



GOBIERNO
DE ESPAÑA

MINISTERIO
DE TRANSPORTES, MOVILIDAD
Y AGENDA URBANA

SUBSECRETARÍA DE TRANSPORTES,
MOVILIDAD Y AGENDA URBANA

COMISIÓN PERMANENTE DE
INVESTIGACIÓN DE ACCIDENTES
E INCIDENTES MARÍTIMOS

CIAIM-03/2020 REPORT

Collision of the passenger and wheeled vehicle ferry EXCELLENT against the South Dock (dock 24B) and the BABCOCK&WILCOX PANAMAX gantry crane number 904 on the 31st of October 2018

NOTE

This report has been elaborated by the Maritime Accident and Incident Investigation Permanent Commission (CIAIM), which is regulated by article 265 of the reformed text of the Law of State Ports and the Merchant Navy, approved by Royal Legislative Decree 2/2011, of the 5th of September, and by Royal Decree 800/2011, of the 10th of June.

The aim of the CIAIM when investigating maritime accidents and incidents is to draw conclusions and extract lessons that allow the risk of future maritime accidents to be reduced, and hence contribute to maritime safety and to preventing contamination from shipping. To this end, the CIAIM carries out a technical investigation in each case in which it attempts to establish the causes and circumstances that, directly or indirectly, may have contributed to the accident or incident and, when necessary, to issue the appropriate safety recommendations.

The elaboration of this technical report is not intended in any way to prejudge any judicial decisions that may be produced, nor does it seek to evaluate responsibilities nor to determine guilt.



Figura 1. RO-PAX EXCELLENT



Figura 2. Accident site

1. SUMMARY

On the morning of the 31st of October, the passenger and wheeled vehicle ferry (RO-PAX) EXCELLENT entered the port of Barcelona, having sailed from Genoa (Italy).

At 07:27, the maritime pilot boarded the craft to advise the captain during the docking manoeuvre at Costa Quay 21 A ("Muelle de Costa"). When entering the Morrot Dock ("dársena de Morrot"), the maritime pilot requested a tug, given the strong wind at that time and the limited available space in the dock, since the RO-PAX GNV CRISTAL was moored there, refuelling from the bunker ship SPABUNKER VEINTIUNO. Since no tugs were available at that moment, the vessel aborted the docking manoeuvre, and informed BPC¹ that it would exit the port to await the arrival of tugs.

To sail out of the port to await the tugs, the RO-PAX EXCELLENT entered the main navigation channel, "Adosado Centro", at a speed of about 10 knots. When it was passing the cruise ship COSTA FAVOLOSA and the tug CALA GULLO, the vessel veered to starboard, colliding at 07:59:50 with the South Quay ("Muelle Sur" 24 B) and the BABCOCK&WILKOX PANAMAX gantry crane number 904.

As a result of the collision, the crane fell over and caused a fire in the APM container terminal on the South Quay, while damage was also caused to the vessel's bulbous bow, the starboard forecastle and the weather deck. The Port Self-protection Plan was activated at level 2.

At 08:50, the EXCELLENT docked in the Costa Quay with the help of two tugs.

At 11:04, the fire was declared under control.

1.1. Investigation

The CIAIM received the notification of the incident on the 31st of October 2018. The same day, the incident was provisionally classified as a "serious accident", and a meeting of the CIAIM ratified this classification and the subsequent safety investigation. This report was reviewed by a CIAIM committee meeting on the 12th of March 2020 and, following its approval, was published on November 2020.

¹ The marine traffic and port control service in Barcelona Port operates from the Control Tower of the port of Barcelona, and its identification in radio-telephone communications and when referring to the service in general is 'Barcelona Port Control'

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2. FACTUAL INFORMATION

PARTICULARS ON THE SHIP/VESSEL	
Name	EXCELLENT
Flag / Port of Registry	Italy
Identification	IMO number: 9143441
Type	Passenger and wheeled vehicle ferry
Main particulars	Total length: 202.78 m Width: 26.80 m Gross tonnage: 3977 GT Hull material: steel Propulsion: 4 WARTSILA engines, 8R46A x 7240 kW, and 2 controllable-pitch propellers. 2 rudders and 2 transversal propellers in the bow, each of 1000 kW.
Owner and management	The vessel belongs to GRANDI NAVI VELOCI SpA (GNV)
Classification society	RINA Services SpA
Shipbuilding details	Built in 1998 in the Nuovi Cantieri SpA shipbuilding yard, Marina di Carrara (Italy)
Minimum safe manning	Up to 500 passengers in short international voyages: 32 crew Up to 1000 passengers in short international voyages: 44 crew Up to 1900 passengers in short international voyages: 52 crew More than 1900 passengers in short international voyages: 70 crew Up to 1148 passengers in unrestricted voyages: 52 crew
VOYAGE PARTICULARS	
Ports of Departure / Arrival	Departure from Genoa (Italy) heading for Tangier (Morocco) with stopover in Barcelona
Type of voyage	Short international scheduled voyage
Cargo information	101 passengers, 59 private cars, 1 trailer and 18 articulated trucks
Crew	91 crew, complying with the minimum number required for safety
Documents	The vessel possessed the requisite valid certificates
INFORMATION ON THE INCIDENT	
Type of incident	Collision with quay and gantry crane
Date and time	31st of October, 07:59:49 local time.
Location	Port of Barcelona, 41°21'28"N 002°10'32"E
Vessel's operations	Navigation in the "Adosado Centro" channel, having suspended the docking manoeuvre, in order to await free tugs
Place on board	Bulbous bow, starboard forecastle and weather deck
Ship damage	Bulbous bow: deformations and splits 3,000mm long. Starboard forecastle and weather deck: deformations and splits 3,500mm long
Injured/missing persons overboard	No
Pollution	No
Other non-ship damage	Gantry crane BABCOCK&WILCOX PANAMAX no. 904. Damage to containers and their contents, stored in the container terminal of the South Quay.
Other personal injuries	No
MARINE AND METEOROLOGICAL CONDITIONS	
Wind	Beaufort force 6 (22 to 27 knots) with gusts of 28 to 40 knots, from S-SE (150° to 180°)
Sea State	Outside the port: Moderate to rough. Inside the port: Waves 1 to 1.5m in height.
Visibility	Moderate (4 to 7 km)
LAND-BASED AUTHORITY PARTICIPATION AND EMERGENCY SERVICE RESPONSE	
Organisations involved	Marine Salvage and Safety Society (SASEMAR) Port police Marine Service of the Guardia Civil Barcelona Maritime Pilots' Corporation National Police Barcelona Urban Guard Regional Police (Mossos d'Esquadra) Protection, Fire extinction and Salvage Service (SPEIS-080) Medical Emergency System (SEM) Port Authority of Barcelona

