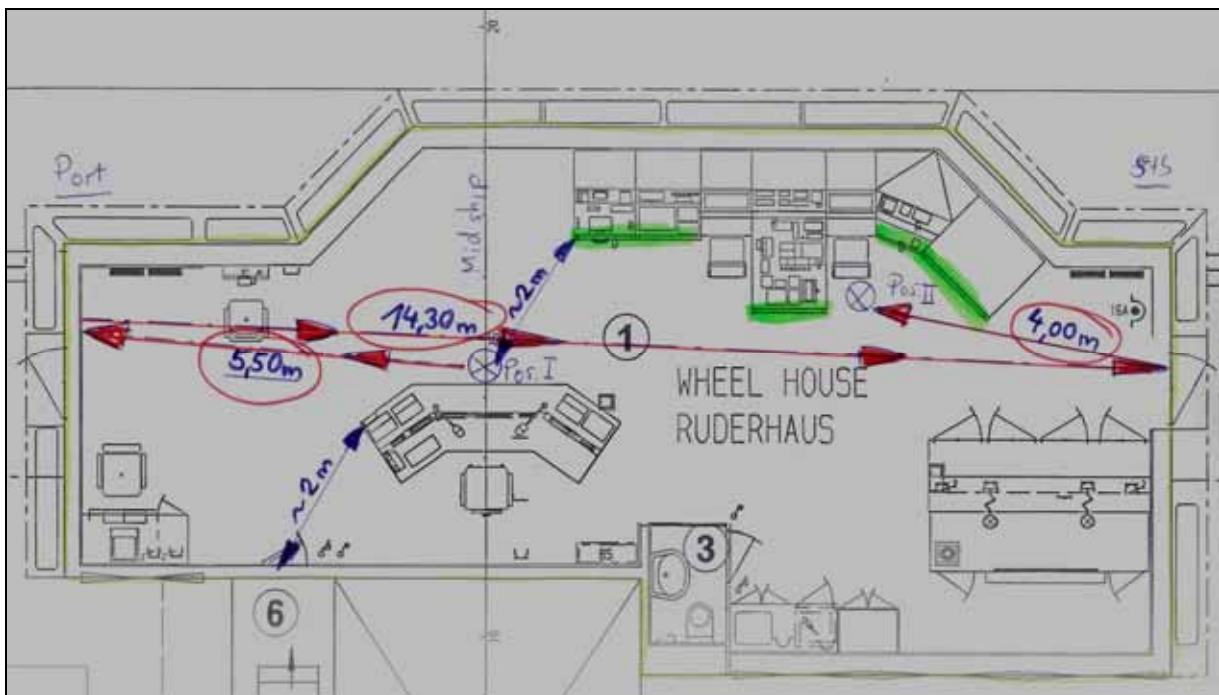


Figure 32: Top view of the bridge

The fatally injured third officer was situated at Pos. I amidships next to the radio workstation. During the accident he slid about 5.50 m to port and then 14.30 m to starboard before the master was able to take firm hold of him at Pos. II while he was sliding back to port again.



The distance from the stairwell door (No. 6) to the radio workstation and from amidships to the first hand bar at the ship's conning position is about 2.0 m.

There is no lashing equipment on the bridge to secure a person lying on the floor, in a stretcher, for example.

## 4 ANALYSIS

### 4.1 Manning

The CCNI GUAYAS was anchored as a hot lay-up with reduced manning off Hong Kong. The sea area in which the vessel was anchored is designated a typhoon risk zone during the period 15 May to 31 October.

The ship was not moored at the pier or dolphins, respectively, in a protected anchorage.

#### 4.1.1 Provisions of the classification society

The classification society, Germanischer Lloyd (GL), released a booklet for laid-up vessels (Recommendations for laid-up ships) and noted the following under 2.8 'Manning':

*"Ships shall be manned/crewed in accordance with the instructions issued by competent authorities. Both administration of the flag and the responsible authority of the anchorage facility are to be involved."*

Accordingly, the classification society, GL, is not responsible for the rules concerning proper manning of vessels, rather, this is the Ship Safety Division (BG Verkehr) in the case of vessels flying the German flag and according to the booklet also the coastal State in whose waters the vessel is anchored.

#### 4.1.2 Vessels flying the German flag

The vessel was laid-up at sea in an area in which tropical typhoons can be expected. This area offers no protection in the sector from NE to SW and the need to weigh anchor immediately cannot be excluded in the months of the typhoon season.

The Ship Safety Division (BG Verkehr) does not issue a separate minimum safe manning certificate for laid-up merchant vessels flying the German flag which have been temporarily withdrawn from cargo and/or passenger services. The German Schiffsbesetzungsverordnung (ships' crew regulation) does not prescribe a fixed manning level for the number of crew members on laid-up vessels. However, the owner continues to be responsible for manning a laid-up vessel properly. In particular, the location of the lay-up must be considered and the vessel manned so that safe watchkeeping is guaranteed and it is possible to respond effectively in emergencies.<sup>5</sup>

At the moment that a vessel leaves a port or berth, she is no longer regarded as a laid-up vessel and must be manned in accordance with the valid minimum safe manning certificate.

In the case of the accident, where in addition to the master the fatally injured third officer was the only nautical officer on board, it is doubtful that effective fire-fighting, for example, or in this case adequate medical care was guaranteed if one of the nautical officers was indisposed.

In light of the above information on the manning of laid-up vessels flying the German flag, especially in respect of the position at which the vessel was laid-up, the CCNI GUAYAS was not sufficiently manned.

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<sup>5</sup> See booklet See-BG (BG Verkehr) 'Information on the manning of laid-up merchant vessels flying the German flag' of 17 February 2009

### 4.1.3 Regulations of the coastal State

The competent authority in Hong Kong, the Marine Department (MARDEP), has special rules for how vessels laid-up in the roadsteads of Hong Kong are to be manned during the typhoon season.

The anchorage of the CCNI GUAYAS until 14 September 2009, at the position 22° 17.2'N and 114° 30.4'E, was about 8 nm away from the nearest land at a depth of about 30 m. According to the charts and sailing directions, this position is about 7 cables outside the outer roadstead of Hong Kong, which run to the meridian 114° 30' E. The investigating authority in Hong Kong, the Marine Accident Investigation Section of the Hong Kong Marine Department, confirmed that the CCNI GUAYAS had anchored outside the Hong Kong roadstead during the period 31 July to 14 September 2009, and as such also outside the jurisdiction. Therefore, the rules of MARDEP do not apply and as coastal State the Hong Kong authorities are not responsible for the manning of vessels anchored on the open sea, as it were.



Figure 33: The outer roadstead of Hong Kong

## 4.2 Stability

Over the past 100 years, rules concerning the assessment of vessel stability have always focused on compliance with the minimum requirements for stability to prevent capsizing accidents in as far as possible. However, based on the experience the BSU has gained from other accidents, too much stability or GM also has very damaging properties with respect to the cargo and vessel, and in some cases can result in crew members suffering fatal injuries.

#### **4.2.1 Fatal accidents in the sea area off Hong Kong**

On 24 September 2008 (one year earlier), a fatal accident occurred on board the CMV CHICAGO EXPRESS during Typhoon 'HAGUPIT' in the same sea area about 7 nm south of the present accident (see Fig. 8). This was thoroughly investigated by the BSU and published on 1 November 2009 in Report No. 510/08. Although an entirely different vessel size, with a length of 336 m and a beam of 42.80 m the CMV CHICAGO EXPRESS was significantly larger, there are certain parallels as regards the excessive stability and the similarity of the circumstances of the accident. The calculations for the CMV CHICAGO EXPRESS revealed that provided that a critical resonance was not reached because of the change in stability or the vessel would not capsize because of insufficient stability, the accident would not have occurred at a certain level of reduced stability. The calculations of the CCNI GUAYAS give rise to the same conclusion. The calculations indicate that for a voyage without cargo, the only way to avoid this accident would have been to proceed without any ballast water. However, that is opposed by a whole raft of rules that must be complied with:

- Container vessels without cargo, few supplies and no ballast have a pronounced trim to aft and a very shallow draught at the forward perpendicular due to their design.
- To comply with the draught prescribed by the class rules (slamming damage) at the forward perpendicular, ballast must be carried at the bow. This increases the longitudinal bending moments and the stability increases because the tanks are positioned in the double bottom.
- To comply with the permissible bending moments, ballast must be placed amidships. This increases the stability even more.
- Indeed, a vessel condition has now been created which complies with the rule 'Draught at the forward perpendicular and permissible longitudinal bending moments' and, of course, more than complies with the stability requirements, but which tends toward extreme vessel accelerations when influenced by a sea state which can still be regarded as normal.
- This vessel, which is sailing only in ballast, has a high hazard potential with respect to the acceleration values. GL, the classification society responsible for approving the stability book and the load cases, had already recognised that heightened accelerations can occur in specific load cases and that the container lashing system is not designed for loads above 0.5 g. At 1.2 g, the accelerations on the bridge were more than twice the load specified for the lashing system.

