

MA2020-7

**MARINE ACCIDENT
INVESTIGATION REPORT**

August 27, 2020



The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board is to determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

TAKEDA Nobuo
Chairperson
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

MARINE ACCIDENT INVESTIGATION REPORT

Vessel type and name: Container vessel OOCL NAGOYA

IMO number: 9445538

Gross tonnage: 40,168 tons

Accident type: Collision

Date and time: Around 07:39, August 17, 2018 (local time, UTC+9 hours)

Location: No. 26 berth of Kasumigaura-Minami Wharf, Yokkaichi Port, Yokkaichi City, Mie Prefecture
Around 149° true bearing, 480 m from Yokkaichi Port Management Association Kasumigaura No.1 range light (front light)
(Approximately 34° 59.5 'N, 136° 39.9'E)

July, 15, 2020

Adopted by the Japan Transport Safety Board

Chairperson	TAKEDA Nobuo
Member	SATO Yuji
Member	TAMURA Kenkichi
Member	KAKISHIMA Yoshiko
Member	OKAMOTO Makiko

SYNOPSIS

< Summary of the Accident >

The Container vessel, OOCL NAGOYA, which was manned by the Master and 23 other crewmembers, was navigated under escort by the pilot's pilotage, while the vessel was proceeding toward west and was approaching for berthing port side head-in to No. 26 berth of Kasumigaura-Minami Wharf, No. 3 district of Yokkaichi Port on Yokkaichi City, Mie Prefecture. At around 07:39 on August 17, her port fore collided with a gantry crane on the berth.

OOCL NAGOYA caused damage of cutting and bending at the bulwark of the port fore part, etc.

No. 26 berth of Kasumigaura-Minami Wharf caused damage of delamination at the concrete construction, derailing and deformation at the gantry cranes, etc. but there were no casualties in OOCL NAGOYA or the port facility.

< Probable Causes >

It is considered probable that this accident occurred, at Yokkaichi port, under conditions a of northwesterly wind blowing at wind force 5 to No. 26 berth of Kasumigaura-Minami Wharf, No. 3 district of Yokkaichi Port on Yokkaichi City, Mie Prefecture, while the Container vessel, OOCL NAGOYA was approaching No. 26 berth for mooring port side head-in by the Pilot's pilotage instruction, and then the Master intervened immediately and conducted maneuvering the vessel himself, and forward movement of the vessel was lost due to using by full astern, because the vessel was swept away toward a car carrier which was moored for starboard side head-out with her port side to No. 25 berth closely, and then taking full ahead was conducted to avoid collision with the car carrier and the vessel was proceeding forward; however, the vessel was not able to control her attitude, with the result that the port fore part of the vessel collided with the gantry crane (S2 Unit) on No. 26 berth.

It is considered probable that the Master intervened immediately and conducted maneuvering the vessel himself, and forward movement of the vessel was lost due to using by full astern, because the Master was not able to make sufficient trusting relationship with the Pilot and felt that the approaching ship speed toward No. 26 berth was fast near the car carrier moored at No.25, and thereby the Maser thought he would abort the vessel movement completely.

It is considered probable that the Master was not able to make sufficient trusting relationship with the Pilot, because the Master felt that the Pilot's explanation was not sufficient for him.

It is considered probable that the accident was occurred by involving in lack of BRM*¹ including effective communication, etc. in the navigation bridge between the bridge team including the Master and the Pilot, while the vessel was in a situation of being imminently swept away toward the port side where No. 25 berth and the car carrier moored at No.25 were located by the leeway exceeding 10°.

*¹ "BRM (Bridge Resource Management)" refers to the effective management of crewmembers, equipment, information, and other available resources on the bridge to maintain and improve operational functions on the bridge.

1 PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Marine Accident

The Container vessel, OOCL NAGOYA, which was manned by the Master and 23 other crewmembers, was navigated under escort by the pilot's pilotage, while the vessel was proceeding toward west and was approaching for berthing port side head-in to No. 26 berth of Kasumigaura-Minami Wharf, No. 3 district of Yokkaichi Port on Yokkaichi City, Mie Prefecture. At around 07:39 on August 17, her port fore collided with a gantry crane on the berth.

OOCL NAGOYA caused damage of cutting and bending at the bulwark of the port fore part, etc.

No. 26 berth of Kasumigaura-Minami Wharf caused damage of delamination at the concrete construction, derailing and deformation at the gantry cranes, etc. but there were no casualties in OOCL NAGOYA or the port facility.

1.2 Outline of the Marine Accident Investigation

1.2.1 Set up of the Investigation

The Japan Transport Safety Board (JTSB) appointed an investigator in-charge and other one marine accident investigator to investigate this accident on August 21, 2018.

1.2.2 Collection of Evidence

August 22, 2018: Interviews and collection of questionnaires

August 23, 2018: On-site investigations, interviews and collection of questionnaires

August 25 and 31, September 6 and 7, October 25, November 1, 2018, and May 10, June 20, July 31, 2019: collection of questionnaires.

February 5 and 6, March 7, 2019: Interviews

1.2.3 Comments of Parties Relevant to the Cause

Comments were invited from parties relevant to the cause of the accident.

1.2.4 Comments from the Flag State

Comments were invited from the flag states of OOCL NAGOYA.

2 FACTUAL INFORMATION

2.1. Events Leading to the Accident

2.1.1 Navigation Progress Traced by the Automatic Identification System

According to the records of the Automatic Identification System (AIS)^{*2} data (hereinafter referred to as "the AIS record") received by a data company in Japan, the navigation tracks of "OOCL NAGOYA" (hereinafter referred to as "the Vessel") from 06:10 to 07:41 on August 17, 2018, were as shown in Table 2.1-1 below.

Changes in heading, course to ground, and ground speed from 07:20:03 to 07:40:04 in the AIS record were as shown in Figure 1.

The positions of the Vessel are the position of the GPS antenna mounted above the navigation bridge respectively. The course over the ground and the heading were the truth bearings (same as hereinafter).

Table 2.1-1 AIS Record of the Vessel (abstract)

Time (HH: MM: SS)	Vessel position		Heading (°)	Course Over the Ground (°)	Speed Over the Ground ^{*3} (knots (kn))
	Latitude (N) (°.-'-")	Longitude(E) (°.-'-")			
06:10:04	34-59-52.5	136-49-21.8	213	211.0	6.6
06:20:02	34-58-47.0	136-48-29.9	213	211.0	9.9
06:30:02	34-57-33.5	136-47-36.9	220	214.6	8.0
06:40:02	34-56-32.7	136-46-20.4	243	235.7	10.0
06:50:02	34-56-46.6	136-44-52.7	315	310.8	6.9
07:00:04	34-57-53.4	136-43-50.9	325	325.8	7.8
07:10:04	34-58-45.4	136-42-50.6	313	310.8	7.0
07:15:04	34-59-09.7	136-42-18.4	305	311.0	7.0
07:18:13	34-59-17.2	136-41-55.3	281	279.7	6.9
07:20:03	34-59-18.8	136-41-39.9	280	275.8	7.0
07:22:03	34-59-20.3	136-41-23.1	280	276.4	6.8
07:23:03	34-59-20.9	136-41-15.1	284	276.0	6.4
07:24:03	34-59-21.7	136-41-07.5	285	280.2	6.0
07:26:03	34-59-23.7	136-40-54.9	287	281.9	5.1
07:28:03	34-59-25.7	136-40-43.7	288	280.5	4.0
07:29:03	34-59-26.4	136-40-38.8	288	284.1	4.2

^{*2} Automatic Identification System (AIS) is a device that each vessel uses to automatically transmit and receive information such as vessel identification code, ship type, name, position, course, speed, destination, and conditions of navigation, and to exchange information with other vessels or land-based navigation aids.

^{*3} "Speed over the ground" refers to the speed of a vessel as measured against one point on the earth's surface. The speed of a vessel as measured against the water in which the vessel is traveling is called "speed over water".