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	Barcelona Harbour Master's Office
Means deployed	Salvage vessel PUNTA MAYOR Salvage ship SALVAMAR MINTAKA Tugboat DAMON CASAS Tugboat SALVADOR DALI Tugboat CALA SEQUER
Speed of intervention	Immediate
Measures adopted	Activation of the Port Self-protection Plan Activation of the port's Internal Maritime Plan (PIM) Activation of the Special Emergency Plan for Accidental Contamination in the Catalonian Seaboard (CAMCAT) Evacuation of the South Quay container terminal and shut-down of all of its activities Mobilisation of tugs to dock the RO-PAX EXCELLENT
Results obtained	Extinction of the fire Docking of the RO-PAX EXCELLENT in the Costa Quay

2.1. Other data

This report has been prepared based on the report of the port police, the Barcelona Harbour Master's Office, Barcelona Pilots and the company GNV, which operates the RO-PAX EXCELLENT, among other documents.

In 2016, the captain of the RO-PAX EXCELLENT was granted an exemption from piloting for the RO-PAX SNAV ADRIATICO, but had not requested an exemption from piloting for the RO-PAX EXCELLENT.

3. DETAILED DESCRIPTION

This relation of events is based on the available data, declarations and reports. The times given are local times and are taken from the voyage data recorder (VDR) of the RO-PAX EXCELLENT. The wind speed data are those registered by the vessel's anemometer.

On the 31st of October 2018, at 07:10, the RO-PAX EXCELLENT neared Barcelona Port, having sailed from the port of Genoa. The vessel contacted BPC, requesting information on the wind speed inside the port, which at that moment was 15 knots.

The assigned mooring was on Costa Quay (21 A), modules 6 to 8. Next to this mooring, on the same quay, the cruise ship GNV CRISTAL was already moored and was refuelling from the bunker ship SPABUNKER VEINTIUNO.

At 07:27, the maritime pilot boarded the RO-PAX EXCELLENT. The vessel entered the south entrance of the port with manual steering and both rudders synchronised, at a speed of about 9 knots. At that time the vessel's anemometer indicated a wind speed of 22.0 knots from 130.6°.

On the bridge were the captain, the first officer of the bridge, the third officer of the bridge, a helmsman and the maritime pilot. In the engine room were the chief engineer, the first engineering officer, the third engineering officer and the electrician.

At 07:35, BPC asked the RO-PAX EXCELLENT, which was navigating the main channel of the East dock, to reduce speed. At that time, the vessel's speed was 8.7 knots and the wind speed was 26.3 knots from 139.2°.

At 07:40, the RO-PAX EXCELLENT approached the COSTA FAVOLOSA cruiser, which was mooring at module D of the Adosado Quay, helped by the tugboat CALA GULLO. BPC informed the maritime pilot aboard the RO-PAX EXCELLENT that the CALA GULLO had reduced power in order not to affect its course. The RO-PAX EXCELLENT's speed was 6.7 knots. The wind speed was 24.4 knots from 150.4°.

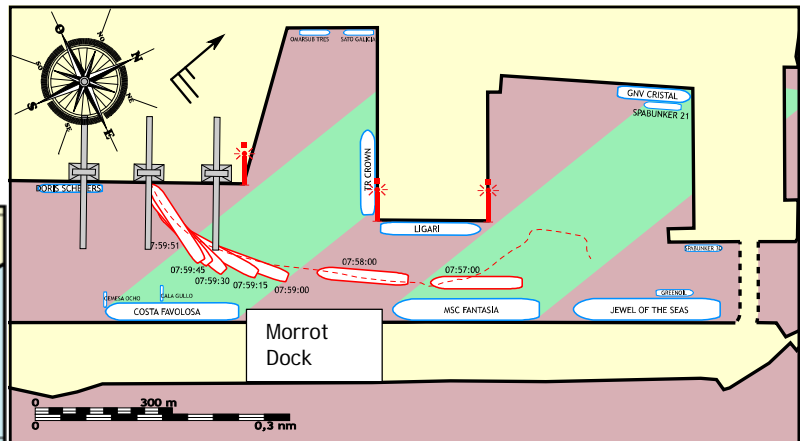
BPC contacted the MSC FANTASIA, which was moored and was holding against the wind using its lateral manoeuvring propellers, and requested them to reduce the propeller power while the RO-PAX EXCELLENT passed them. They replied that they would try to reduce power as much as possible, given the strong side wind at that time.

At 07:41, the maritime pilot received the information that the MSC FANTASIA had its lateral propellers running but that they would reduce power when they passed by. The vessel's anemometer indicated 25.8 knots from 152.7°.