In summary, the expertise of the TUHH gives rise to the following conclusions with regard to the vessel's ballast condition:

***The calculations have shown clearly that with a probability bordering on certainty the accident would not have happened if the vessel was loaded differently – notably, if ballast water was dispensed with. This is because the stability of the vessel does not change significantly with the associated floating condition, but the roll moments transmitted to the vessel by the sea do. However, there is no way the crew could have known this because to establish this load case they would have had to contravene known safety rules of the stability book. And to set sail with a load condition that does not comply with the rules set forth in the stability book in every respect can by no means be regarded as good seamanship. Conversely, the calculations have shown clearly that the accident would have happened in the same manner with a load that complied with the approved stability book because the accelerations were comparable with those of the accident situation.***

***The expert also notes that the vessel's stability book was approved even though it had been established by the approving organisation itself that accelerations, which are too high, would arise in certain load conditions. This was confirmed by its own calculations. In the opinion of the expert, this can only be the case Ballast beginning/end of voyage in which the accident involving the vessel then actually occurred. At any rate, significantly higher accelerations occurred during the accident than those on which the remark of the approving organisation is based, which pertains to cargo safety, but not to the safety of the people on board. Although only ballast water, and no containers, was on board in the load case relevant to the accident, one should assume that the protection of commercial goods does not take priority over the protection of humans.***

***In the opinion of the expert, the CCNI GUAYAS case illuminates problems in the current safety landscape very clearly: for the central problem with regard to the CCNI GUAYAS (like the CHICAGO EXPRESS) is that no coordinated overall safety assessment is present, which, in each case, quantifies the particular risk. And in this uncoordinated safety assessment stability always loses out in principle, because there is no physically sound requirements for assessing stability in swell in general. In particular, with regard to considering the stability of vessels there is also absolutely no signs of the will to try to evaluate excessive stability. Although stability values are included in the cargo securing manual, they are not included so that stability recognised as being clearly excessive has any repercussions on the actual stability to be approved, as demonstrated by the CCNI GUAYAS. From that it becomes evident that the cargo securing manual is not fit for purpose in terms of setting an upper limit for stability; therefore, in reality there is no stability limit.***

***The accumulation of accidents involving container vessels at partial draught clearly demonstrates that the evaluation of too much stability is just as necessary as the evaluation of too little stability. Only then can such accidents be avoided.***

***Furthermore, the calculations once again highlight the need to address swell induced stability problems using methods of calculation which have a sound physical basis, and not via more speculative or simplistic approaches. The CCNI GUAYAS shows that the determinants are very complex. Only a proper calculation of all the relevant factors will reflect the tendencies correctly. CCNI GUAYAS also shows that in the relevant facets such accidents are predictable and that it is much more a case of properly applying such methods to practise when constructing and classifying sea-going vessels in order to be in a position to avoid such accidents in the future.***

#### **4.2.2 Accident in the North Sea off Borkum on board the FRISIA LISSABON**

The investigation of marine casualty 520/09 involving the CMV FRISIA LISSABON in the North Sea off Borkum, which was conducted simultaneously to this analysis, demonstrates that accidents caused by excessive stability are not limited to only the sea area off Hong Kong and the situation in extreme weather conditions during the typhoon season. With the exception of slight differences, this vessel is almost identical to the CCNI GUAYAS as the design of these two container vessels stems from the original design of the Bremer Vulkan shipyard.

##### **4.2.2.1 Summary of the accident involving the FRISIA LISSABON, Ref.: 520/09**

On 16 October 2009, the container vessel FRISIA LISSABON ran into severe weather off Borkum and rolled heavily. As a result, the pilot was thrown from a chair, rolled through the bridge and was seriously injured.

The vessel was sailing from Emden to Rotterdam in ballast condition after she had been laid-up for two months for lack of cargo.

The vessel ran into poor weather abeam of Borkum with winds forces of 8 to 9 Bft from NNW, the highest gusts were 10 to 11 Bft. The sea also approached from NNW; for the significant wave height, the DWD specified a wind sea of 6 m and swell of 6.7 m. Superimposed that indicated a significant wave height of 9.0 m, where at 10 m the largest single wave was measured at the FINO1<sup>6</sup> Platform.

At 1245 (CEST), the vessel proceeded at a speed of 8 to 10 kts on a heading of 270°. At position 53° 36.8'N and 006° 25.9'E, she was suddenly struck by two large waves in quick succession and according to the ship's command heeled about 30-45° over, in the process, the pilot was thrown from his seat.

After the accident, the vessel was turned towards the wind and sea and the speed adjusted to 2-3 kts; this prevented the vessel from rolling so heavily.

It was not possible to evacuate the injured pilot by helicopter or rescue vessel due to the weather conditions, therefore, the FRISIA LISSABON turned around, sailed into Eemshaven and took the casualty ashore after reaching there at 1630.

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<sup>6</sup> FINO = Research platforms in the North Sea and Baltic Sea  
FINO1 is the name of the working platform north of Borkum

As a result of the fall, the pilot broke three cervical vertebrae, two thoracic vertebrae and three ribs, he also suffered a laceration to the head and has been unable to work since the accident.

#### 4.2.2.2 Photo of the FRISIA LISSABON



Hasenpusch Photo-Productions

Figure 34: Photo of the FRISIA LISSABON

#### 4.2.2.3 Vessel particulars – FRISIA LISSABON

Name of vessel:	FRISIA LISSABON, ex Cap Flinders, ex Capo Prior
Type of vessel:	Container vessel
Nationality/flag:	Republic of Liberia
Port of registry:	Monrovia
IMO number:	9299020
Call sign:	A8IY9
Owner:	Hartmann Schifffahrts GmbH & Co. KG
Year built:	October 2004
Shipyard/yard number:	Wadan Yards MTW GmbH/Aker NB 101
Classification society:	Germanischer Lloyd
Length overall:	207.40 m
Breadth overall:	29.80 m
Gross tonnage:	25,405
Deadweight:	33,892 t
Draught (max.):	16.40 m
Engine rating:	21,770 kW
Main engine:	MAN B&W 7L 70 MC C
(Service) Speed:	21.0 kts
Hull material:	Steel





#### 4.2.2.6 Shore authority involvement and emergency response

Agencies involved:	Helicopters and rescue vessel on standby, WSP Emden and Vessel Traffic Service
Resources used:	Called at a port of distress and took casualty ashore
Actions taken:	First aid on board
Results achieved:	Casualty is not yet able to resume work

#### 4.2.2.7 Investigation and analysis of the FRISIA LISSABON marine casualty

Similar to the CCNI GUAYAS, the FRISIA LISSABON was sailing in ballast. The BSU wanted to ascertain whether this accident is comparable to the two fatal accidents off Hong Kong. The BSU commissioned the TUHH to carry out stability and trim calculations for this case, too. To that end, the owner provided the load condition and weight of the vessel in the form of a printout from the 'MACS3' shipboard computer made by SEACOS GmbH.