07:30:03	34-59-27.5	136-40-33.8	287	283.9	4.2
07:31:03	34-59-28.5	136-40-28.9	286	284.2	4.0
07:32:03	34-59-29.2	136-40-24.2	281	280.2	3.8
07:33:03	34-59-29.7	136-40-19.9	278	272.4	3.6
07:34:03	34-59-29.8	136-40-15.6	279	267.5	3.2
07:35:03	34-59-29.5	136-40-12.0	281	265.5	2.8
07:36:04	34-59-29.5	136-40-08.9	281	272.4	2.5
07:36:33	34-59-29.6	136-40-07.4	280	272.9	2.1
07:37:04	34-59-29.5	136-40-06.5	279	261.6	1.2
07:37:23	34-59-29.4	136-40-06.3	281	231.2	0.7
07:37:43	34-59-29.2	136-40-06.3	281	179.6	0.5
07:38:04	34-59-29.0	136-40-06.5	280	157.1	0.4
07:38:23	34-59-28.9	136-40-06.2	280	200.8	0.5
07:38:43	34-59-28.7	136-40-06.0	282	235.0	0.9
07:39:04	34-59-28.5	136-40-05.4	284	255.7	1.8
07:39:13	34-59-28.4	136-40-05.0	286	260.9	2.0
07:39:23	34-59-28.4	136-40-04.5	287	269.2	2.3
07:39:33	34-59-28.5	136-40-04.1	287	283.9	2.4
07:39:43	34-59-28.6	136-40-03.6	286	281.9	2.4
07:39:52	34-59-28.7	136-40-03.2	287	272.8	1.9
07:40:04	34-59-28.8	136-40-03.0	288	307.1	1.4
07:40:13	34-59-28.9	136-40-02.8	289	306.6	1.3
07:40:23	34-59-29.1	136-40-02.6	289	312.7	1.4
07:40:33	34-59-29.2	136-40-02.3	288	326.1	1.5

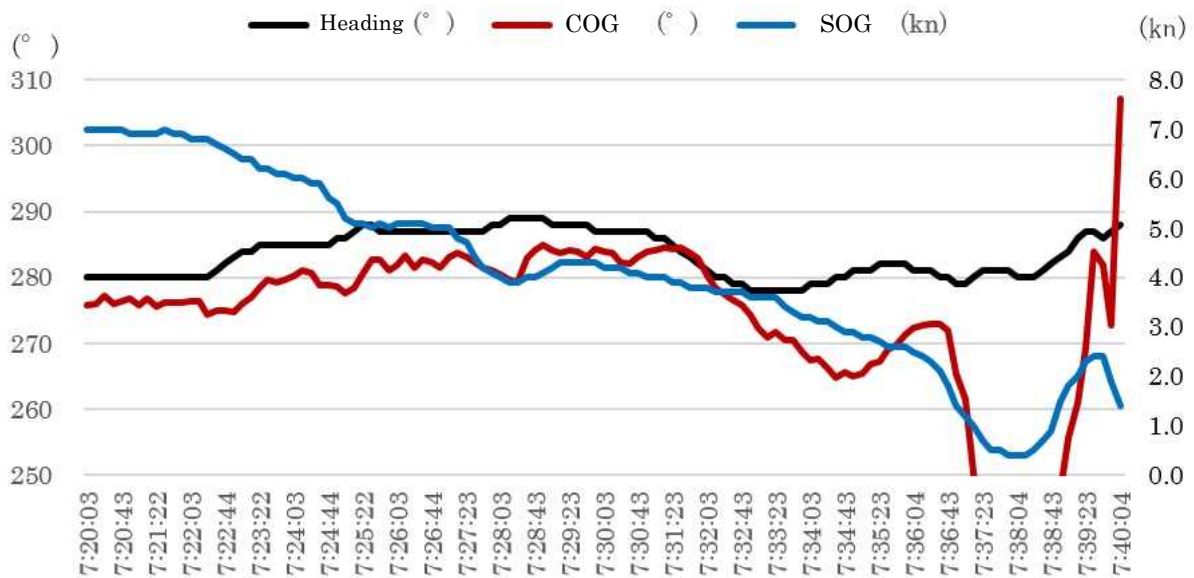


Figure 1 Changes in Speed over the ground (SOG), Course over the ground (COG), and Heading based on AIS records.

2.1.2 Records of Main Engine Operation

According to the records of the telegraph logger*⁴ of the Vessel, the use of the main engine between 07:33.0 and 07:39.0 on August 17, 2018, was as shown in Table 2.1-2.

Table 2.1-2 Operating condition of Main engine

operation time	Engine order
07:33.0	STOP
07:36.0	D.SLOW-AS SLOW-AS HALF-AS FULL-AS
07:37.0	HALF-AS STOP
07:37.5	D.SLOW-AH
07:38.0	SLOW-AH HALF-AH
07:38.5	FULL-AH
07:39.0	STOP

2.1.3 VDR Records of the Vessel

According to the audio recorded by the Voyage Data Recorder (hereinafter referred to as "VDR")*⁵ installed in the Vessel, the status of the maneuvering order at the Vessel Bridge from around 07:21 to around 07:40 was as shown in Table 2.1-3 below.

In addition, the information recorded in the VDR concerning the utterances of the master of the Vessel (hereinafter referred to as "the Master"), the pilot (hereinafter "the Pilot") and the crewmembers of the Vessel, and the operation of the main engine and rudder are provided.

Table 2.1-3 Information such as audio (excerpt)

Time	Voice, etc.
07:21:34	The Pilot : Dead slow ahead. Crewmember : Dead slow ahead.
07:21:49	Crewmember : Engine dead slow ahead, sir.
07:22:07	The Master : 2, 8, 5.

*⁴ "Telegraph logger" is a device that automatically records the operation and operation time of an engine telegraph (a device that remotely controls the main engine from the bridge).

*⁵ "Voyage Data Recorder (VDR)" refers to a device that can record a ship's position, course, speed, radar information and other data related to navigation, as well as communications by VHF radio telephone and voice communication on the bridge, among others.

	Crewmember : 2, 8, 5.
07:22:44	The Pilot : Can you see the bridge mark? The Master : Yeah.
07:22:47	The Pilot : End of gantry crane.
07:22:52	The Master : Gantry crane is the last?
07:22:53	The Pilot : Last one . The Master : Yeah. Course to the last one.
07:22:55	Crewmember : Yes.
07:23:17	Crewmember : Mark end by, sir.
07:23:19	The Pilot : OK. This degree.
07:23:27	The Master : The ship behind planning berth?
07:23:29	The Pilot : Hmm?
07:23:30	The Master : The ship behind afterward. 60 meters? [Voice unclear]
07:24:00	The Pilot : 2 bits away. The Master : 2 bits? The Pilot : Yes.
07:24:07	The Master : OK.
07:24:18	The Pilot : Stop engine. Crewmember : Stop engine.
07:24:42	Crewmember : Engine stop, sir. The Pilot : OK.
07:25:01	The Pilot : Dead slow ahead. Crewmember : Dead slow ahead.
07:25:05	The Pilot : [In Japanese to the tug boat] Pull by the dead slow. Tug boat : [In Japanese] Roger.
07:25:30	The Pilot : Steady. Crewmember : Steady.
07:25:40	Crewmember : Captain, Captain, steady, over.
07:26:45	Crewmember : Course 2, 8, 3.
07:26:47	The Pilot : OK.
07:26:52	The Pilot : Steady.
07:27:04	The Pilot : Stop engine. Crewmember : Stop engine.
07:27:22	Crewmember : Engine stop, sir. The Pilot : OK.
07:27:34	The Pilot : [to the tug boat] Stop engine.
07:27:36	Tug boat : [In Japanese] Roger.
07:28:12	The Pilot : Dead slow ahead. Crewmember : Dead slow ahead.
07:29:35	The Pilot : [In Japanese to the tug boat] I'm going to use the thruster.
07:30:06	The Pilot : Captain, Thruster? The Master : Roger. It's standby.
07:30:12	The Pilot : Dead slow to starboard. Crewmember : Pace ease. The Master : OK, enough. Enough.

07:30:34	The Pilot : Port 20. Crewmember : Port 20.
07:30:38	Crewmember : Port 20, sir. The Pilot : OK.
07:31:28	The Pilot : 2, 7, 8. Crewmember : 2, 7, 8.
07:32:44	The Master : Bow thruster*6 ready. Crewmember : Bow thruster ready.
07:32:46	The Pilot : [In Japanese] Close to the berth.
07:32:50	The Master : Excuse me sorry.
07:33:19	The Pilot : Stop engine. Crewmember : Stop engine.
07:33:32	Crewmember : Engine stop, sir.
07:33:43	The Pilot : [In Japanese to the tug boat] Move to the starboard side and prepare for pulling.
07:33:46	Tug boat : [In Japanese] Roger.
07:34:02	The Pilot : Go a stand. The Master : Yes.
07:34:25	Crewmember : She was no course, no steady, hard to port.
07:34:30	The Master : Mid Ships. Crewmember : Mid Ships.
07:35:26	Crewmember : Steady, 2.6 ahead.
07:35:59	Crewmember : Now speed 2.5.
07:36:14	The Pilot : Dead slow astern. Crewmember : Dead slow astern.
07:36:15	The Master : Too fast, pilot, sir.
07:36:21	The Master : Too fast. High, high, high, high.
07:36:24	The Master : Half astern. Crewmember : Half astern.
07:36:26	The Master : Pull line. Pull line. Tug boat pull line.
07:36:29	The Master : Full astern. Crewmember : Full astern.
07:36:32	Crewmember : Full astern, master.
07:36:38	Crewmember : Full astern.
07:36:44	The Master : Tug boat pull line fast.
07:36:54	The Master : Pull line. Pull line. Tug boat pulls.
07:37:00	The Master : Pull. Pull. Tug boat pulls.
07:37:03	Crewmember : Still 1.4 ahead.
07:37:11	The Master : Pull, Tug full.
07:37:14	Crewmember : Still 1 knot ahead.
07:37:18	The Master : Stop engine. Crewmember : Stop engine.
07:37:22	The Master : Starboard full.