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Figura 3. Accident site



Costa Quay 21 A,
intended mooring

Figura 4. Detail of the positions prior to the collision

At 07:42, the wind speed, according to the anemometer of the RO-PAX EXCELLENT, dropped momentarily to 1.4 knots from 113.5°, with the COSTA FAVOLOSA alongside them to starboard. The captain commented that perhaps the anemometer was not working properly. The maritime pilot and the captain speculated on the wind speed inside the Morrot Dock, anticipating that it would be between 20 and 25 knots, and also commented that probably, the MSC FANTASIA would protect them from the wind.

At 07:43, the maritime pilot asked BPC for the wind speed. BPC replied that, according to data provided by the COSTA FAVOLOSA, it was 35 knots.

At 07:44, the RO-PAX EXCELLENT was in the entrance to the Morrot Dock, navigating between the MSC FANTASIA, moored in module B of the Adosado Quay, and the merchant vessel LIGARI, in module 22 B of the Contradique Quay. The maritime pilot asked BPC about the situation of the CALA GULLO, but the tugboat was still helping the COSTA FAVOLOSA to dock. At this time the vessel's anemometer indicated a wind speed of 29.4 knots from 155.5°.

At 07:46, the RO-PAX EXCELLENT started to turn around in the Morrot Dock, to head for the assigned mooring. The available docking space was very limited, since the GNV CRISTAL was moored in this dock, with the bunker ship SPABUNKER VEINTIUNO refuelling it. (See figures 3 and 4).

The maritime pilot asked BPC if they could use the tugboat CALA GUYO. BPC replied that the captain of the COSTA FAVOLOSA needed it. The vessel's anemometer indicated 5.65 knots from 043°.



Figura 5. General view of the control console

At 07:47, the maritime pilot recommended that the anchor be prepared. Wind speed 16.1 knots from 147.9°.

At 07:49, while the RO-PAX EXCELLENT continued the mooring manoeuvre, trying to keep the stern steady, the maritime pilot again asked BPC if they had contacted the cruiser COSTA FAVOLOSA. BPC replied that they could not contact COSTA FAVOLOSA and that they were sending other tug.

At 07:50, the maritime pilot indicated to the captain that, if they could not hold the stern steady, they should abort the mooring manoeuvre in the Costa Quay, since the tugs would not arrive for some time.

At 07:51, the maritime pilot told the captain that they were suspending the manoeuvre and would await the arrival of tugboats at the entrance to the port. The maritime pilot informed BPC of this and that they would need two tugboats to dock.

At 07:55, about to complete the exit from the Morrot Dock, the vessel's speed was 2.4 knots. The maritime pilot asked for the speed to be increased, while giving steering orders. The vessel's anemometer indicated 27.3 knots from 181.7°.

At 07:57, the maritime pilot indicated that all was going well, ordering increased engine power and giving steering orders. At that time, the vessel's speed was 9 knots. Wind speed 34.9 knots from 152.7°.

At 07:58, the wind speed was 16.4 knots from 210.5°. The vessel was sailing at 10.3 knots along the "Principal Adosado Centro" channel, between the MSC FANTASIA and the COSTA FAVOLOSA cruise ship. The latter was maintaining its position using its six lateral propellers, three in the bow and three at the stern, with an average power in the three stern propellers of 41% of maximum power, while the tugboat CALA GULLO helped it to maintain its position.

At 07:58:14, the maritime pilot ordered the rudder to 10° starboard and dead slow ahead, to separate them from the COSTA FAVOLOSA and the CALA GULLO and the wash from their propellers.

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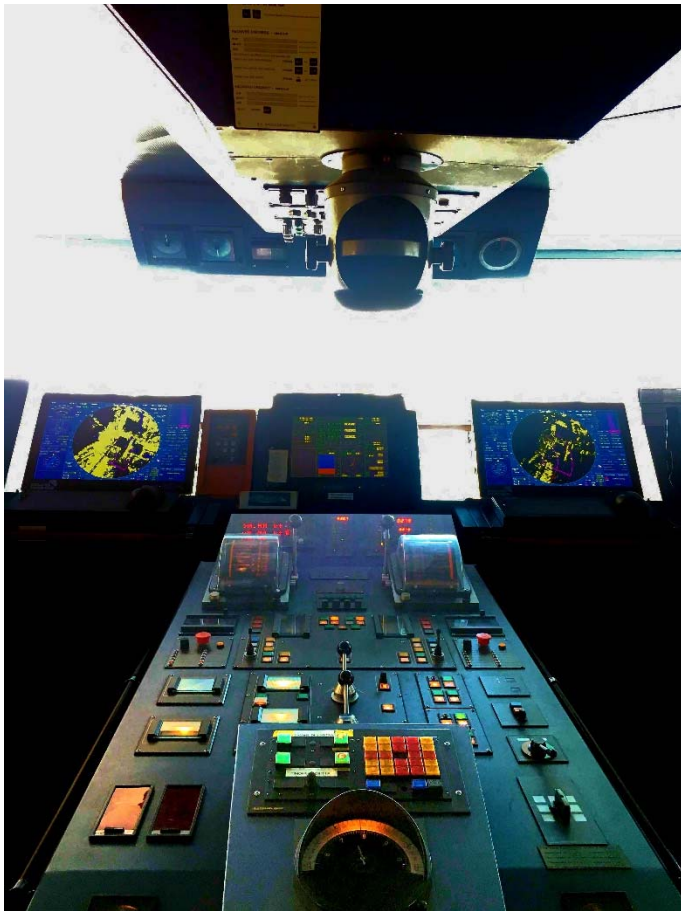


Figura 6. Detail of the centre console

(RCC) received a call from the Control Centre of the Barcelona Port Authority (CC APB) informing them of the accident and requesting that the fire brigade and the port police be sent there.