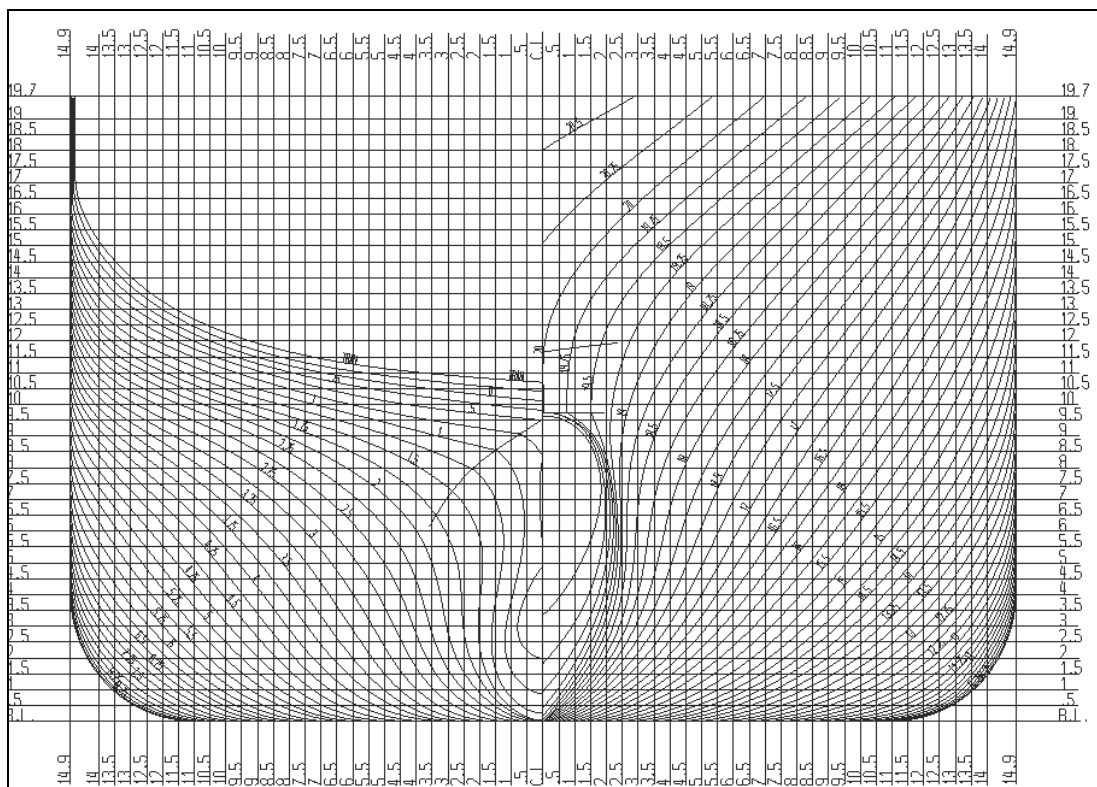


Figure 36: Framing plan – FRISIA LISSABON

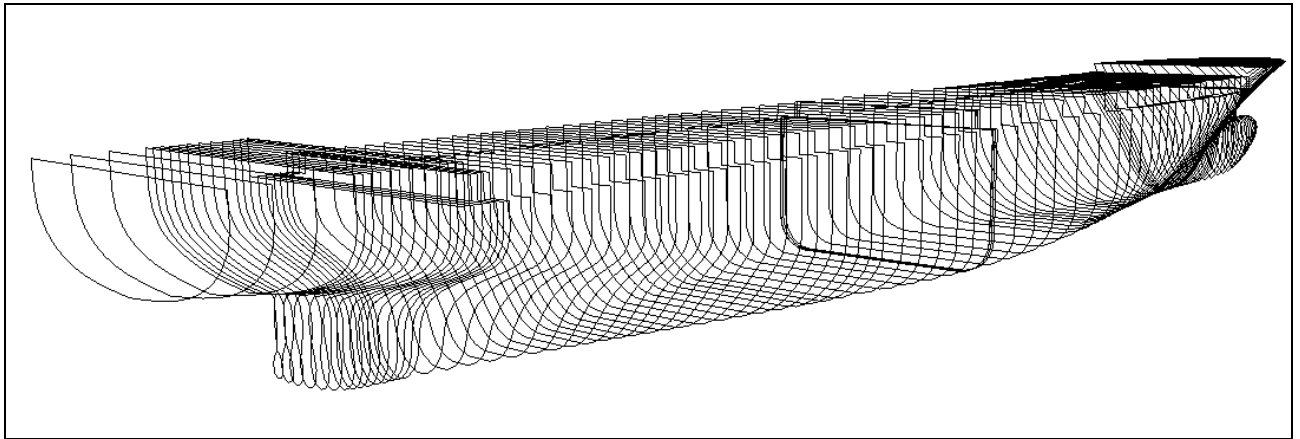


Figure 37: Calculation model – FRISIA LISSABON

The following values emerge owing to different software:

	TUHH	MACS3
D Aft	6.14 m	6.14 m
D Mid-section	5.59 m	5.59 m
D Fore	5.04 m	5.04 m
GM	4.56 m	4.51 m

The draughts are identical and only the GM differs slightly. This can be explained by the fact that not all the ancillary equipment, such as rudder or sea chests, was modelled in the same form.

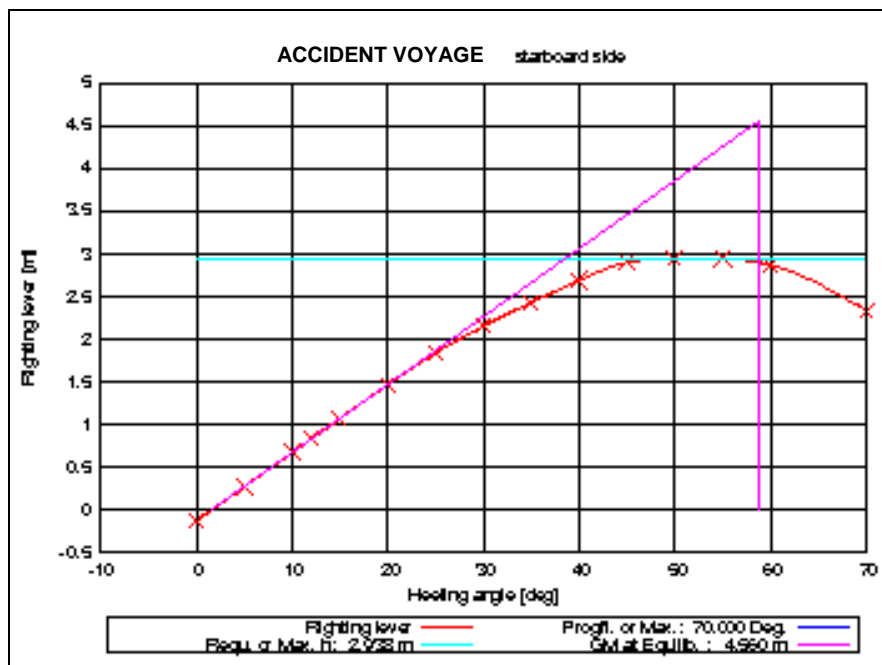


Figure 38: Righting lever curve for smooth water – FRISIA LISSABON

The righting lever curve for smooth water in the accident condition is more than sufficient.

The FRISIA LISSABON was forced to steer a course of 270° out of the Westerems. Wind and swell approached from NNW, i.e. from about 340°. This resulted in an encounter angle of 60-70°. Using the significant wave height specified by the DWD, a calculation as to the circumstances under which a roll angle of 30° would occur for wave periods of 9.5 s, 9.0 s and 8.5 s, which correspond roughly to the range of swell conditions on the day of the accident, was made. This roll angle appears to be realistic, although roll angles of up to 45° occurred according to statements given by the crew.