*6 "Bow thruster" as Side thruster, refers to a power unit for moving a ship in the side direction, installed on the bow.

07:37:25	Crewmember : Stop. The Master : Pull Tug Full. Tug, Tug pull. Tug pull.
07:37:34	The Master : Pull.
07:37:40	Unknown : Don't be shout.
07:37:41	Crewmember : Still go ahead 0. The Pilot : Dead slow ahead.
07:37:42	The Master : Dead slow ahead, I forgot.
07:37:50	Crewmember : Engine stop.
07:37:51	Crewmember : Full to starboard.
07:37:53	The Master : Dead slow ahead. Crewmember : Dead slow ahead.
07:37:53	The Master : Pull Tug hard.
07:38:02	The Pilot : Hard starboard. Crewmember : Hard starboard.
07:38:03	The Master : Half ahead. Crewmember : Slow ahead.
07:38:06	Unknown : Don't be shout.
07:38:07	The Pilot : Full ahead.
07:38:08	The Master : Full ahead.
07:38:09	The Pilot : Full ahead.
07:38:10	Crewmember : Full ahead.
07:38:14	The Master : Freeze, Oh, freeze.
07:38:17	The Master : Pull. Tug boat pulls.
07:38:23	The Master : Pull hard. Tug boat pulls hard.
07:38:33	Crewmember : More advance.
07:38:34	The Master : Pull starboard, pull.
07:38:35	The Master : [In Japanese to the tug boat] Pull a little more.
07:38:43	The Master : Full ahead. Crewmember : Now, Full ahead.
07:38:57	The Master : Pull. Crewmember : Now, Full ahead.
07:39:00	The Master : Yes.
07:39:02	The Pilot : Hard port, Hard port.
07:39:03	The Master : Oh, ease to hard port. Crewmember : Ease to hard port.
07:39:09	Crewmember : Hard port.
07:39:21	Crewmember : Clear her bow.
07:39:24	The Master : Mid Ships. Crewmember : Mid Ships.
07:39:26	The Master : Stop engine. Crewmember : Stop engine.
07:39:31	The Master : Pull Tug, pull Tug.
07:39:35	Crewmember : Now, Mid Ships.
07:39:37	The Pilot : [To the tug boat] Hard to pull.

07:39:39	<Sound of impact> The Master : Hard Starboard. Crewmember : Hard Starboard.
07:39:46	Crewmember : Engine stop.
07:39:50	Crewmember : Still hard to starboard.
07:39:50	The Master : Mid Ships. Crewmember : Mid Ships.

2.1.4 Video and audio recorded in the drive recorder

According to the records of the drive recorders mounted respectively in the two vehicles parked on No. 26 berth of Kasumigaura Minami Wharf (hereinafter referred to as "the Berth"; regarding the other berths of Kasumigaura Minami Wharf, the phrase "Kasumigaura Minami Wharf" is omitted) by the stevedores who worked on the mooring of the Vessel, etc., the collision situation between the Vessel and the port facility was as follows.

The drive recorders also recorded the audio sounds between the tug boat and the Pilot communicating by transceiver in Japanese.

The drive recorder mounted on the vehicle located at 34.9917° north latitude and 136.6655° east longitude is referred to as "Recorder A", and that mounted on the vehicle located at 34.9915° north latitude and 136.6660° east longitude is referred to as "Recorder B".

(See Figure 2)

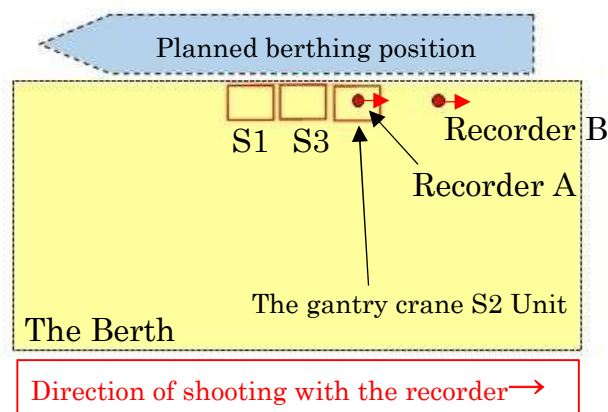


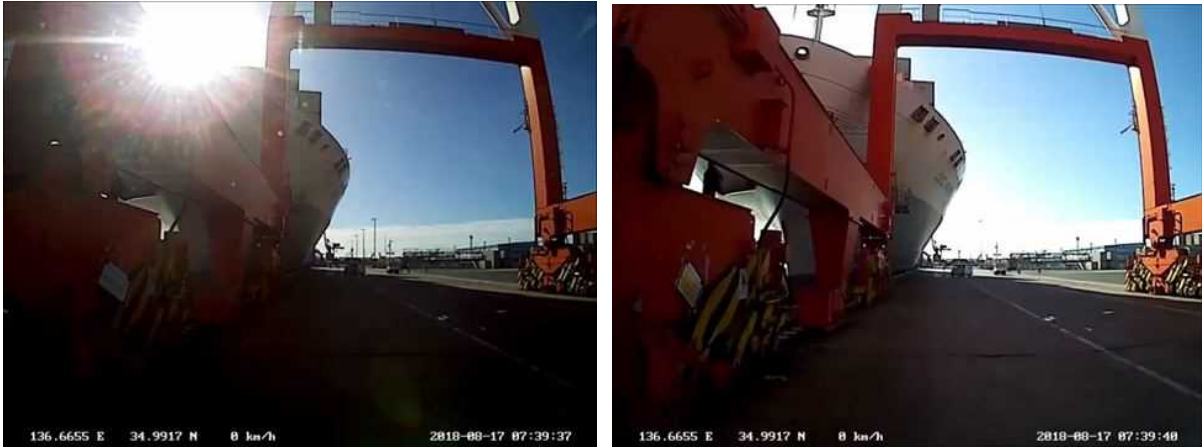
Figure 2 Approximate position of drive recorders

(1) Recorder A

From around 07:39:39, Recorder A recorded that an impact sound began to be heard with intermittent frictional noise, between the gantry crane^{*7} (S2 Unit) on the Berth

^{*7} In this report, "gantry crane" refers to a heavy crane that is set on a gantry on a pier and runs on rails for the purpose of loading containers.

(hereinafter referred to as “GC S2”), and that the bulwark of the Vessel’s fore port part that contacted the gantry crane and the gantry leg part of GC S2 were moving in front of the screen. (See Figure 3)

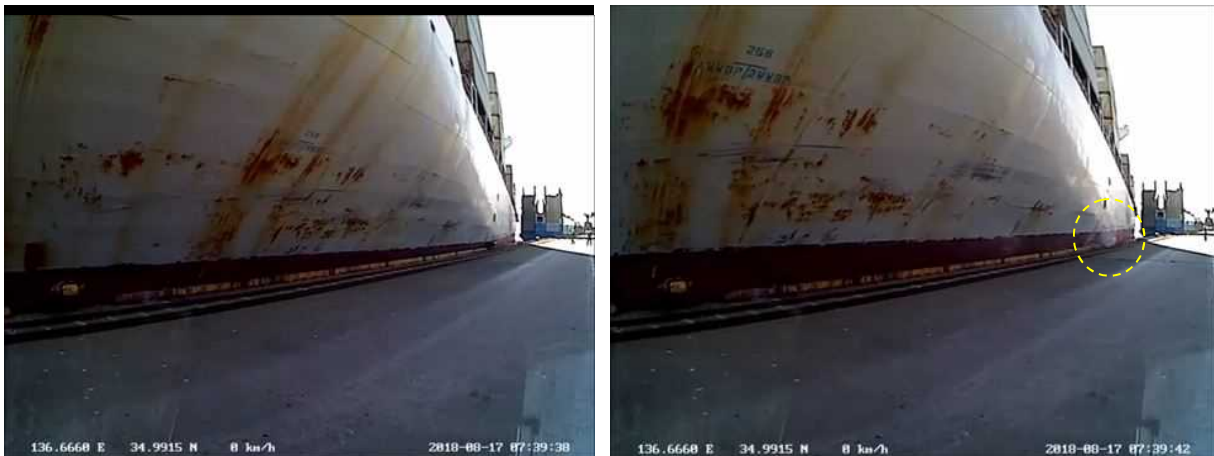


Left: 07:39:37, Right: 07:39:40

Figure 3 Record from Recorder A (excerpt)

(2) Recorder B

Recorder B recorded the impact sound heard from around 07:39:39 for more than 10 seconds, the contact between hull plate of the Vessel’s port side and the Berth, and the concrete flakes blowing upwards. (See Figure 4)



Left: 07:39:38, Right: 07:39:42

Figure 4 Record from Recorder B (excerpt)

2.1.5 Events Leading to the Accident according to the interview with the Pilot, etc.

According to the statement of the Pilot and the reply by the Master to the questionnaire, the events leading to the accident were as follows.