At 08:09, two tugboats arrived to help the RO-PAX EXCELLENT: the SALVADOR DALI headed for the bow of the EXCELLENT, and then the CALA SEQUER did the same.

At 08:20, the Port of Barcelona Self-protection Plan was activated, at level 2.

At 08:49, the salvage ship SALVAMAR MINTAKA informed that it was in the area of the fire and that a large number of firemen were working to extinguish it.

At 08:50 the EXCELLENT docked in the Costa Quay with the help of the two tugs.

At 09:38, the Barcelona RCC received a call from CC APB, informing them that the PIM had been activated in alert phase.



Figura 7. Moment of the collision



Figura 8. Collapse of the crane

At 07:58:28 the maritime pilot ordered 10° port rudder. Seeing that the vessel continued to veer to starboard, he ordered 20° port, and then fully to port. The vessel did not cease to veer to starboard.

At 07:59, the maritime pilot ordered half speed ahead, then immediately after, full speed ahead, expressing his surprise upon observing that the engine telegraph was showing astern, since he had not recommended reverse thrust. Seconds later, being unable to control the veering of the vessel, the maritime pilot ordered both propellers full astern and the captain ordered the anchor to be dropped.

At 07:59:49 local time, the bow of the RO-PAX EXCELLENT collided with one of the legs of the BABCOCK & WILCOX PANAMAX gantry crane number 904, which toppled onto several containers stored nearby, causing a fire in the APM container terminal of the South Quay. Several containers were affected, some containing hazardous merchandise. The bulbous bow of the vessel collided with the South Quay (24 B) in the area of module 5. The approximate angle of the impact between the vessel and the quay was 45° with respect to the quay. At this time the vessel's engines were powering astern, its speed was 5 knots and its course was 260.8°. The wind speed indicated by the vessel's anemometer was 35 knots from 159.1°.

At 08:03, the Barcelona Rescue Coordination Centre (RCC) received a call from the Control Centre of the Barcelona Port Authority (CC APB) informing them of the accident and requesting that the fire brigade and the port police be sent there.

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At 09:48, the Barcelona RCC contacted the consignee of the RO-PAX EXCELLENT, who confirmed that no-one on board had been injured and that they were preparing a damage report.

At 09:54, the Operations Coordination Centre of Catalonia (CECAT) communicated that the CAMCAT had been activated in pre-alert status, as a result of the activation of the PIM by the Barcelona Port.

At 10:45, the salvage ship SALVAMAR MINTAKA informed that they could no longer see fire and that the tugboats had ceased to supply water. The land-based fire brigade continued cooling the area.

At 11:04, the Barcelona fire brigade declared that the fire was under control.

The container terminal affected remained closed from 08:00 to 17:00.

After an inspection of the vessel by inspectors from the Barcelona Harbour Master's Office and from RINA (the vessel's classification society), the damage was determined to be as follows:

- In the bulbous bow: damage with a length of 3,000mm at approximately 2,000mm from the base line (deformations and splits). The most important damage was the V-shaped split located in the starboard side of the forepeak.
- Forecastle and weather deck: deformations and splits, including to reinforcements and hawsehole, with a length of 3500mm.

On land, the crane fell, as already mentioned, and there was damage to various containers and their contents, which the CIAIM has not evaluated. Damage to the quay was also observed, in the area where the bulbous bow collided with it. No personal injuries were caused.



Figura 9. Damage to the starboard forecastle and the weather deck



Figura 10. Damage to the bulbous bow

4. ANALYSIS

4.1. Moment of the collision

Figura 11 shows the vessel's heading, obtained from data in its VDR, together with the Rate of Turn (RoT) during the moments before and after the accident. It can be seen that the vessel was veering starboard at a more or less constant rate. At a certain moment, at 07:59:49, the heading stopped increasing and the RoT decreased abruptly

to zero. This happened when the bow hit the quay, so the vessel could not continue to veer to starboard, and this establishes the exact time of the collision.