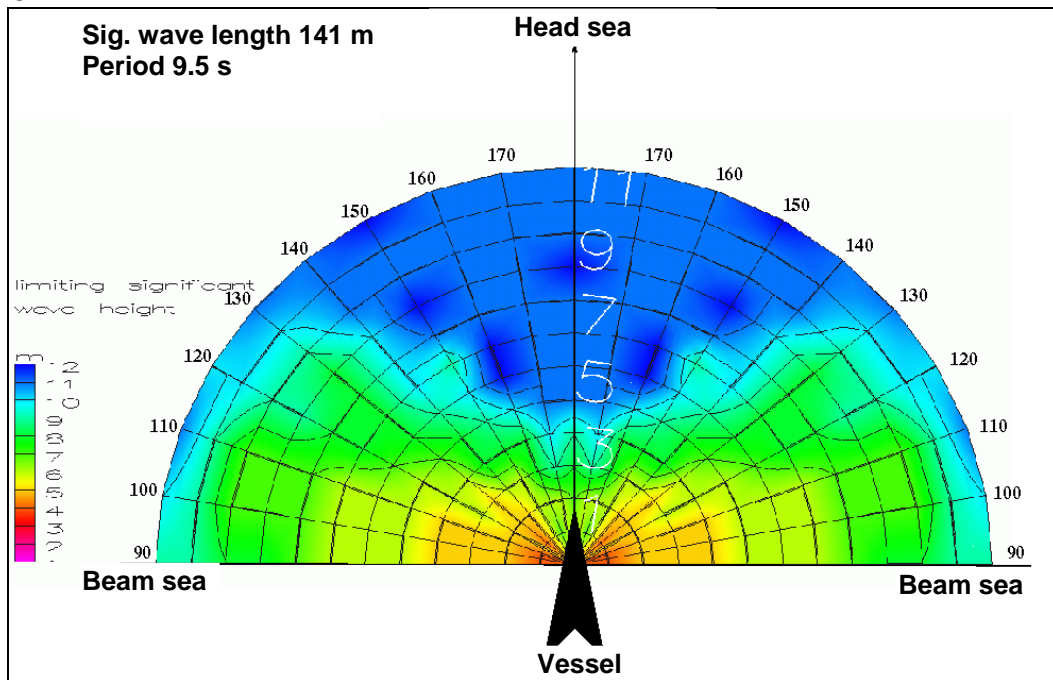


Figure 39: Polar coordinate diagram up to 12 kts, period 9.5 s – FRISIA LISSABON

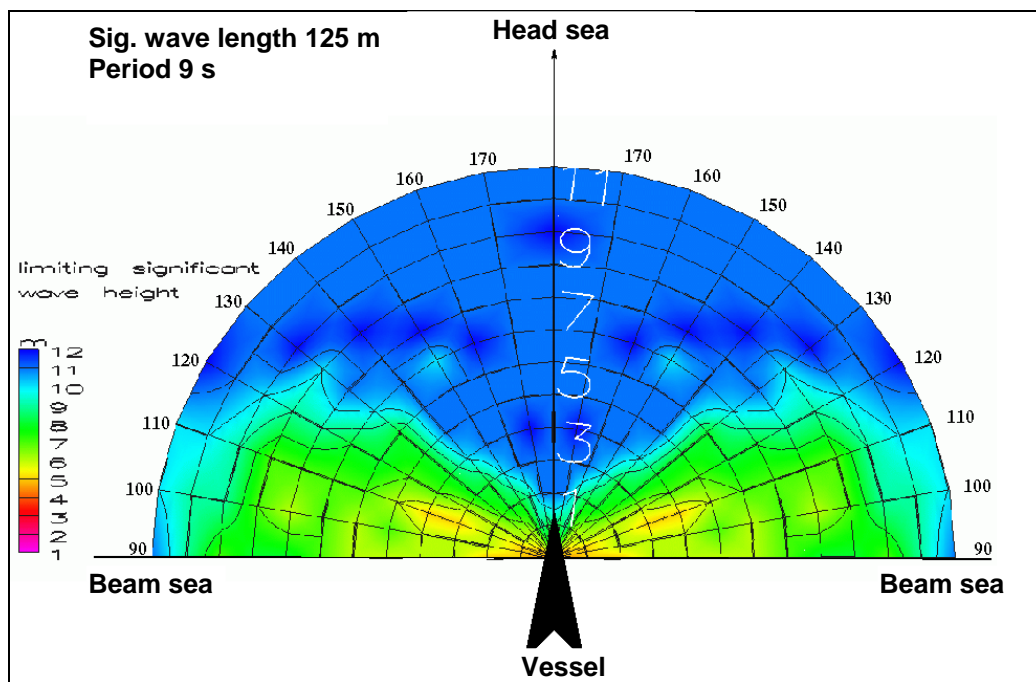


Figure 40: Polar coordinate diagram up to 12 kts, period 9.0 s – FRISIA LISSABON

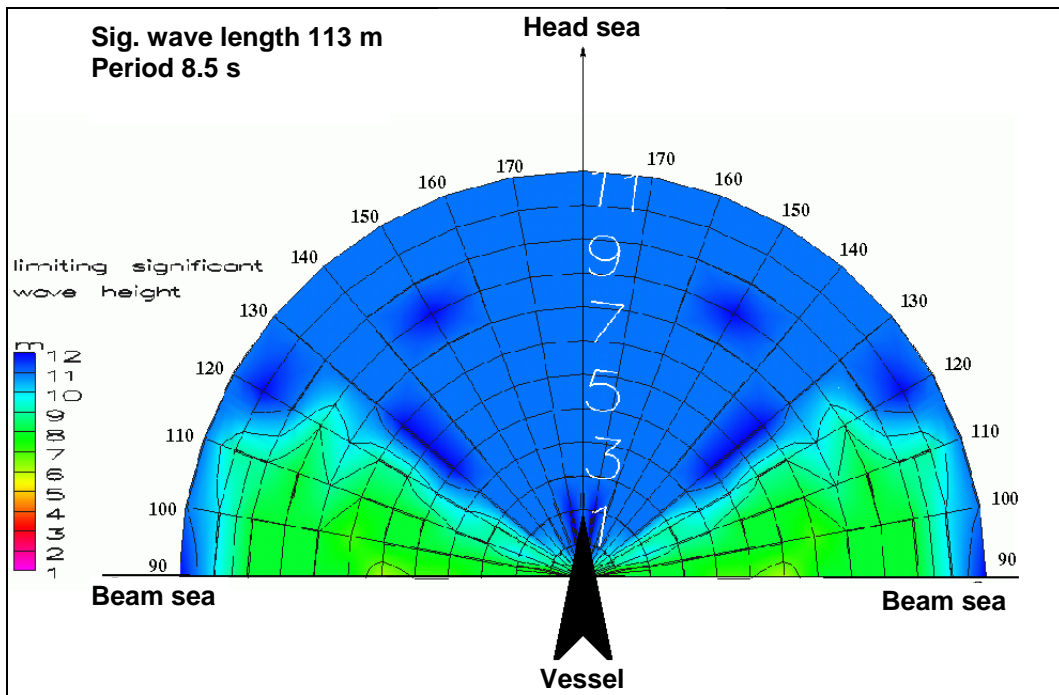


Figure 41: Polar coordinate diagram up to 12 kts, period 8.5 s – FRISIA LISSABON

On the above three diagrams, the different speeds and courses up to a roll angle of 30° are shown with the corresponding periods of 8.5 s to 9.5 s for the significant wave lengths of 113-141 m.

Certain parallels with the accidents involving the CCNI GUAYAS and the CHICAGO EXPRESS can be seen in the polar coordinate diagrams. Parametric rolling is not dominated and resonances are not visible, therefore, the cases are comparable. However, in the case of the FRISIA LISSABON a large angle range is present in which large roll angles do not occur with such long waves. The calculations fit very well with the statements. The accident occurred in a head sea at an encounter angle of 60°, which equates to an angle of 120° on the radial axis in the above polar coordinate diagram. However, it also reveals that the accident could have been avoided had the vessel been steered into the sea, which was not possible owing to the draught and fairway conditions leading up to the scene of the accident. Due to the high level of swell, the weather situation was worse than during the accidents off Hong Kong. The calculations relating to the FRISIA LISSABON show clearly that the rolling of the vessel could have been significantly minimised and the accident thus avoided if it had been possible to steer the vessel directly into the sea at a sufficient speed of about 5 kts. However, the data from the polar coordinate diagrams are not available in the required stability information on board since such calculations are not made in this regard. Accordingly, the crew had no knowledge of this information. The frequency distribution of the transverse acceleration on the bridge at a speed of 5 kts is shown on Figure 42 below.