The Vessel was boarded by the Master and 23 others (18 people from the People's Republic of China and 5 people from the Republic of the Philippines), it had loaded 18,536.9 tons of container cargo, the Pilot was on board, it had departed from Nagoya Port in Aichi Prefecture at around 05:30 on August 17, 2018, and it was subsequently bound for the Berth.

Prior to the departure, at around 05:00, the Pilot visited the Vessel which had moored at a departure berth and exchanged information with the Master in the Vessel's navigation bridge. The contents of the information exchange were that the Pilot confirmed the maneuvering performance of the Vessel using the pilot card^{*8}, and then the Pilot explained to the Master the summary of the pilotage plan, laying out weather information distributed by a private information company and a pilot information card^{*9}, and then accepted an agreement from the Master to use one tug boat (3,500 HP) due to the anticipated average wind speed of less than 10 m/s when departing from Nagoya Port and entering Yokkaichi Port.

The Master had command over the Vessel maneuvering, a Navigation Officer was keeping watch, a Deck Cadet was handling the engine telegraph under supervision of a Navigation Officer on watch, an Able Seaman was steering the wheel in manual operation and the Pilot was maneuvering the Vessel for the pilotage, the Vessel was navigating southward from the ordinary route while adjusting the navigation time, restraining the ship speed, and taking a round route in consideration of the time of the cargo handling.

When the Vessel departed from the East route of Nagoya Port, it was approaching a domestic cargo vessel which was entering the anchorage, and then the Pilot contacted the domestic cargo vessel and instructed the Vessel to be maneuvered so as to pass starboard-to-starboard.

The Master inquired with the Pilot concerning the intention of maneuvering the Vessel by passing the domestic cargo vessel starboard-to-starboard, and received an explanation from the Pilot that he was required to pass starboard-to-starboard by the domestic cargo vessel through radio communication.

At around 07:13, the Vessel entered No. 3 passage in Yokkaichi Port, took the tug line from the tug boat on the starboard stern, prepared both anchors, and then was taking the approach for port side head-in toward the Berth seeing port fore, subsequently began to decrease the ship speed by using the main engine operation and the tug boat.

^{*8} "Pilot card" refers to the document handed over from a master to a pilot which notes the information of cargo condition, propulsion unit, maneuvering performance, etc. for a vessel.

^{*9} "Pilot information card" refers to the document handed over from a pilot to a master which notes the information of maneuvering methods, methods to use tug boats, etc.

The Pilot recognized that at around 07:26, when the ship speed was reduced to approximately 5 kn (ground speed, the same applies hereafter), the leeway^{*10} was between 2° and 3° due to northward wind.

While the Vessel was navigating by the course set to 285° in order of dead slow ahead at around 07:29, since the Vessel was passing northerly in the port in consideration of the north-west wind, the Pilot thought that the Vessel was going to approach the Berth at a larger angle.

At around 07:32, the Pilot noticed the Master taking a heading to the bridge mark located on No.27 berth on the west of the Berth, and then transmitted to steer to port and to change the course to 278°.

The Pilot transmitted an instruction to stop the main engine at around 07:33, since the ship speed became approximately 3 kn, and then commanded the tug boat by the transceiver to move to the starboard side and to prepare to pull toward the 3 o'clock direction. Subsequently, the Pilot moved from the navigation bridge interior to the port wing with the Master.

The Master remembered seeing that the ship speed was indicated as 3.9 kn on the display screen of the Electronic Chart Display and Information System^{*11} (hereinafter referred to as "ECDIS") before leaving the navigation bridge interior.

The Pilot recognized that the Vessel body was sweeping away from starboard to port, the Berth side, and then thought of using the bow thruster at full to starboard and tried to swing the bow to starboard. The Pilot transmitted to the Master that after a while, he would reduce the ship speed by using the astern engine. The Pilot continued to use the bow thruster at full to starboard because the Vessel had been sweeping away heavily more than he had expected, and subsequently he instructed the tug boat to tighten the line taken at the stern toward the 3 o'clock by transceiver.

When the Master had been transferring the Pilot's instructions from the port wing, he noticed sudden changes of wind direction and wind speed, and then measured by eye the separation distance of approximately 90 meters between the Vessel and a car carrier of length approximately 118 meters which was moored for starboard side head-out with her

^{*10} "Leeway" refers to the situation in which a vessel has received the wind in navigation while being pressed downwind, so that the bow direction does not match the moving direction of the vessel, and moves in a skewed manner. It indicates the degree of the lateral flow of the vessel.

^{*11} "Electronic Chart Display and Information System (ECDIS)" refers to a device that can display a ship's own position on an official electronic chart (Electronic Navigational Chart or Raster Navigational Chart) that meets the standards of the International Hydrographic Organization (IHO), as well as displaying radar, scheduled passages and other information in combination, and also has the function of transmitting alerts when approaching shallows and other hazards.

port side to No. 25 berth (hereinafter referred to as “the Moored Vessel”), but he did not discuss these circumstances with the Pilot.

The Pilot thought that if the ship speed was not maintained to a certain extent, the Vessel would be swept further and further away to port side. Therefore, the Pilot thought that if the Vessel increased astern thrust after her stern passed the Moored Vessel and used the main engine by half astern, the Vessel could proceed in front of the Berth and could stop, thereby the bow of the Vessel would swing to the starboard side by the characteristics of a right-handed rotation single screw vessel^{*12} and would be allocated a position in parallel to the Berth; however the Pilot did not explain his thoughts to the Master.

At around 07:36, the ship speed became approximately 2.5 kn, and then the Pilot transmitted to the Master to use the main engine to dead slow astern and also continued to use the bow thruster at full to starboard, and subsequently requested the tug boat to pull to the 3 o'clock direction at dead slow. At that time, the Master asserted to the Pilot repeatedly that the ship speed was too high.

Although the Master had been transmitted by the Pilot that he would take the main engine motion from dead slow astern to slow astern, the Master felt that the speed of the Vessel was too high, had a premonition of failure that the Vessel would fail to accomplish berthing maneuvering, and therefore it seemed to the Master that the Vessel was swept away toward the Moored Vessel by a pressurized flow of wind. Therefore the Master asserted to the Pilot that the Pilot's maneuvering instruction was insufficient, took command to take half astern and full astern himself, and got the Vessel to decelerate immediately, and then urged the Pilot repeatedly to pull by the tug boat to the starboard side with full power.

Since the Master no longer accepted the Pilot's maneuvering instructions, the Pilot decided to follow the Master's maneuvering commands and transmitted to the tug boat by the transceiver to pull the Vessel's stern to the starboard side with full power, the Pilot recognized that the Vessel had stopped her forward movement and was sweeping away heavily to port side.

Since the Vessel was sweeping away and furthermore was approaching the Moored Vessel, the Master took command and set the steering to hard port, used the main engine and increased the revolution of the main engine by full ahead, and commanded the tug boat to

^{*12} “Right-handed rotation single screw vessel” refers to a ship that has one propulsion shaft that rotates when driven by the main engine, and whose propellers turn clockwise when viewed from her stern, and has the characteristic that the stern swings to left and the bow swings to right when astern is used (the propeller is reversed).

pull the Vessel's starboard stern to the starboard side with full power.

The Master accepted the report that the Vessel's stern had already passed the Moored Vessel, and then the Master immediately took command, set the steering to mid-ships, stopped the main engine, and then set the steering to hard starboard.

However, at around 07:39, the port fore part of the Vessel collided with GC S2 on the Berth, and then continued moving forward while contacting with GC S2, and thereby the other two gantry cranes, which were not in operation, were pushed and were moved together by GC S2. In addition, the port fore side plate of the Vessel collided with the upper edge of the Berth.

At around 07:48, the Vessel sent the first mooring line to the Berth and completed the mooring works at around 08:24.