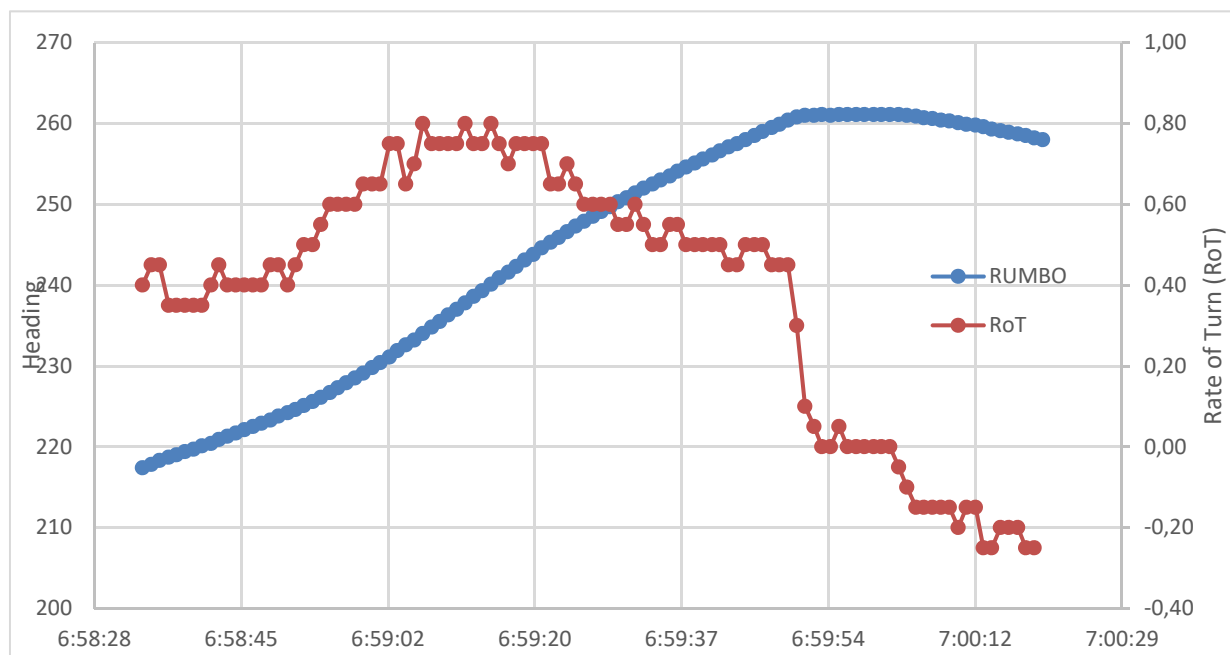


Figura 11. Vessel's heading and rate of turn - RoT (time in UTC)

4.2. Entry manoeuvre to the port to dock at the Costa Quay

During the entry manoeuvre, with a maritime pilot on board, the vessel's speed was 9 knots. BPC indicated that they reduce speed, since they were in the internal waters (Zone 1) of Barcelona Port. According to the rules regulating the organisation and coordination of maritime traffic in Barcelona Port, the maximum admissible speed in this zone is 6 knots. After this communication, the approach to the Morrot Dock was carried out at a speed of less than 7 knots.

The maritime pilot and the captain, while approaching the mooring, speculated as to the wind speed. Given the variations recorded by the vessel's anemometer, they considered the possibility that it was not working properly. At 07:42, while the RO-PAX EXCELLENT was passing the COSTA FAVOLOSA cruiser, which was to starboard, a wind gust of maximum 23.4 knots and minimum 1.4 knots was recorded.

When the vessel was nearing the Morrot Dock, the maritime pilot asked the BPC several times about the availability of tugs to help them to dock, because of the strong winds. No tugboat was immediately available. The closest was the CALA GULLO, but this was required by the captain of the COSTA FAVOLOSA to maintain its position.

The decision to request tugs was taken late, with the RO-PAX EXCELLENT already in a compromised situation. Neither the captain nor the pilot consider the need to be assisted by tugs before entering the port⁷.

During this first phase, the steering and engine orders were given mainly by the captain, while the maritime pilot made no recommendations in this regard.

4.3. Exit manoeuvre

After aborting the mooring manoeuvre and once in the main navigation channel, after passing the MSC FANTASIA, the RO-PAX EXCELLENT started to slowly increase its speed. At 07:58:14, the vessel's speed was 10.20 knots², with a wind speed of 35.21 knots from 158.9°.

² This speed is 4 knots greater than that allowed in zone 1. This increase in speed may be useful to counteract the effect on the vessel of the strong gusty wind. The port regulations specify that the maximum speeds may be exceeded when unexpected circumstances make it necessary in order to avoid a collision or to minimise the consequences of an accident while manoeuvring.

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In this phase of the operations the maritime pilot is seen to be giving constant instructions regarding the manoeuvre.

The vessels moored at the quays during the exit manoeuvre were the same as during entry, viz., to port of the RO-PAX EXCELLENT was the COSTA FAVOLOSA and the tug CALA GULLO, which was helping it to dock. During the exit manoeuvre of the RO-PAX EXCELLENT there were no communications with BPC to inform them of the operating power of the transversal propellers of the moored vessels, of the tugs that were helping them to dock, nor of any other question.

The RO-PAX EXCELLENT changed course, veering to starboard to avoid closing in on the COSTA FAVOLOSA, which, as was verified later in its VDR, had its three lateral stern propellers at 41% of full power, to push it towards the quay, and on the tugboat CALA GULLO and its propeller wash, which was acting in the same direction as the wind.

The maritime pilot ordered "dead slow ahead" at about 07:58:14. At that moment, with the vessel sailing ahead at more than 10 knots, the propellers are seen to reduce power and then reverse direction, although in the recordings of the VDR, no order to do this is heard at any time. Seconds later, the maritime pilot ordered the rudder to port (first 10 degrees, seconds later, 20 degrees and then full port rudder) and half ahead, but the vessel did not respond and continued to veer to starboard.

Tabla 1 shows an extract from the rudder, main propellers and transversal bow propeller data during the minutes preceding the collision, taken from the vessel's VDR. The data shown in red correspond to the port rudder and propeller, while those in green correspond to the starboard rudder and propeller. Figura 12 shows this data graphically.

During a period of half a minute (see Tabla 1 and Figura 12), the propellers were in reverse, so the rudders did not have the expected effect. In the VDR, the maritime pilot's surprise can be heard as he noticed that the engine telegraph was showing both propellers powering astern, ordering full ahead. Seeing that it was impossible to control the vessel, he then ordered both engines full astern. The captain ordered the anchor to be dropped, but there was no time for this, and seconds later the vessel collided with the quay and the crane.