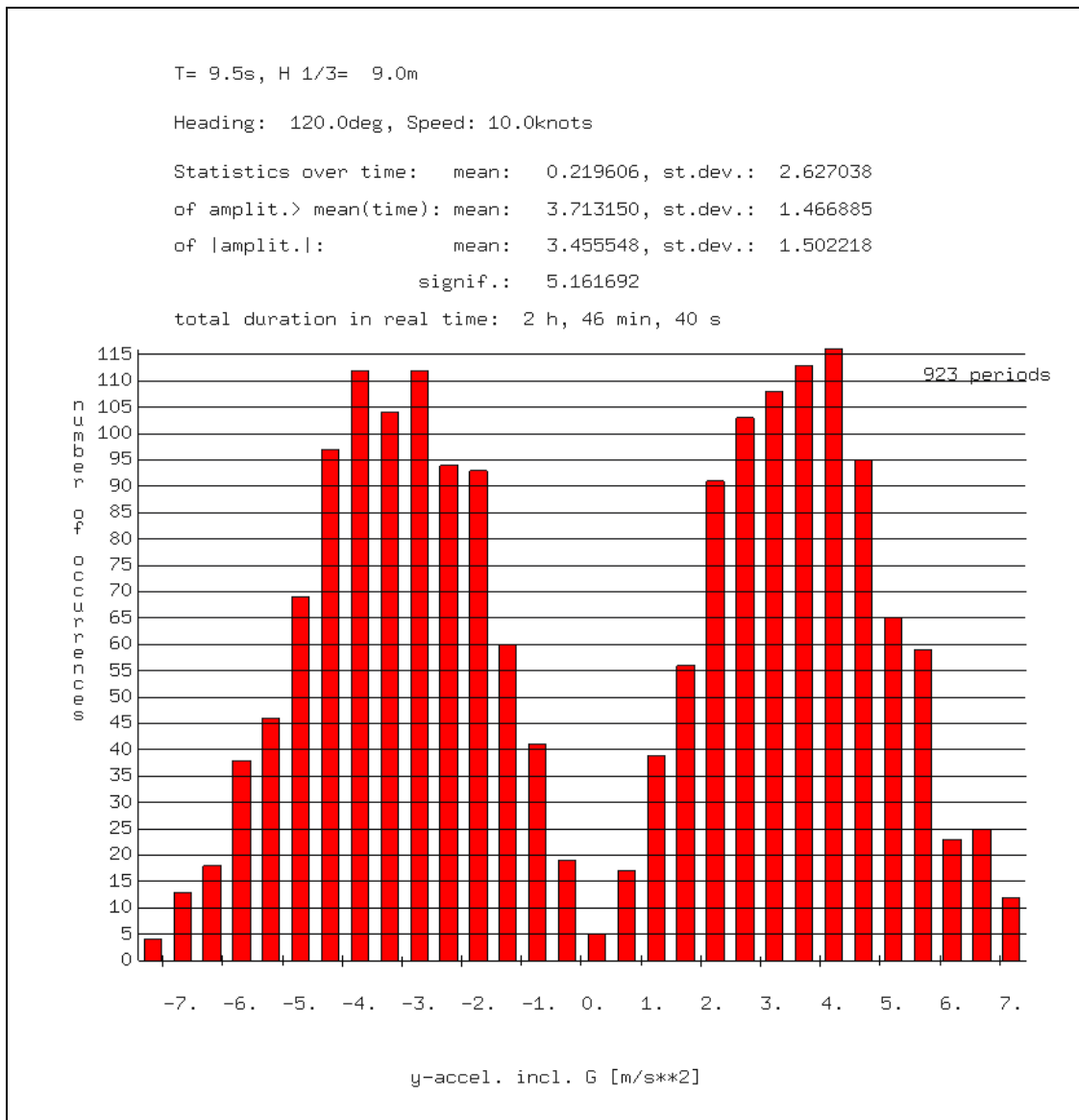


Figure 43: Frequency distribution of transverse accelerations on the bridge at a speed of 10 kts

The transverse accelerations acting on the bridge were calculated for the accident situation. The maximum value stands at 1g, which is quite similar to the cases off Hong Kong since in the case of the FRISIA LISSABON the waves were much higher.

### 4.3 Measures for avoiding the accident

#### 4.3.1 Course and speed

The accident involving the FRISIA LISSABON could have been avoided by maintaining a speed of 8-10 knots or steering a course directly into the wind and sea. Similarly, the speed of the CCNI GUAYAS should have been increased significantly to 9 kts in order to escape from the hazardous area. However, this theoretical measure can be ruled out because of the principles of good seamanship and the expected slamming damage. In both cases, the crew could not have known that the roll angle and transverse accelerations would have been minimised by increasing the



speed. Added to that is the misguided view that, according to prevailing nautical doctrine, a reduction in speed must effect a reduction in acceleration.

Another measure would have been to allow the vessel to drift in a heavy storm. But that was not an option for either the CCNI GUAYAS or the FRISIA LISSABON due to local conditions.

#### **4.3.2 Navigating in typhoons**

During the course of the investigation, a supplementary opinion on whether multiple typhoons may occur in the waters off Hong Kong at the time of the accident and whether timely evasion would have reduced the risk of accident was requested from the DWD.

The DWD responded by saying that statistically September is in the middle of the tropical storm season, that normally Hong Kong is situated on the usual path of the systems and then often affected by high winds and heavy rains at short notice.

The CCNI GUAYAS was not receiving advice from a weather service, but, according to the master, was monitoring the weather forecasts constantly.

Warnings released by the official agencies were updated continuously and the path of Typhoon KOPPU predicted very well. It would have been possible to escape from the dangerous core area only if a recommendation had been given early enough. Past experience shows that 'early enough' means 24 to 48 hours prior to the estimated encounter of vessel and typhoon. When a vessel underway approaches a typhoon, the recommendation of a course that leads away from the prevailing wind field along the path is a real possibility. In the case of vessels in the harbour area or at anchor, that applies only to a limited extent, for it is hardly possible to gain an appreciable distance from a directly approaching typhoon within 24 hours. Hence, the forecasts made on 13 September 2009 would be relevant in terms of meaningful advice on evasion; however, at this point the storm was still designated a tropical depression. It first appeared in the forecasts as a tropical storm named KOPPU on 14 September at 0346 (HKT). Furnished with this information, the vessel had less than 10 hours to find an alternative to the selected course to the south-west in a north-easterly direction before actually weighing anchor. However, it is clear that this time window is too small to get far enough away from the centre of the path. The analysis of the wave heights results in somewhat lower values, but the periods remain the same. The investigation did not consider whether the accident could have been prevented by remaining at anchor at the old position, or whether this would possibly have led to even greater damage.

#### **4.3.3 Ballast water and roll damping**

When put into practise, the theoretical consideration of dispensing with ballast water altogether, which was possible according to the shipboard computer, and the resulting draughts of 7.35 m at the aft perpendicular and 0.37 m at the forward perpendicular, is not regarded as a practicable option for reducing the roll accelerations because of the significant differences in draught and insufficient draught at the forward perpendicular.

Ballasting with partly filled tanks and in so doing softening the vessel, thus increasing the roll damping, was not calculated in the stability information on board. This stability case is not provided for in the shipboard computers and the crew would not have been able to estimate the effect of the free surfaces. If it had kept to the only known model in the shipboard computer, Case 3 B Vessel in ballast, then the accident would have happened nonetheless.

With that being said, the calculations also show that it would not have been possible to prevent the accident by filling tanks partially.

In practise, the expert was unable to demonstrate a reduction in roll angle for two partially filled and then filled tanks. This would have required the vessel to have a continuous tank designed especially for that, which, logically, would need a greater height, at least on the sides.

Nevertheless, the calculations show clearly that basically it makes sense to design special tanks for partial filling as a means for reducing the stability of container vessels in ballast. That would have been feasible without significant additional costs had this been considered in the vessel's design phase. However, for this the overall stability calculation needs to be improved. Furthermore, navigational personnel would need to receive much better training in the effect of free surfaces. For in the present stability calculation – both in the stability book and on board – consideration of the effect of free surfaces is limited to only the initial GM. However, this is clearly wrong and leads to a miscalculation of the free liquid effect, and in such a way that in actual fact one is punished with too great a reduction in stability.

Since in terms of stability the free liquids are viewed incorrectly, the navigational personnel on board have absolutely no training in this regard. It is unable to assess the effect of free surfaces, which means that sound decision making on board is impossible. Therefore, to use free liquid surfaces as a means of reducing the resulting accelerations, constructive measures on the vessels are advisable and especially an improvement to the calculation methods as well as appropriately modernised training for navigational personnel. From a technical standpoint, that would be possible without significant additional costs.

Other ways to reduce roll oscillation, such as the partial flooding of a cargo hold, were not considered due to various complications because the practical implementation thereof meets with considerable difficulties.

#### **4.4 Bridge design**

The 'Guidelines on Ergonomic Criteria for Bridge Equipment and Layout' (Circular MSC/Circ.982, 20 December 2000) sets the international standard for safety on the bridges of vessels. Section 5.2.6 thereof states the following with regard to occupational safety:

##### *5.2.6.1 Non-slip Surfaces*

*Wheelhouse, bridge wings and upper bridge decks should have non-slip surfaces.*

#### 5.2.6.2 General Wheelhouse Safety

*There should be no sharp edges, corners or protuberances which could cause injury to personnel.*

#### 5.2.6.3 Hand and Grab Rails

*Sufficient hand or grab rails should be fitted in an appropriate amount to enable personnel to move or stand safely in bad weather. Protection of stairway openings should be given special consideration.*

Covered with non-slip rubber, the flooring of the wheelhouse is already designed so that maximum stability should be given when standing. However, since the floor was covered with various objects on the day of the accident, paper sheets in particular, a significant risk of slipping prevailed.

Sharp edges and corners, in this case, for example, the heater and door openings, cannot be avoided completely and with respect to injuries would probably not be regarded as critical under normal circumstances.

Regarding the last point concerning hand or grab rails, the bridge of the CCNI GUAYAS is inadequately equipped.

In the rules and regulations concerning handrails on bridges, the now expired UVV-See<sup>7</sup> of the Ship Safety Division (BG Verkehr) contained precise instructions for the equipment in section V 'Structural equipment' **art. 94a<sup>8</sup> – Handrails. Grab rails:**

*"94a. On bridges and other navigational areas – especially on bridge consoles, the front bulkhead, the chart table and the free-standing navigational equipment – in galleys and pantries as well as in the passageways between lounges, an appropriate amount of handrails or other provisions shall be provided for holding on to."*

In the case of this vessel, which was built in 1997, it is difficult to understand why the shipyard did not observe these provisions regarding the equipment of the bridge with handrails. For example, there are no handrails whatsoever amidships at the free-standing radio workstation and it is very difficult to find something to hold on to there. On the entire bridge, especially at the windows (the front bulkhead), there are no handrails, handles or other provisions on which the lookout, for example, who normally spends the most time at the window and keeps lookout, could hold.

The only three handrails are on the ship's conning position. However, to get there from the staircase a 2 x 2 m space, in which there are no handholds, needs to be crossed.