The date and time of occurrence of the accident were at around 07:39:39 on August 17, 2018, and the location was approximately 149° true bearing, 480 meters from Yokkaichi Port Management Association Kasumigaura No.1 range light (front light)
(See Annex Figure 1 Navigation path and Annex Figure 2 Navigation path in Yokkaichi Port)

2.2 Injuries to Persons

According to the statement of the Pilot, there were no fatalities or injuries on the Vessel.

2.3 Damage to Vessel

According to the reply to the questionnaires by the Pilot and Company A, these were as follows:

- (1) The port bulwark plate was cut and buckled, and the remote control stand of the mooring equipment was deformed on the forecastle deck
- (2) The port fore part of the shell plate was dented.

(See Figure 5 and 6)



Figure 5 State of damage to the Vessel (Bulwark on the port fore part)



Figure 6 State of damage to the Vessel (Port fore part shell plate)

2.4 Damage to Other Facilities

According to the statements and the reply of the questionnaires by the person in charge of the Yokkaichi Port Authority (hereinafter referred to as the “Port Authority”), and the person in charge of the Yokkaichi City Container Terminal Co., Ltd. (hereinafter referred to as the “Facility Management Company”) which was commissioned to operate the Container Terminal of Yokkaichi Port, these were as follows. (See Figures 7-10)

2.4.1 Berth

The fenders' body was cracked, etc., and concrete parts such as the upper surface of the Berth and the pedestal part of the fenders, were damaged in the form of delamination, etc., and the corner metallic fittings at the front edge, etc. of the Berth were bent.

2.4.2 Gantry cranes

The gantry cranes were in the order of GC S2, Unit S3 and Unit S1 from the east side of the Berth, and were not in operation but were on standby condition. They were all moved due to the accident. The Unit 3 was damaged at the traveling motor, and the gantry leg part structure of Unit S3 was deformed. GC S2 was derailed and the traveling equipment was bent, was broken, etc., and the gantry leg part structure of GC S2 was deformed, furthermore a part of fixing component of traveling rail was damaged, respectively, and thereby GC S2 and Unit S3 were caused to be inoperable. Still, Unit S1 was not damaged.

The collision part of GC S2 was the northeast corner of the gantry leg, with a horizontal distance of approximately 2 meters from the front of the fender installed at the Berth front edge and a height of approximately 10 meters from the surface of the Berth.

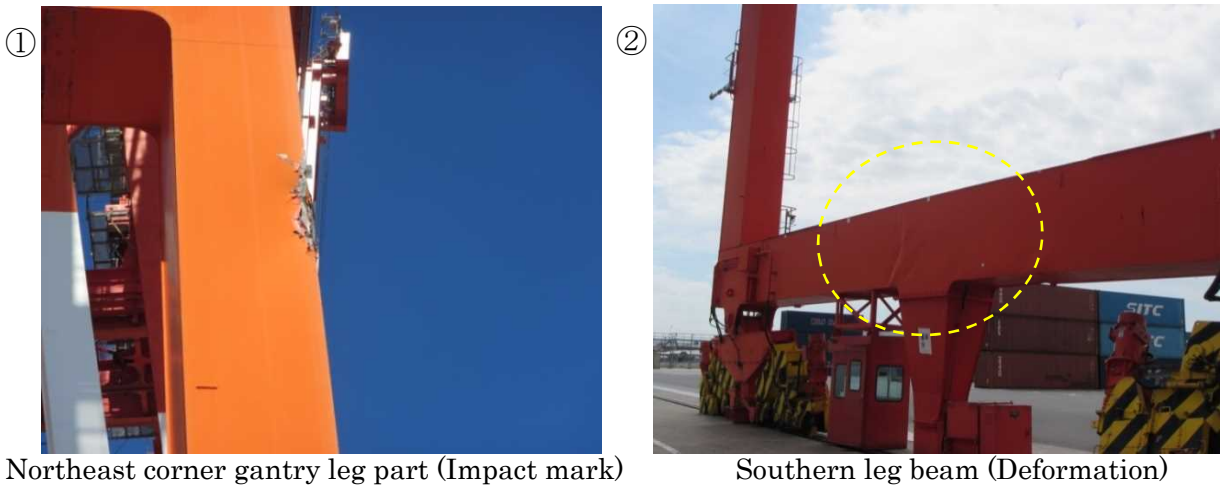


Figure 7 Damage to the quay



GC S2, Unit S3 and Unit S1 from the front of the photo

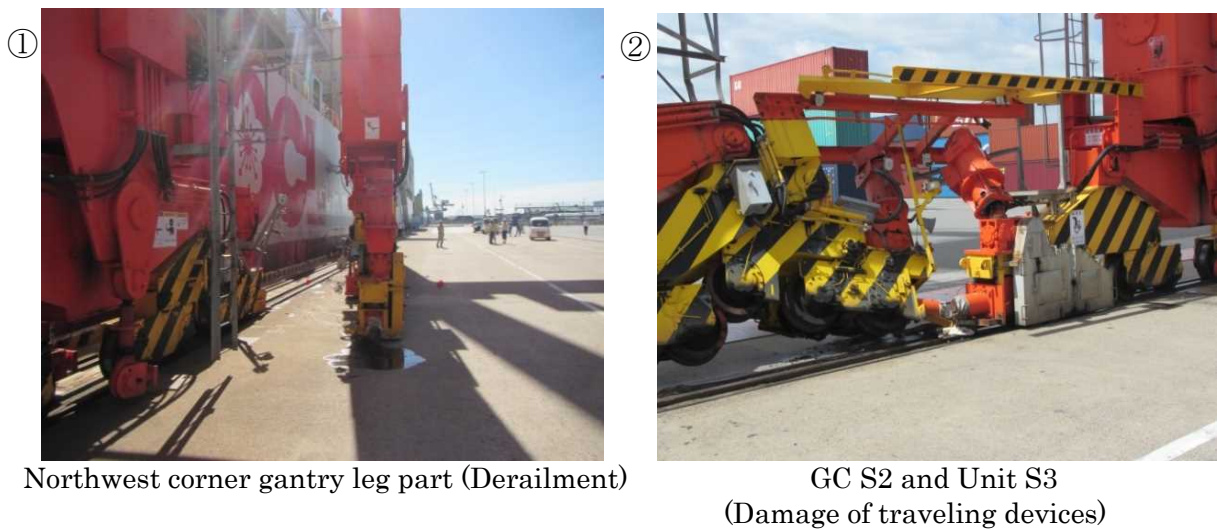
Figure 8 Damage to gantry cranes



① Northeast corner gantry leg part (Impact mark)

② Southern leg beam (Deformation)

Figure 9 Damage 1 to GC S2



① Northwest corner gantry leg part (Derailment)

② GC S2 and Unit S3
(Damage of traveling devices)

Figure 10 Damage 2 to GC S2

2.5 Crewmember Information

(1) Gender, Age, Certificate of Competence

The Master: Male 60 years old, Nationality: Republic of Singapore

Endorsement attesting the recognition of certificate under STCW regulation I/10:
Master (issued by the People's Republic of China)

Date of Issue: August 24, 2017

(Valid until June 8, 2022)

The Pilot: Male 58 years old, Nationality: Japanese

Ise-Mikawa Wan Pilot District First Class Pilot's License

Date of Issue: January 13, 2018

Date of Revalidation: January 13, 2018

Date of Expiry: January 12, 2022

(2) Seagoing Experience, etc.

According to the statement by the Pilot, the replies by the Pilot and the Master of the questionnaires of response, there were as follows.

① The Master

In June 1992, he assumed the role of master and worked at sea for about three years. After working ashore, he resumed boarding on container vessels of a similar type as the Vessel in September 2017, and then he had been on board the Vessel since June 2018.

At the time of the accident, there was no problem with his health.

② The Pilot

He joined a shipping company in 1983, had taken experience as a marine technician while he had been working at sea and on land alternately. He had taken experience as a captain for approximately two and a half years and was working mainly on car carriers. He became a pilot of Ise-Mikawa Bay Pilot District in February 2017, and has been engaged in pilotage work for approximately one and a half years.

At the time of the accident, there was no problem with his health.

2.6 Vessel Information

2.6.1 Principals of the vessels

IMO No.: 9445538

Port of registry: Hong Kong Special Administrative Region of the
People's Republic of China

Owner:	NEWCONTAINER NO 102 (MARSHALL ISLANDS) SHIPPING INC (Republic of the Marshall Islands)
Operator:	ORIENT OVERSEAS CONTAINER LINE LIMITED (Hong Kong Special Administrative Region of the People's Republic of China) (hereinafter referred to as "Company A")
Management Company	Company A
Classification Society:	Nippon Kaiji Kyokai
Gross tonnage:	40,168 tons
L x B x D:	260.05m x 32.25m x 19.30m
Hull material:	Steel
Engine:	Diesel engine x 1
Output:	36,560kW
Propulsion:	6-blade fixed pitch propeller x 1
Date of construction:	July, 2009

(See Figure 11)



Figure 11 The Vessel

2.6.2 Load conditions

According to the replies to the questionnaires from the Master and Company A, the Vessel had a capacity of 4,578 TEU, and at the time of the accident, 18,536.9 tons of containers were loaded, and the draft was approximately 8.70 meters at fore and approximately 9.30 meters by the at stern.