Tabla 1. Engine speed and rudder positions (local time)

Time	Wind (knots)	Heading (°)	Speed (knots)	Rudder angle (°)	Stern propellers (%)	Transversal bow propellers (%)
07:58:00	34.9	210.7	10.11	-0.29 / 0.06	75.7 / 78.7	0
07:58:09	31.4	209.5	10.74	22.09 / 21.9	63.9 / 65.4	0
07:58:20	35.3	211.8	10.59	10.96 / 11.19	63.6 / 65.3	0
07:58:30	24.1	216.3	10.37	-0.35 / 0.14	32 / 25.3	0
07:58:40	10.7	220.1	9.92	-11.29 / -9.43	-12.3 / -29.8	0
07:58:49	22.4	223.8	9.15	-30.66 / -28.89	-40.1 / -43	0
07:59:01	31.1	229.8	7.76	-46.25 / -46.93	-40.4 / -49.8	-35
07:59:10	22.5	237.0	7.22	-46.24 / -46.93	-4.6 / 22.1	-100
07:59:20	24.8	243.8	6.97	-46.25 / -46.93	27.5 / 40.3	0
07:59:30	36.1	250.8	6.75	-46.27 / -46.93	-12.4 / -7.0	0
07:59:39	32.8	255.6	5.80	-46.27 / -46.93	-38.3 / -30.2	0
07:59:49	35	260.4	5.11	-46.23 / -46.93	-48.2 / -46.5	0

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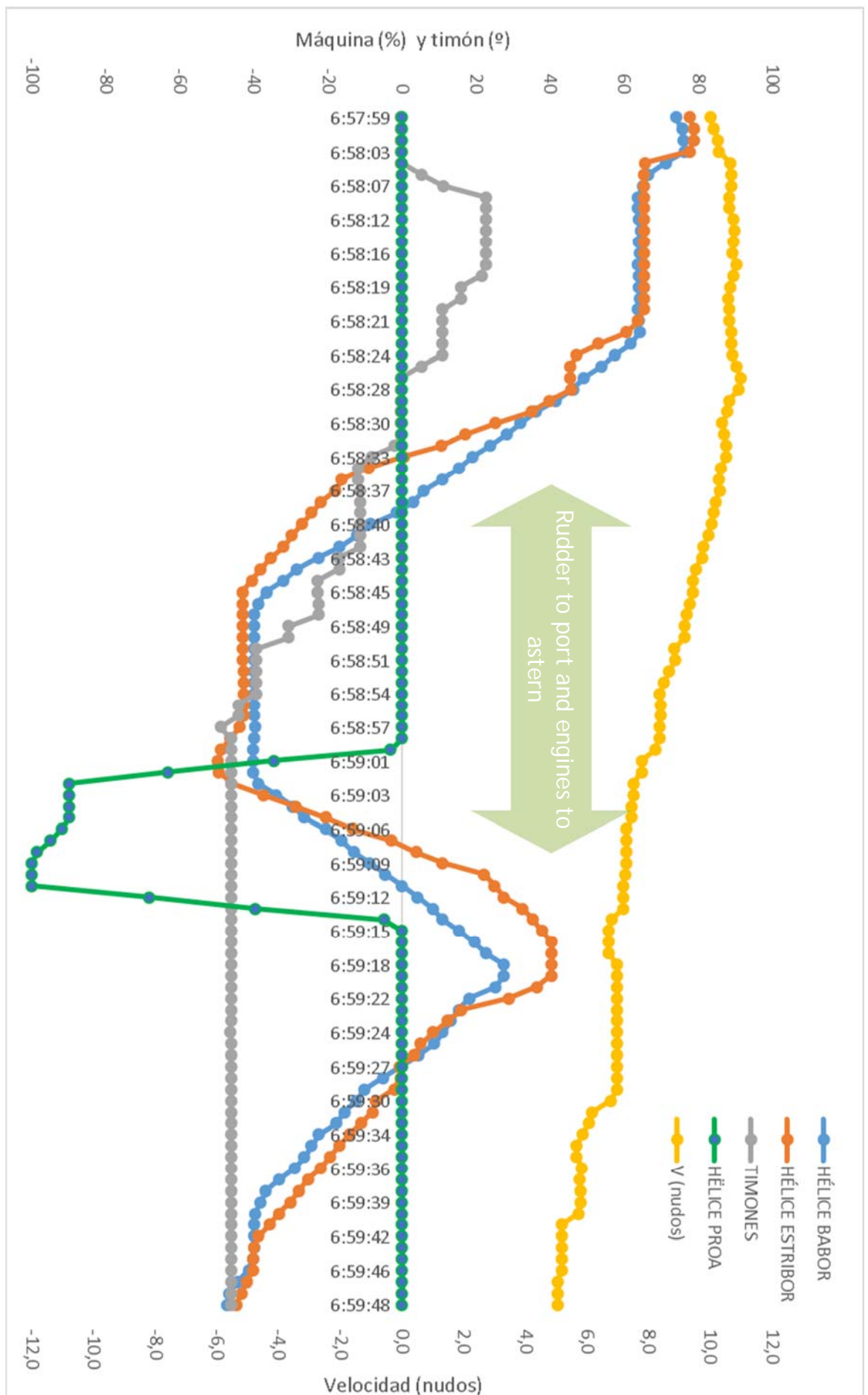


Figura 12. Engine speed and rudder positions (UTC time)

4.4. Weather forecast and conditions

The wind predicted at the Barcelona buoy, located at the entrance to the port, for 08:00 on the 31st of October was 23 knots and approximate direction 340°. The wind speed was expected to increase after 07:00.

In the real data recorded by the anemometer in the nearest weather station to the site of the accident, on the Adosado Quay, an increase in the wind speed is observed, starting at 07:30, coinciding with the maritime pilot boarding the vessel.