## 4.5 Cause of death

It was not possible to clarify the actual cause of death conclusively for lack of a forensic examination (post mortem) of the body of the casualty and the absent medical report.

<sup>7</sup> UVV-See = Accident Prevention Regulations for Shipping Enterprises

<sup>8</sup> This article of the UVV-See was repealed by the Federal Ministry of Labour and Social Affairs on 1 December 2010.

The BSU requested a forensic opinion for the investigation of the accident from the Hamburg Port Health Centre (Head: Dr Schlaich), Central Institute of Occupational Medicine and Maritime Medicine (ZfAM), in consultation with Professor Püschel, Forensic Medicine at UKE Hamburg, on the basis of the photos on hand, witness accounts, and the death certificate issued in Hong Kong.

The assessment revealed that death may have been caused by several patterns of injury, during which the casualty suffered cardiovascular arrest or respiratory failure. The following hypothetical statements about the cause of death are taken from the report:

***The death is probably due to and as a result of the casualty suffering severe injuries during the fall (polytrauma).***

.....

.....

***Since the cause of death cannot be determined conclusively, it is not possible to state whether it could have been prevented.***

***However, medically the following requires consideration:***

- ***placing the casualty in a sitting position,***
- ***the late transmission of an emergency call for medical assistance by radio and to the Maritime Rescue Coordination Centre, and***
- ***insufficient pain management.***

## 5 CONCLUSIONS

### 5.1 Sea-going behaviour and stability

There are no statutory, flag State or class-related requirements for the necessary minimum roll damping on vessels. Large modern container vessels are, regardless of the area of operation, prone to absorbing high levels of swell moments because of their large bow flare. Stability of the vessel and roll moments, roll accelerations and roll damping are directly related. Vessels with insufficient stability are at risk of capsizing due to excessive rolling; in the case of too much stability, there is a risk that cargo maybe lost and a risk to the crew due to excessive roll accelerations. Structural measures, such as bilge keels, do not represent an adequate means of minimising rolling effectively. Other structural measures, such as gravity tanks, roll damping tanks, anti-rolling stabilisers, etc., should be introduced at the planning stage in order to achieve greater roll damping.

This investigation of the accidents involving the CCNI GUAYAS, the FRISIA LISSABON, the CHICAGO EXPRESS and also the calculations of the TUHH made in the course of a thesis demonstrate that such accidents can only be avoided in the future if sufficient attention is paid to the effects of the sea state during the vessel design and approval stage.

### 5.2 Manning of laid-up vessels

The rules for the manning of sea-going vessels underway with sufficient and qualified personnel are clearly dealt with in the jurisdiction of the flag State. According to art. 4 Schiffsbesetzungsverordnung (ships' crew regulation), the Ship Safety Division (BG Verkehr) is responsible for issuing minimum safe manning certificates. The procedure for issuing minimum safe manning certificates is dealt with in the general administrative provisions under art. 4 Schiffsbesetzungsverordnung. According to para. 9 of this regulation, the Ship Safety Division (BG Verkehr) may issue a minimum safe manning certificate limited to a maximum period of 48 hours with lower manning than that specified in the valid minimum safe manning certificate for the purpose of moving laid-up vessels.

The owner is, with due regard to art. 3 and art. 5 Ship Safety Act, solely responsible for the manning of laid-up vessels flying the German flag. The owner determines where, when, how long, and with how many crew members a vessel is laid-up. The German Schiffsbesetzungsverordnung does not prescribe manning fixed according to the number of crew members for laid-up merchant vessels; therefore, the German flag State Administration (Ship Safety Division (BG Verkehr)) does not issue separate minimum safe manning certificates.

In the spring of 2009, the Ship Safety Division (BG Verkehr) issued general information to shipowners concerning the manning of German flagged laid-up merchant vessels (see Annex 8.1) in a circular. In particular, this circular refers to IMO circular STCW.7/Circ14 of 24 May 2004, which discusses the shipowner's responsibility for the maintenance of a safe anchor watch (see Annex 8.2).

According to the analysis of the findings of the investigation, the vessel was not manned with a sufficient number of deck officers to cope with the accident. Unprotected and beyond the outer roadstead of Hong Kong, the selected anchorage was not suitable for a prolonged lay-up with reduced manning. During the time of year and in the sea area, a higher incidence of typhoons is to be expected and the vessel should be operational and able to proceed fully manned at all times.

Safe watchkeeping and sea operation was not possible with reduced manning after the anchor was weighed; similarly, it would not have been possible to respond effectively to emergencies, such as the outbreak of fire.

### **5.3 Bridge design and safety**

On today's large, wide and spacious bridges, more safeguards must be provided for the crew members situated there. Similarly, attachment points or eyes for safety straps or life lines, or to secure a person in a stretcher, for example, must be included in the bridge design.

The guidelines, implementation instructions and recommendations of the now officially expired UVV-See for structural equipment on the bridge should continue to be regarded as generally accepted rules for health and safety and a sufficient number of handrails installed on the bridge for the safety of the crew. As a result of the accident, the owner of the CHICAGO EXPRESS immediately arranged for various additional handrails and guard rails to be installed on vessels of this class to minimise the risk of falling due to heavy seas. (See Investigation Report 510/08 of 1 November 2009, pages 58, 59, 60, for implementation details.)

### **5.4 Medical care**

The vessel was in a difficult situation before and after the accident.

The person with the best training in the initial treatment of casualties, the master, had to steer the vessel and was unable to continue caring for the injured person. Other officers were not on the bridge to provide medical care.

The injuries were not considered to be very serious as the third officer was still responsive and loss of responsiveness only became evident when he began to slowly drift off.

The extent of the injuries and overall situation on the bridge were wrongly assessed. Additional assistance should have been promptly sought via intercom or telephone and shore-based rescue stations quickly informed with a request for medical advice for further treatment of the casualty.

According to the medical specialists, the casualty was positioned improperly and should have been placed in a lying position to avoid further injuries and complications due to orthostatic volume distribution.

Adequate pain management should have been implemented using shipboard pain medication, e.g. morphine by injection.

An intravenous line should have been used to give the casualty fluids. Fluids should not be given orally when injuries are unclear.

It must be called into question whether the people on board possessed this medical expertise without external advice, respectively, were up-to-date with the latest methods of medical care on board a vessel. In this regard, note the Richtlinie zur Durchführung von medizinischen theoretisch-praktischen Wiederholungslehrgängen (guidelines on the implementation of refresher courses in medical theory and practise for masters and ship's officers) in the Annex.

However, had medical advice been sought, by radio, for example, it must also be called into question whether there was a sufficient number of crew members on board to implement it.

## **5.5 Reiteration of the safety recommendations from Investigation Report 510/08 of 1 November 2009**

Owing to the continuing fundamental importance, the Federal Bureau is reiterating the safety recommendations from Investigation Report 510/08 of 1 November 2009 'Fatal accident on board the CMV CHICAGO EXPRESS during Typhoon 'HAGUPIT' on 24 September 2008 off the coast of Hong Kong'.

### **5.5.1 Observance of swell-related stability effects**

The Federal Bureau of Maritime Casualty Investigation recommends that, in cooperation with classification societies and shipyards, the operators of sea-going vessels increase efforts aimed at paying far more attention than hitherto to the dramatic consequences of swell-related stability effects, which are evident under certain circumstances, during the design and approval of future vessels. This must take into account the fact that very large units, in particular, often sail with very little cargo on board, respectively, in ballast in a condition far removed from that intended in the actual design, and for that reason especially, depending on the weather, both crew and cargo can inevitably be exposed to the effect of very dangerous forces and acceleration when at sea.

### **5.5.2 Drifting abeam**

The Federal Bureau of Maritime Casualty Investigation recommends that nautical colleges, vessel operators and ship's commands intensively address the issue of hazards on the bridge of large container vessels in heavy swell. Drifting abeam would have led to a significant portion of energy from the swell being converted into a drift motion rather than a rolling motion and typically a large roll angle does not occur in such situations. However, it should be remembered that the external circumstances (danger of running aground) and the eventual possibility that the stern will turn against the sea and can then be exposed to extreme slamming pressures on the flat aft section must be duly considered.

### **5.5.3 Medical care**

The Federal Bureau of Maritime Casualty Investigation refers ship owners and ship's commands to the need for regular performance of medical refresher courses for masters and ship's officers. (See Annex 8.3)



#### **5.5.4 Revision of design specifications**

The Federal Bureau of Maritime Casualty Investigation recommends that, in cooperation with the classification societies, the Federal Ministry of Transport, Building and Urban Development (BMVBS) take initiatives at the IMO aimed at developing and/or revising internationally binding rules, which from a shipbuilding perspective concern vessel safety. The trend in shipbuilding towards ever larger vessels shows that it is now more necessary than ever before to better address the issue of swell-related effects during the design and approval of such vessels.