2.6.3 Navigation equipment, etc.

According to the replies of the questionnaires from the Master and Company A, the Vessel was equipped with two radars, ECDIS, etc., which were in use at the time of the accident.

2.6.4 Information about the Maneuverability

According to the maneuverability characteristics table of the Vessel, her maneuverability

was as follows.

(1) Main engine revolutions and speed

Speed classification	Main engine's rotations per minute (rpm)	Speed Loaded condition (kn)	Speed Ballast condition (kn)
Navigation full ahead	100.4	23.85	25.17
Full ahead	70.0	16.8	18.5
Half ahead	45.0	10.4	11.2
Slow ahead	35.0	7.0	7.6
Dead slow ahead	29.0	6.2	6.7

(2) Time and distance needed until stopping at speed full astern

State when astern engine order is issued	Loaded condition		Ballast condition	
	Time (seconds)	Distance (M)	Time (seconds)	Distance (M)
Navigation full ahead	664	1.975	427	1.364
Half ahead	414	0.679	270	0.478

(3) Effect of bow thruster

Direction	Turning angular velocity at 0 kn	Speed of ineffectiveness
To starboard	16.8 deg/min	5kn
To port	13.9 deg/min	

2.6.5 Other Relevant Vessel Information

- (1) According to the Pilot card, the output of the bow thruster was 1,600 kW.
- (2) According to the statements by the Pilot and the Master's replies to the questionnaires, there were no malfunctions or failures in the hull, engine, or equipment of the Vessel at the time of the accident.

2.6.6 Information about Tug boat

According to the description of Register of ships in Japan, the engine output of the tug boat which was used at the time of the Vessel's berthing, was 3,500 HP (2,574 kW).

2.7 Information on Bridge Organization

2.7.1 Situation concerning communication

According to the statement by the Pilot, voice information recorded on the VDR, and the voice recordings of Recorder A and Recorder B, the commanding orders and the instructions, communication and their conversations among the Master, the Crewmember and the Pilot were conducted in English, and the communication by transceiver between the Pilot and the tug boat was conducted in Japanese.

2.7.2 Information on information exchange

According to the statement by the Pilot, the replies from the Ise-Mikawawan Pilots' Association (hereafter referred to as "the Pilots' Association") and the Master to the questionnaires, there were as follows.

- (1) Prior to departure from Nagoya Port, the Master and the Pilot signed in a pilot card, a pilot information card and a checklist for communication between the Master and the Pilot, and then confirmed the pilotage plan mutually.
- (2) The pilot information card presented in item (1) described turning directions of the Vessel, the number of tug boats used when leaving the berth of Nagoya Port and arriving at the Berth and the standard route between ports, etc. However, there was no description of the target, heading, etc. at the time of maneuvering for approaching the Berth.
- (3) After the Vessel had avoided a domestic cargo vessel from Nagoya Port to the Berth, the Master inquired with the Pilot as to the Pilot's intention for maneuvering to avoid that vessel and received a response from the Pilot.
- (4) The Master and the Pilot exchanged information concerning the mooring place at approximately 07:22; however after that time, they did not exchange information with each other concerning whether the Vessel would accept pressurized flows.
- (5) When the crewmembers received maneuvering commands from the Master and the Pilot, the crewmembers repeated these orders and then reported the response actions according to the commands. However, the crewmembers had hardly reported anything concerning leeway increases, change of wind force, etc.

2.7.3 Information on the situation surrounding the Vessel and decisions on maneuvering

According to the statement of the Pilot, the replies from the Pilots' Association and the Master to the questionnaires, there were as follows.

- (1) The Master
 - ① When confirming the pilotage plan, the Master did not receive detailed explanations concerning the measures of approaching the Berth, such as the course, or the ship speed, etc. at the time of berthing from the Pilot; therefore the Master thought that it was necessary to observe the Pilot's behavior carefully.
 - ② At around the time of the Vessel being in parallel with the Moored Vessel, the Master observed the situation that the Vessel was sweeping away by wind blowing from the sea to the Berth and was being blown to the Mooring Vessel immediately,

and then he seemed to feel that the ship speed was more than 4 kn and was too much faster than standard berthing maneuvering.

- ③ The Master noticed that the deceleration being conducted by the Pilot was not sufficient to approach the Berth safely, and then he intervened immediately and took command of maneuvering the Vessel himself due to aborting her movement completely, and subsequently ordered full astern and thereby the Vessel was decelerated immediately.

(2) The Pilot

- ① The Pilot thought that he had good communication with the Master due to the Master always standing to his right side and often talking about avoiding the domestic cargo vessel, etc. when leaving Nagoya Port.
- ② The Pilot was navigating the Vessel on a route further north than the ordinary route in consideration of the influence of winds, and then thought the Vessel would be approaching the Berth at a large angle, and transmitted his instruction that her course was set at 278° due to the separation distance being larger from Kasumigaura Minami Wharf.
- ③ When transmitting the course of 278°, the Pilot thought that he was recognized that the course had been accepted by the Master due to the Master raising no objections.
- ④ The Pilot thought that the wind was intensifying and the Vessel was swept away heavily to port side, however the Vessel was delaying a little to reduce the ship speed and continue to move forward, and thereby it would be possible to be berthing at the Berth by using half astern and controlling the forward movement.

2.8 Weather and Sea Conditions

2.8.1 Meteorological observations and Tide

(1) Meteorological observations

According to meteorological observations at the Yokkaichi Special Regional Meteorological Observation Station, which is located approximately 9.7 km west-southwest of the accident site, there were as follows.

Time	Average wind speed		Maximum instantaneous wind speed	
	Wind speed (m/s)	Wind direction	Wind speed (m/s)	Wind direction
07:00	2.2	North	7.3	North
07:10	4.3	NNW	9.8	North
07:20	3.8	NNW	8.7	North
07:30	4.5	NNW	8.7	North
07:40	4.2	NNW	8.0	North

07:50	4.8	NNW	9.6	North
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The weather was fine and visibility was 20 km.

(2) Observations of Port Authority

The observation data of the anemometer installed near the accident site by the Port Authority on the day of the accident were as follows.

Time	Average wind speed		Maximum instantaneous wind speed	
	Wind speed (m/s)	Wind direction	Wind speed (m/s)	Wind direction
07:10	8.0	NW	15.5	NW
07:20	8.8	NW	13.3	NW
07:25	9.6	NW	13.3	NW
07:26	9.5	NW	14.5	NW
07:27	9.8	NW	17.1	NW
07:28	9.8	NW	17.1	NW
07:29	10.0	NW	17.1	NW
07:30	10.0	NW	17.1	NW
07:31	10.0	NW	17.1	NW
07:32	10.0	NW	17.1	NW
07:33	10.0	NW	17.1	NW
07:34	10.1	NNW	17.1	NW
07:35	10.1	NW	17.1	NW
07:36	10.0	NNW	17.1	NW
07:37	9.5	NW	15.4	NW
07:38	9.4	NW	15.4	NW
07:39	9.2	NW	13.9	NW
07:40	9.2	NW	13.9	NW

(3) Tide

According to the tide table published by Japan Coast Guard, the tide was at the middle of rising and the height was approximately 1.6 m at Yokkaichi Port.

2.8.2 Observation by crewmembers, etc.

At the time of the accident, it was as follows.

- (1) According to the navigation logbook of the Vessel, wind from northwest and wind force 5 were written in the column from 07 o'clock to 08 o'clock.
- (2) According to the reply from the Pilot, the weather was fine, wind direction was northwest to north-northwest, wind speed was 8 m/s to 12.5 m/s, and the visibility was 10 km.

2.8.3 Announcement of Warnings and Advisories

At the time of the accident, Warnings and Advisories had not been issued.

2.9 Characteristics of the Area Information on Bridge Organization

2.9.1 Information on pilotage

(1) Compulsory pilotage area and object vessels

According to Article 35 of the Pilotage Law (Act No.121 of 1949) and Article 5 of the Government ordinance pursuant to the Pilotage Law (Government ordinance No.354 of 1964), the Ise-Mikawa Bay district including the site of the accident is designated as a compulsory pilotage area, and it is stipulated that a master of a vessel with a gross tonnage of 10,000 tons or more must have a pilot on board.