The table below shows the wind speeds recorded by the anemometer in the aforementioned weather station (on the Adosado Quay) and the anemometer on the vessel, from minutes before until just after the collision of the vessel in the "Adosado Centro" channel:

Tabla 2. Wind conditions

Time	Adosado Quay S (knots)	Direction (°)	Adosado Quay S _{max} (knots)	Vessel S _{min} (knots)	Direction (°)	Vessel S _{max} (knots)
07:05	4.7	44.7	6.1	-	-	-
07:15	4.8	16.5	6.1	-	-	-
07:30	15.6	151.8	20.6	-	-	-
07:45	22.5	141.4	27.2	-	-	-
07:57	25.5	158.7	29.9	24.2	155.8	34.9
07:58	23.4	159.8	26.0	10.7	158.6	35.3
07:59	24.7	165.5	30.3	22.5	180.8	36.1
08:00	24.5	166.9	29.4	22.2	79.6	35.6

The orders of magnitude of the data recorded by the two anemometers coincide, so, although while approaching the Morrot Dock, the maritime pilot and the captain of the vessel contemplated the possibility that the vessel's anemometer might be faulty, these data appear to indicate that this was not the case. The variation in the wind speed would have occurred because at times the vessel was downwind of the moored vessels, while at other times it was not. Figura 4 shows the approximate areas in the channel exposed to the wind (in red) and the areas protected by the other vessels (in green) in the minutes prior to the accident.

According to the captain's declarations both at the time of the accident and later, the wind initially declared was coming from the south-east, with a speed of 18-20 knots, then increased suddenly to 25/30 knots with stronger gusts, from directions varying between, S, SE and ESE. According to the data recorded by the anemometers, there was a brusque increase in wind speed that, during the entry manoeuvre into the port and the attempt to moor, reached the predicted values of about 23 knots at 8 o'clock in the morning.

4.5. Influence of the propeller washes of the COSTA FAVOLOSA cruise ship and the CALA GULLO tugboat

According to the VDR records and the AIS data, it can be seen that at 07:58:38, the moment when the maritime pilot ordered 20° to port, the vessel did not respond to the rudder and continued to veer to starboard. Instants later, the maritime pilot ordered full to port, half ahead, and then full ahead.

The following sequence of images shows the movements of the EXCELLENT, captured by a television camera located on the COSTA FAVOLOSA cruiser (Figura 13), and by the Port Authority AIS (Figura 14). At 07:58:38, the EXCELLENT had not yet come abreast of the tugboat CALA GULLO. In fact, it did not do so until a few seconds before the collision with the quay, so the propeller wash from the tug did not influence the EXCELLENT's veering to starboard.

Collision of the passenger and wheeled vehicle ferry EXCELLENT against the South Dock (dock 24B) and the BABCOCK&WILCOX PANAMAX gantry crane number 904 on the 31st of October 2018



Figura 13. Movements of the EXCELLENT and the tugboat CALA GULLO seen from the COSTA FAVOLOSA cruise ship

Collision of the passenger and wheeled vehicle ferry EXCELLENT against the South Dock (dock 24B) and the BABCOCK&WILCOX PANAMAX gantry crane number 904 on the 31st of October 2018