## **6 SAFETY RECOMMENDATIONS**

The following safety recommendations do not constitute a presumption of blame or liability in respect of type, number or sequence.

### **6.1 Critical speed**

The Federal Bureau of Maritime Casualty Investigation recommends that the owners of the CCNI GUAYAS and the FRISIA LISSABON convey to their crews that it has been found in the investigation that under extreme sea conditions and when vessels sail in ballast, the vessel and (deck) cargo are not only exposed to a risk arising from excessive speed, but that reducing the speed, in particular, to less than a critical value can also lead to a dangerous deterioration of the dynamic roll damping.

### **6.2 Bridge design**

The Federal Bureau of Maritime Casualty Investigation recommends that in cooperation with the classification society and the shipyard the owner of the CCNI GUAYAS immediately improve the fall prevention measures on the bridge and the measures for securing injured persons in the event of heavy sea conditions.

### **6.3 Manning of laid-up vessels**

The Federal Bureau of Maritime Casualty Investigation recommends that the owner of the CCNI GUAYAS man laid-up vessels sufficiently with nautical and technical personnel so that safe shipboard operations and proper seaworthiness are ensured if vessels have to proceed at short notice in an emergency.

### **6.4 Medical care**

The Federal Bureau of Maritime Casualty Investigation refers the owner of the CCNI GUAYAS to the need for sufficient manning with medically trained personnel and the related need for regular medical refresher courses for masters and ship's officers.

## 7 SOURCES

- Investigations by the waterway police (WSP)
- Written statements
  - Ship's command
  - Owner
  - Classification society
  - Recordings of the VDR
- Witness accounts
  - Email correspondence with the Marine Department (MARDEP) of the Hong Kong Special Administrative Region
- Reports/expert opinion
  - Opinion on the very serious marine casualty on board the CCNI GUAYAS off Hong Kong on 15 September 2009  
Abridged opinion on the serious marine casualty on board the FRISIA LISSABON off Borkum on 16 October 2009  
Prof. Dr.-Ing. S. Krüger, Director of the Institute of Ship Design and Ship Safety, Hamburg-Harburg University of Technology
  - Opinion on the fatal accident, Central Institute of Occupational Medicine and Maritime Medicine, Hamburg 26 May 2010
- Charts and vessel particulars, Federal Maritime and Hydrographic Agency (BSH)
- Official weather report by Germany's National Meteorological Service (DWD)
- Documentation, Ship Safety Division (BG Verkehr)
  - Accident Prevention Regulations for Shipping Enterprises (UVV-See)
  - Guidelines and information sheets
  - Ship files
- Thesis by Nicolas Rox, Examination of the intact stability and the seakeeping behaviour of container vessels within the ballast condition, Hamburg-Harburg University of Technology, December 2010

## 8 APPENDICES

### 8.1 Information on the manning of laid-up merchant vessels



**Bundesrepublik Deutschland**  
*Federal Republic of Germany*

**See-Berufsgenossenschaft**  
**Schiffssicherheitsabteilung/Ship Safety Division**

Reimerstwiete 2, D-20457 Hamburg  
Tel.: 040/361 37-0, Fax: 040/361 37-204

#### **INFORMATIONEN ÜBER DIE SCHIFFSBESETZUNG VON AUFLIEGENDEN HANDELSCHIFFEN UNTER DEUTSCHER FLAGGE**

Die nachfolgende verbindlichen Information gelten für Handelsschiffe unter deutscher Flagge, die aufliegen. Aufliegende Schiffe sind Schiffe, die vorübergehend aus dem Fracht- und/oder Personenverkehr gezogen wurden.

Sobald ein Schiff einen Hafen, einen Liegeplatz oder einen Ankerplatz verlässt, gilt es nicht mehr als aufliegendes Schiff und muss gemäß des gültigen Schiffsbesatzungszeugnisses besetzt werden.

#### **Anforderungen an die Schiffsbesetzung bei aufliegenden Handelsschiffen:**

1. Der Reeder ist für die ordnungsgemäße Besetzung auch eines aufliegenden Handelsschiffes verantwortlich.
2. Insbesondere ist das Schiff während des Aufliegens so zu besetzen, dass:
  - der sichere Wachbetrieb gewährleistet ist,
  - in Notfällen effektiv reagiert werden kann,
  - der Verschlusszustand hinsichtlich Feuerschutz und Erhaltung der Schwimmfähigkeit hergestellt ist,
  - die ISM- und ISPS-Rechtsvorschriften eingehalten werden,
  - vor Anker eine sichere Ankerwache im Sinne STCW.7/Circ. 14 vom 24.05.2004 („Guidance for Masters on keeping a safe anchor watch“) gegangen wird (vgl. Anlage).
3. Für aufliegende Schiffe wird von der deutschen Flaggenstaatsverwaltung (See-Berufsgenossenschaft) kein gesondertes Schiffsbesatzungszeugnis ausgestellt. Nach der deutschen Schiffsbesatzungsverordnung wird keine festgelegte Besetzung nach Anzahl der Besatzungsmitglieder für aufliegende Handelsschiffe vorgeschrieben.
4. Örtliche Rechtsvorschriften z. B. in Häfen sind einzuhalten.

See-Berufsgenossenschaft

Hamburg, 17. Februar 2009

## 8.2 IMO circular STCW.7/Circ.14

INTERNATIONAL MARITIME ORGANIZATION  
4 ALBERT EMBANKMENT  
LONDON SE1 7SR

Telephone: 020 7735 7611  
Fax: 020 7587 3210



IMO

*E*

Ref. T2/4.1.5

STCW.7/Circ.14  
24 May 2004

### GUIDANCE FOR MASTERS ON KEEPING A SAFE ANCHOR WATCH

- 1 The Sub-Committee on Standards of Training and Watchkeeping, at its thirty-fifth session (26 to 30 January 2004), considered the requirements in section A-VIII of the STCW Code relating to watchkeeping requirements at anchor after seeking the advice of the NAV Sub-Committee as this was an operational matter.
- 2 The Sub-Committee, noting the advice issued by the NAV Sub-Committee, developed additional guidance for masters on keeping a safe anchor watch, set out at annex.
- 3 The Maritime Safety Committee, at its seventy-eighth session (12 to 21 May 2004), approved the circulation of this guidance for masters on keeping a safe anchor watch.
- 4 Member Governments are invited to bring the guidance to the attention of those concerned.

\*\*\*

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STCW.7/Circ.14

**ANNEX**

**GUIDANCE FOR MASTERS ON KEEPING A SAFE ANCHOR WATCH**

1 The master of every ship at an unsheltered anchorage, at an open roadstead or any other virtually "at sea" conditions in accordance with chapter VIII, section A-VIII/2, part 3-1, paragraph 51 of the STCW Code, is bound to ensure that watchkeeping arrangements are adequate for maintaining a safe watch at all times. A deck officer shall at all times maintain responsibility for a safe anchor watch.

2 In determining the watchkeeping arrangements, and commensurate with maintaining the ship's safety and security and the protection of the marine environment, the master shall take into account all pertinent circumstances and conditions such as:

- .1 maintaining a continuous state of vigilance by sight and hearing as well as by all other available means;
- .2 ship-to-ship and ship-to-shore communication requirements;
- .3 the prevailing weather, sea, ice and current conditions;
- .4 the need to continuously monitor the ship's position;
- .5 the nature, size and characteristics of anchorage;
- .6 traffic conditions;
- .7 situations which might affect the security of the ship;
- .8 loading and discharging operations;
- .9 the designation of stand-by crew members; and
- .10 the procedure to alert the master and maintain engine readiness.

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### 8.3 Guideline for medical care

**ARBEITSKREIS DER KÜSTENLÄNDER  
FÜR SCHIFFSHYGIENE (Ak/Kü)**

**Richtlinie Nr. 6 vom 21.5.2008  
im Einvernehmen mit der See-Berufsgenossenschaft**

**zur Dritten Verordnung zur Änderung der Verordnung über die  
Krankenfürsorge auf Kauffahrteischiffen  
vom 5. September 2007**

**- Durchführung von medizinischen theoretisch-  
praktischen Wiederholungslehrgängen für Kapitäne oder Schiffsoffiziere -**

Der Arbeitskreis der Küstenländer für Schiffshygiene (Ak/Kü) verfolgt mit dieser Richtlinie das Ziel, einheitliche Grundsätze und gleiche Anforderungen in den Küstenländern anzuwenden, die dem Entwicklungsprozess der Schifffahrt angepasst sind. Hinweise und Verbesserungsvorschläge sind an die Geschäftsführung des Ak/Kü zu richten



## **Empfehlungen über die Anerkennung und Durchführung von medizinischen Wiederholungslehrgängen für Kapitäne oder Schiffsoffiziere**

Nach § 2 Absatz 3 der Krankenfürsorgeverordnung hat der Reeder dafür zu sorgen, dass ein Kapitän oder Schiffsoffizier für die Durchführung der Krankenfürsorge verantwortlich ist, bei dem der erstmalige Erwerb eines Befähigungszeugnisses nicht mehr als 5 Jahre zurückliegt oder der vor nicht mehr als 5 Jahren einen von der nach Landesrecht zuständigen Behörde anerkannten Wiederholungslehrgang auf dem Gebiet der medizinischen Ausbildung besucht hat.