(2) Standards for maneuvering and mooring

According to the Standards for maneuvering and mooring stipulated by the Pilots' Association, the main standards applied to the Vessel when berthing at Yokkaichi Port were as follows. The standard of wind speed less than 10m/s was applied by the exchange of information between the Master and the Pilot at the time of the departure from Nagoya port.

- a The minimum distance between two vessels moored at a similar berth was 35 meters in principle.
- b If wind speed was 15 m/s or more, the pilotage services were suspended.
- c If wind speed was 10m/s or more, the number and size of tug boats used for pilotage was determined according to the situation at that time.
- d When wind speed was less than 10 m/s, the standard for using tug boats was to use two tug boats with an output of 3,000 HP (2,237 kW).
- e If a bow thruster with a nominal horsepower of 1,600 HP (1,193 kW) was equipped, one tug boat might be reduced.

(3) Reference materials of Standards for maneuvering and mooring

According to the Pilots' Association's reference materials, it was recommended that a course be set at 285° as the fore target to the intersection part of No. 27 berth and No. 70 berth when approaching for port side head-in toward the Berth. Also, navigators should be careful of northerly winds and take a course with a sufficient margin against wind which had an influence sweeping away toward the Berth, and take also a course of 290° as the fore target aiming at the joint part between No. 70 berth and No. 71 berth in consideration of sweeping away to leftward was described, and the Pilot had already been aware of these things.

2.9.2 The Berth

According to the statements and the replies of the persons in charge of the Port Authority and the Facility Operation Company, and the Sailing Directions for South & East Coasts of Honshu, published by the Japan Coast Guard, there were as follows.

The Berth was located in the northern part of Kasumigaura Minami Wharf in the northern part of Yokkaichi Port. The berth normal line*¹³ direction was approximately 295°, the length was 300 meters, and the depth of the front water area was approximately 13.2 m.

The Rail grooves were provided at 2 meters and 18 meters from the front edge on the upper surface of the Berth, so that the traveling devices of the gantry cranes were able to move on them.

There are two gantry cranes on the Berth and one gantry crane on the adjacent No. 27 berth. Furthermore, there were three gantry cranes on Kasumigaura Kita Wharf No. 80 berth facing the Berth. All of the gantry cranes were operated as core facilities of Yokkaichi container terminal.

2.9.3 Mooring plan for the Berth

According to the statements and the replies by the person in charge of the Facility Operation Company to the questionnaires, there were as follows.

If there was a container vessel that was going to a berth on the container terminal, the Facility Operation Company would prepare a "Ship Mooring Plan" which was indicated using mooring bits, the position of the navigation bridge at the time of berthing, and allocations of the gantry cranes, etc., and then sent them to the shipping agent, stevedore, etc. in advance.

When the flare (overhang toward the outer side of shell plating) of the fore part and the stern part of a container vessel oscillated horizontally, the upper part of the vessel body would push out over the berth. Therefore, the Facility Operation Company assigned gantry cranes that avoid fore and stern structures in the berthing. The gantry cranes were assigned around the center of the body in the "Ship Mooring Plan" for the Vessel.

At the time of the accident, the gantry cranes were arranged in the order of the Berth near the bits of 264-267 on the Berth, in order of GC S2, Unit S3 and Unit S1 from east. The mooring lines of the Vessel were planned to use the bit of 271 concerning the fore side and the bit of 260 concerning the stern side, and stern side mooring line of the Moored Vessel

*¹³ "Berth normal line" refers to an extension line of the plane of the berth where the vessel is contact-moored.

was planned to use the bit of 257. The installation interval of each bit was 30 meters. (Refer to Attached Figure 2 Navigation path in Yokkaichi Port)

2.9.4 Status of container handling since the accident occurred

According to the statements and the replies by the persons in charge of the Port Authority and the Facility Operation Company, there were as follows.

After the accident, Unit S1 was able to operate only out of three gantry cranes installed on Kasumigaura Minami Wharf. As the large-sized container vessels were going to have to handle container cargo at Kasumigaura-Kita Wharf No. 80 berth, the container storage capacity of the wharf came to exceed the wharf's performance; therefore the container terminal required the works to transfer unloaded containers by land transportation to the Minami Wharf.

2.10 Information on Safety Management of the Vessel

Company A's safety management manual described the responsibilities of the masters and the watch officers when a pilot is on board as follows.

- (1) The presence of the pilot on the navigation bridge does not relieve the master or officers on watch of their responsibilities for the safe navigation of the vessel.
- (2) The master and officers on watch should fully understand the pilot's intentions.
- (3) Upon a pilot boarding, the master should immediately discuss the Pilotage Plan, (Anchoring / Mooring / Unmooring / Berthing / Unberthing etc.), as applicable, and furnish a pilot with the "Pilot Card".
- (4) The master, or in his absence, officers on watch, must be prepared to take action to supersede the pilot if it is thought that the pilot's actions may endanger the vessel. However, such action demands careful judgement and shall be made in ample time to ensure that the safety of the vessel is maintained.

2.11 Other References

2.11.1 Occurrence status of collision with gantry cranes by Container vessel

In a report on the investigation of marine accidents, etc. from October 2008 to December 2019, from which the Japan Transport Safety Board was established, there were 8 accidents involving gantry cranes by container vessels (5 cases in berthing, 3 cases in unberthing).

Looking at the causes of these accidents, there were 7 cases in which the attitude of a vessel body could not be controlled, and 1 case in which did not reach the objective berth due to wind pressure and collided with the berth.

For accidents where the attitude of a vessel body could not be controlled in front of the mooring place, since the ship speed was controlled, the impact at the time of the collision was relatively small and the damage to the container cranes was relatively slight. However, in the one case in which the vessel could not reach the planned objective berth due to sweeping away by wind, the vessel moved too far forward near the planned objective berth and collided with the gantry crane because the attitude of her body was not able to be controlled. Therefore the impact at the time of the collision was large, and subsequently the gantry crane was derailed, was not able to operate, and thereby caused serious damage. (Refer to Annex Table 1 List of Gantry Crane Collisions by Container vessels)

2.11.2 Standard berthing maneuver

According to literature^{*14}, it is described as follows.

Maneuvering of right-handed, 1 shaft, -1 rudder vessel at berthing is generally carried out as follows.

(1) *Berthing to moor port head-in (Small angle approach, Fig. 6.31)*

In case of approaching the berth at a small angle, the maneuvering of vessel will be carried out according to the following procedure.

- ① *For a vessel of approximately 10,000 gross tons, the approach angle is 15° to 20° with respect to the berth normal, and she proceeds to the planned berth with small inertia toward the destination.*

The separation distance from the berth when the vessel stops in the front of the planned berth can be approximately 1 to 1.5 times the width of the vessel.

For a vessel over 50,000 gross tons, the approach angle is generally 10 to 15 degrees, and the separation distance from the berth can be generally twice the width of the vessel.

- ② Below (omitted)

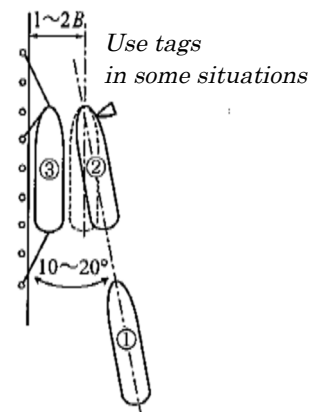


Fig. 6.31
Small angle approach

2.11.3 Ship speed control for approaching and berthing

According to literature^{*15}, the control of approaching ship speed at berthing is described

^{*14} Literature: "Basics of Ships Maneuvering (Second Edition)" written by HASHIMOTO Susumu, YABUKI Hideo and OKAZAKI Tadatane, Kaibundo-Shuppan Co., Ltd. (issued March 15, 2012)

^{*15} Literature: "Theory and Practice of Ships Maneuvering" by INOUE Kinzo, Seizando-Syoten Co., Ltd.

as follows.

1.3 Guideline for ship speed reduction control

When approaching a berth, most pilots are aware that, in the ship speed reduction plan, the safety margin is included in the range from 0.3 to 0.6 under the braking force of Dead Slow Astern, on any vessel type eg. VLCC, PCC, Container vessel. The Pilots' estimations of the safety margin appear to include considerations for "Keeping the vessel far from large swinging."

While utilizing the importance of this know-how and taking safety margins into account and response, it would be possible to make adjustments to the ship speed of forward movement based on always making firm decisions in approach maneuvering. The Practical guidelines for ship speed reduction are shown in Fig. 3.1.21.

Fig. 3.1.21 shows the guidelines for the ship speed reduction for approach maneuvering of each type of vessel.