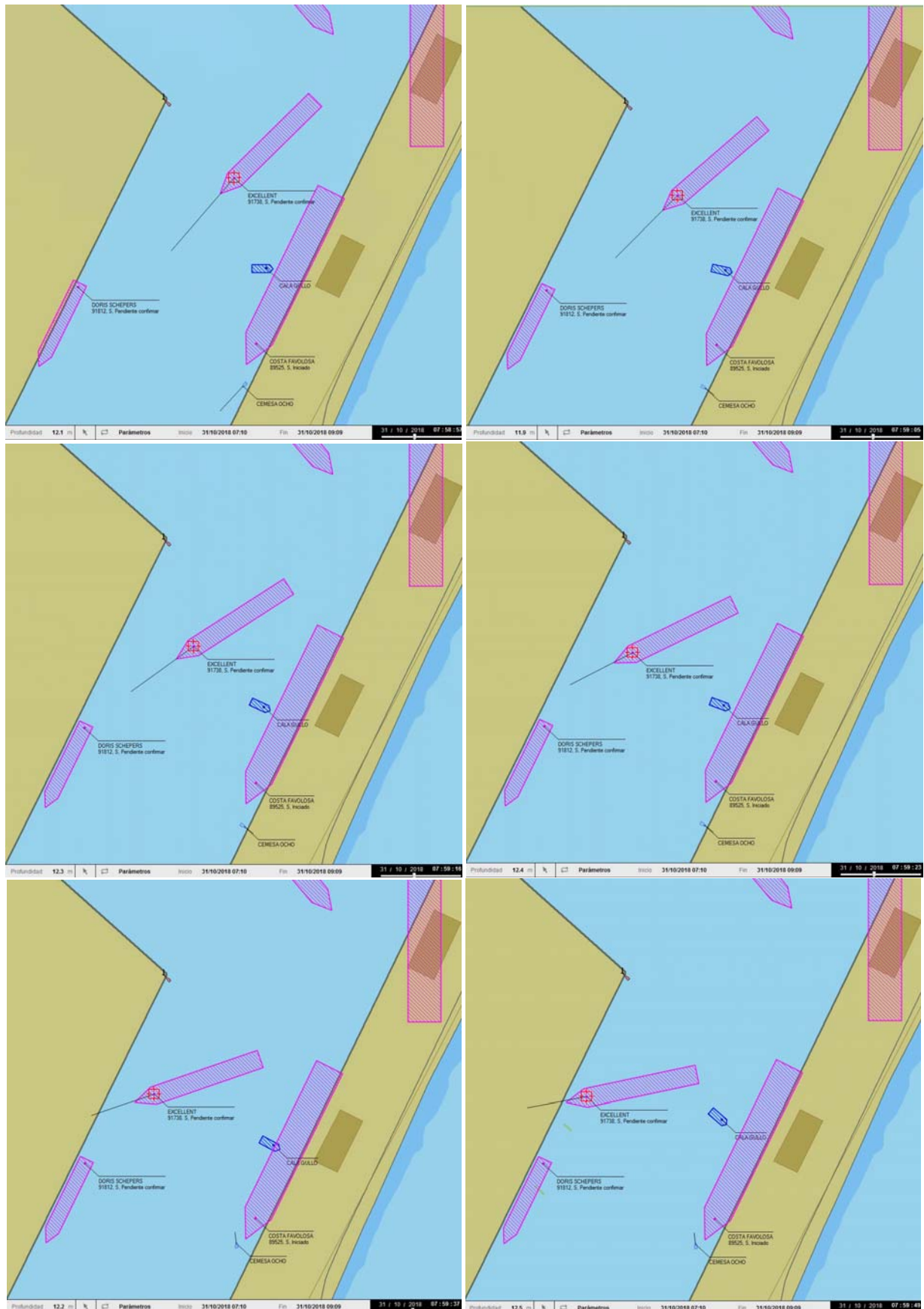


Figura 14. EXCELLENT, tugboat CALA GULLO and COSTA FAVOLOSA (source: Barcelona Port Authority)

The EXCELLENT came abreast of the CALA GULLO and its propeller wash approximately half a minute before the collision, so the collision was inevitable, and would have occurred even if the CALA GULLO had not been pushing the COSTA FAVOLOSA.

As for the cruiser COSTA FAVOLOSA, the EXCELLENT came alongside its stern at about 07:58:45; at that moment, the EXCELLENT was already failing to respond to the rudder, because the propulsion propellers were operating in reverse, not forward, as the maritime pilot believed.

Although the wash from the stern propellers of the COSTA FAVOLOSA could have affected the deviation of the EXCELLENT, this wash hit its hull along its entire length; consequently, it did not have a significant effect on the veering of the EXCELLENT to starboard that culminated with its collision against the quay.

4.6. Manoeuvring propeller of the EXCELLENT

The EXCELLENT has two manoeuvring propellers located in transversal tunnels in the bow, made by KAMEWA. Each propeller has a diameter of 2000mm and is driven by an electrical motor with a power of 1000kW. The blades are of controllable pitch, with hydraulic system.

According to the VDR records, the manoeuvring propellers were connected and pushing to port during approximately 15 seconds (see Figura 12), between the moment when the maritime pilot ordered full ahead after realising that the main propellers were driving in reverse and the moment when the engines went full astern, scarcely thirty seconds before the collision.

No effect of the manoeuvring propellers in the vessel's heading can be appreciated, since it maintained a positive RoT (see Figura 11) during the seconds prior to the collision.

4.7. Availability of port tugs

In the minutes before the accident there were six tugs available in the port, berthed in its dock. The estimated time from when a tug is requested until it leaves its berth and can reach the Morrot dock is about 20 minutes. This means that, if the need for support tugs is foreseen, they must be requested some time in advance.

5. CONCLUSIONS

The RO-PAX EXCELLENT collided against the South Quay 24 B in the port of Barcelona and the BABCOCK & WILCOX gantry crane for the following reasons:

- The strong gusting wind made the mooring manoeuvre and navigation inside the port difficult, and pushed the EXCELLENT to starboard when it was exiting the dock.
- The lateral propeller of the cruiser COSTA FAVOLOSA and the propeller wash from the tugboat CALA GULLO may have contributed to the EXCELLENT veering to starboard while exiting the dock. It is difficult to determine the extent of this effect, but its influence was not sufficient to cause the collision.
- The communications procedure between the maritime pilot and the officials on the bridge was not followed, since when the EXCELLENT was in the exit channel, the engines were reversed without the pilot on board having ordered this. This caused the rudders to lose the power to turn the vessel to port, and, as a result, the vessel's capacity to manoeuvre was limited, without the maritime pilot being aware of this.
- The decision to use tugs to help the mooring was taken too late. No tugs were available when their help was requested upon entering the Morrot Dock. The docking manoeuvre in the Costa Quay was initiated without tugs and with a strong wind, and with limited space in the dock, since the RO-RO GNV CRISTAL was moored there with the bunker ship SPABUNKER VEINTIUNO refuelling it.

As a subsidiary cause, the manoeuvre to turn the vessel around and close the vessel to the dock required the use of at least one tugboat. Before entering the port, the captain and the maritime pilot did not properly evaluate the difficulties that they would face in navigating through the port and when mooring; a strong, gusting wind of increasing strength according to the weather forecast, the unavailability of tugs, the presence of the GNV CRISTAL and the SPABUNKER VEINTIUNO in the adjacent mooring, and the effects of the lateral stern propeller of the COSTA FAVOLOSA and the wash from the tug CALA GULLO.

The result was that the EXCELLENT found itself navigating inside the port with almost no safety margin should anything unforeseen happen. Said unforeseen circumstance occurred when, at 07:58:28, the maritime pilot ordered the rudder to port and the vessel did not respond as expected, veering out of control to starboard, pushed by the wind and with the rudder unable to correct this, because the engines were still operating in reverse. From that moment on, the collision against the quay was inevitable.

6. ACTIONS TAKEN

Following the accident, the company GNV decided to send the captains of their ships to a training centre belonging to the company MSC, for a simulator course in which all of the parameters involved in this accident could be reproduced, in order to manage similar incidents in the best manner possible.

7. SAFETY RECOMMENDATIONS

To the Barcelona Port Authority and Barcelona Maritime Pilots:

To establish as mandatory the assistance of tugs for entering and leaving the port with meteorology forecast, having large vessels mooring, manoeuvring or refuelling; or in definitive if difficulties of any nature are anticipated in the transit and docking.