### **Bei der Anerkennung und Durchführung der Kurse sollen die folgenden Kriterien erfüllt sein:**

#### **1 Ziel, Dauer**

- 1.1 Die für die Durchführung der Krankenfürsorge verantwortlichen Kapitäne oder Schiffsoffiziere müssen alle 5 Jahre einen von der zuständigen Landesbehörde anerkannten medizinischen Wiederholungslehrgang absolvieren, damit sie ihre Kenntnisse und Fähigkeiten erhalten, verbessern und mit neuen Entwicklungen Schritt halten können.
- 1.2 Die medizinischen Wiederholungslehrgänge werden in Form eines zusammenhängenden Lehrgangs durchgeführt, der Fallbeispiele und praktische Übungen in kleinen Gruppen – wenn möglich auch auf einer Notfall- /Unfallstation oder in einer entsprechenden Ambulanz eines Krankenhauses – einschließt.
- 1.3 Die Dauer der Lehrgänge für Kapitäne oder Schiffsoffiziere außerhalb der Nationalen bzw. Küstenfahrt sowie der Großen und Kleinen Hochseefischerei (Ausrüstungsverzeichnisse A1, A2 und B) beträgt insgesamt vierzig Stunden, in der Regel eine Woche mit fünf Tagen (Anlagen 3 und 4). Kurstitel: *Medizinischer Wiederholungslehrgang / medical care refresher course*.

Die Dauer der Lehrgänge für Kapitäne oder Schiffsoffiziere in der Nationalen bzw. Küstenfahrt sowie der Küstenfischerei (Ausrüstungsverzeichnisse C1 und C2) beträgt insgesamt sechzehn Unterrichtsstunden, in der Regel zwei Tage (Anlagen 5 und 6). Kurstitel: *Medizinischer Wiederholungslehrgang - Küstenfahrt / medical care refresher course – coastal voyage*.

#### **2 Gegenstände der medizinischen Wiederholungslehrgänge**

- 2.1 Die Lehrgänge müssen auf dem Inhalt der jeweils neuesten Fassung der Krankenfürsorgeverordnung sowie der „Anleitung zur Krankenfürsorge auf Kauffahrteischiffen“ und dem „Leitfaden für medizinische Erste-Hilfe-Maßnahmen bei Unfällen mit gefährlichen Gütern (MFAG)“ beruhen.
- 2.2 Die Lehrgänge sollen im Hinblick auf die Eigenheiten und Schwierigkeiten der medizinischen Versorgung an Bord möglichst praxisbezogen sein, um den Schiffsoffizieren die erforderlichen Kenntnisse und praktischen Fähigkeiten für eine ordnungsgemäße Durchführung der Krankenfürsorge an Bord zu vermitteln. Hierfür sollen praktische Unterweisungen, Demonstrationen,

Fallbeispiele und Übungen durchgeführt werden. Wenn möglich, sollen die Teilnehmer darüber hinaus Gelegenheit erhalten, als Hospitanten an Ambulanzdiensten und an Fahrten von Rettungs- und Unfallhilfsdiensten teilzunehmen.

### 3 Anerkennungsverfahren

- 3.1 Nach § 2 Absatz 3 der Krankenfürsorgeverordnung wird der jeweils nach Landesrecht zuständigen Behörde die Zuständigkeit für die Anerkennung von medizinischen Wiederholungslehrgängen zugewiesen.
- 3.2 Vor Anerkennung eines Lehrganges prüft die zuständige Landesbehörde die Qualifikation des bewerbenden Lehrgangsanbieters anhand der vorliegenden Richtlinie nebst Anlagen. Es liegt im Ermessen der zuständigen Landesbehörde, sich hierzu eines Auditors zu bedienen, der die Einhaltung der Qualitätskriterien durch eine Ortsbegehung überprüft und der zuständigen Behörde hierüber Bericht erstattet.
- 3.3 Gültigkeit der Anerkennung
- Die Anerkennung kann mit Auflagen verbunden werden.
  - Die Anerkennung kann durch die zuständige Landesbehörde widerrufen werden, wenn
    - Zweifel an der Zuverlässigkeit des Kursanbieters entstehen oder
    - die Anforderungen der Richtlinie Nr. 6 des Ak/Kü nicht eingehalten werden.

### 4 Qualitätssicherung

- 4.1 *Auditoren*  
Die von der zuständigen Landesbehörde beauftragten Auditoren sollen die fachliche Eignung nach Anlage 1 aufweisen. Der Ak/Kü soll der zuständigen Landesbehörde auf Anfrage geeignete Auditoren vorschlagen.
- 4.2 Jede Änderung anerkennungsrelevanter Sachverhalte ist der zuständigen Landesbehörde unverzüglich anzuzeigen. Hierzu zählen insbesondere:
- 4.2.1 *Raumausstattung und Unterrichtsmaterialien*  
In Anlage 2 sind die zur Qualitätssicherung notwendige Raumausstattung für den vierzig- und sechzehnständigen medizinischen Wiederholungslehrgang sowie die erforderlichen Unterrichtsmaterialien zusammengefasst. Diese Aufstellung definiert die materiellen Voraussetzungen zur Anerkennung eines Lehrgangs. Dabei setzt sich der Bewertungsmaßstab aus drei Kategorien zusammen:
- erforderliche Ausstattung: Diese Ausstattung ist obligatorisch und muss im Falle der Unvollständigkeit unmittelbar, spätestens bis zum nächsten Lehrgang, komplettiert werden. Anderenfalls kann die Anerkennung bis zum Nachweis der Vollständigkeit widerrufen werden.
  - dringend empfohlene Ausstattung: Diese Ausstattung ist obligatorisch und muss bei Feststellung der Unvollständigkeit binnen eines Jahres

komplettiert werden. Anderenfalls kann die Anerkennung bis zum Nachweis der Vollständigkeit widerrufen werden.

- c. sinnvolle Ausstattung: Diese Ausstattung ist fakultativ, d. h., sie sollte vorhanden sein, eine Verpflichtung zur Anschaffung besteht nicht.

#### 4.2.2 *Theoretischer und praktischer Unterricht*

In den Anlagen 3 / 4 und 5 / 6 ist der theoretische sowie praktische Unterricht im vierzig- und sechzehnständigen medizinischen Wiederholungslehrgang definiert. Die obligatorischen Ausbildungsinhalte müssen im Falle der Unvollständigkeit unmittelbar, spätestens zum nächsten Lehrgang, komplettiert werden. Anderenfalls kann die Anerkennung bis zum Nachweis der Vollständigkeit entzogen werden.

#### 4.2.3 *Ausbilder*

In Anlage 7 sind die Mindestqualifikationen der Ausbilder im medizinischen Wiederholungskurs definiert. Die Lehrgänge sollen von Ärzten geleitet werden, die mit den Verhältnissen der Seefahrt und den Eigenheiten und Schwierigkeiten der medizinischen Versorgung an Bord vertraut sind. Das sonstige Ausbildungspersonal der Wiederholungslehrgänge soll nach Möglichkeit ebenfalls diesen Anforderungen entsprechen.

Die leitenden Ärzte haben dafür zu sorgen, dass die Lehrgänge planmäßig, zeitlich und sachlich gegliedert so durchgeführt werden, dass das Ausbildungsziel in der vorgesehenen Zeit erreicht werden kann.

#### 4.2.4 *Evaluation*

Jeder Lehrgang muss am Ende von den Teilnehmern in schriftlicher Form anonym evaluiert werden. Es wird der in Anlage 8 befindliche Evaluationsbogen eingesetzt. Die Evaluationsergebnisse werden über die zuständige Landesbehörde dem Ak/Kü zur länderübergreifenden Bewertung zugeleitet.

#### 5 *Teilnahmebescheinigungen*

Die Lehrgangsteilnehmer erhalten nach Beendigung des Lehrganges von den Trägern der Wiederholungslehrgänge eine Teilnahmebescheinigung (Anlage 9).

#### 6 *Inkrafttreten*

Diese Richtlinie tritt am 21.05.2008 in Kraft.

**Arbeitskreis der Küstenländer für Schiffshygiene**  
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