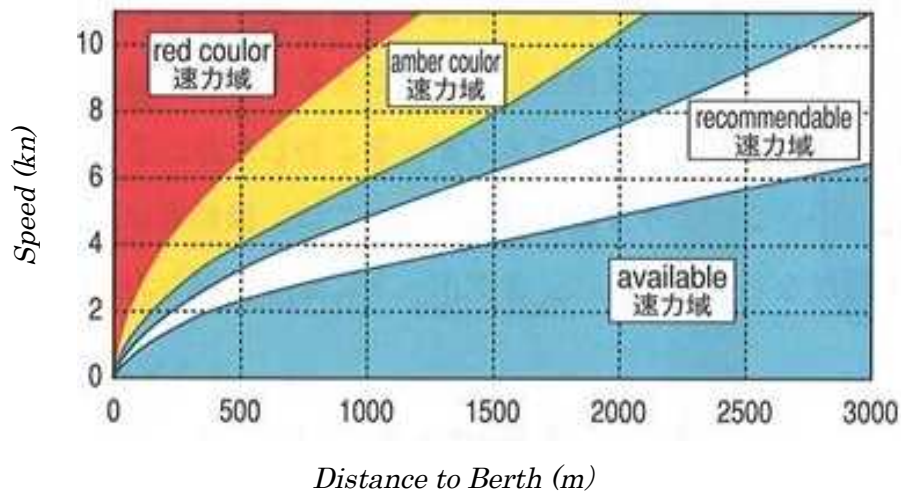
■ Available speed area

The speed area below the curve indicating the condition that the safety margin becomes zero when braking is used to Dead Slow Astern is basically defined as the available speed area. All of the pilots' speed reduction plans were within this range. This is a pilot's know-how cultivated from empirical judgment that it is desirable to control the ship speed of forward movement within this range so as not to allow the ship to sway to a large extent.

■ Recommendable speed area

In the available speed area, two-thirds of the total pilots are also aware of the safety margin from 0.3 to 0.6. The fact that many pilots concentrate on this area probably suggests that this speed area is the most practical, based on the pilots' long experience. In that sense, here, this speed area is referred to as a recommendable speed area. However, in the available speed area, the safety margin is in the range of 0 to 0.3 based on the braking force of Dead Slow Astern. Some pilots responded that they set the ship speed reduction plan in a somewhat bold manner, with a speed area where the safety margin is lower than 0.6 based on the braking force of Dead Slow Astern, while other pilots answered that they set the speed reduction plan quite carefully. These areas sandwiching the recommendable speed area are positioned in "available" but not "recommendable".

(omitted below)



(Container vessel, PCC, LNG carrier)

Fig. 3.1.21

3 ANALYSIS

3.1 Situation of the Accident Occurrence

3.1.1 Course of the Events

According to 2.1, it is considered probable as follows.

- (1) At around 07:22, the Pilot and the Master exchanged information concerning the Berth, and navigated to the course of 285° while the Vessel decelerated.
- (2) At around 07:32, the Vessel changed the course to 278°. After a while the leeway exceeded 10° from around 07:34:03 to around 07:35:53, and then the Vessel was swept away heavily toward the port side, No. 25 berth and the Moored Vessel.
- (3) At around 07:36:04, the Vessel was approximately 260 meters from the Berth and the ship speed was approximately 2.5 kn, and then at around 07:36:14, she used astern engine, but shortly thereafter, the Vessel decelerated immediately by using full astern .
- (4) At around 07:37:41, the Vessel lost forward movement near the Moored Vessel, and then it was forced to sweep away to port side and furthermore approached the Moored Vessel.
- (5) The Vessel was quite near the Mooring Vessel, and used the main engine by full ahead at around 07:38. Thereafter, since the Vessel was able to pass the Moored Vessel, the main engine was stopped; however, at around 07:39:39, the port fore part of the Vessel collided with GC S2.

3.1.2 Date, time and the location of this accident

(1) Time and date of the accident

According to 2.1.3 and 2.1.4, it is considered highly probable that the occurrence date and time of the accident was on August 17, 2018, at around 07:39:39, when the impact sound was recorded on both the VDR and the drive recorders.

(2) Accident location

According to 2.1, it is considered highly probable that the location of the accident was around 149°, 480 meters from the Yokkaichi Port Management Association Kasumigaura No.1 range light (front light) where the northeastern leg part of GC S2 was located.

3.1.3 Situation about the collision

According to 2.1.1, 2.9.2, 3.1.1 and 3.1.2, it is considered highly probable that the heading of the Vessel at the time of the collision was approximately 286°, the ship speed was approximately 2.4 kn, and the intersection angle between the centerline and the face line of the berth was approximately 9°.

3.1.4 Information of casualties or injuries

According to 2.2, it is considered probable that there were no casualties or injuries in this accident.

3.1.5 Damage to the vessel and other facilities

According to 2.3 and 2.4, it is considered highly probable that these were as follows.

(1) The Vessel

- ① Breakage of the port bulwark of the fore castle deck with cutting, deformed to the remote control stand of the mooring device
- ② Denting of her shell plate on her port fore part

(2) The Berth

The fenders' body was cracked, etc, concrete parts such as the upper surface of the Berth and the pedestal of the fenders were damaged in the form of exfoliation, etc. and the metal fittings at the front edge of the Berth were damaged.

(3) The gantry cranes

All of the gantry cranes on the Berth were moved, the traveling device of Unit S3 was the damaged and the leg part structure was cracked, deformed, etc. GC S2 was derailed and the traveling device was bent, was broken, etc., this leg part structure was deformed, and furthermore a part of fixing component of traveling rail was damaged, etc. As a result, GC S2 and Unit S3 were in an inoperable condition. Still,

there was no damage to Unit S1.

3.2 Causal Factors of the Accident

3.2.1 The situation of the crewmembers, etc.

According to 2.5, the situation of the crewmembers, etc. were as follows.

(1) The Master

The Master possessed legally valid certificates of competence.

It is considered probable that he was in good health at the time of the accident.

(2) The Pilot

The Pilot possessed a legally valid certificate of competence as a pilot.

It is probable that he was in good health at the time of the accident.

3.2.2 Situation about the Vessels

According to 2.6.5, at the time of the accident, it is considered probable that there were no malfunctions or failures in the hulls, engines and equipment of the Vessel.

3.2.3 Information on the weather and sea conditions

According to 2.8, the weather and sea conditions were as follows.

(1) It is considered probable that, at the time of the accident, the weather was fine, a west-southwest wind was blowing at force 3, the visibility was 5 M or more, waves with a height of approximately 0.3 meters were coming from the south, and the tide was at the end of rising.

(2) At around the berth, a northwest wind with a maximum instantaneous wind speed of 17.1 m/s was observed from 07:27 to 07:36, because winds were strengthening during that time, and then at 07:34 and 07:35, the average wind speed was 10.1 m/s, and it is considered highly probable that winds were particularly strong at around 07:34.

3.2.4 Analysis on mooring plan

According to 2.1, 2.9.1 to 2.9.3 and 2.11, it is considered probable that these were as follows.

(1) The mooring interval between the Vessel and the Mooring Vessel was about 60 meters or more, which satisfies the Standards for maneuvering and mooring of the Pilots' Association.

- (2) In consideration of past accidents concerning collision of container vessels with gantry cranes that have occurred so far, it was the case that the separation distance was small near the front of the mooring berth, and that both the speed and the vessel's attitude could not be controlled, and thereby the accidents with severe damage had occurred.
- (3) The mooring plan for the Berth was designed the gantry cranes on the Berth to hull parallel part of the Vessel body, and when conducting the operation of maneuvering the Vessel in accordance with standard berthing maneuvering methods, the Vessel would have a separation distance of 1 or 2 times the width of her in front of the Berth and would approach in parallel toward the Berth after her ship speed and her body attitude were controlled, because it is considered somewhat likely that the Vessel would not collide with GC S2 and would not produce a large impact.

3.2.5 Analysis on the course and flows of the Vessel during approaching

According to 2.1.1, 2.1.5, 2.7, 3.1.1 and 3.2.3, it is considered probable that the situation was as follows.

- (1) At around 07:22, when the course was set to 285° according to the Pilot's maneuvering instruction, the Vessel was receiving northwesterly wind to starboard fore at that time, because the Vessel body was swept away to port side with a leeway being from approximately 3° to 5°.
- (2) Under the situation of the increasing force of northwesterly wind, at around 07:32, the course had been set to 278° by the Pilot's maneuvering instruction, at around 07:34, the force of wind was strengthening especially, because from around 07:34, this leeway was exceeding 10° for approximately 2 minutes, and then the Vessel was approaching the Moored Vessel immediately by being swept away heavily to port side.
- (3) Since around 07:34, the Vessel had used the bow thruster at full to starboard against pressurized flows to the port side and had been pulled the starboard stern to the starboard side by a tug boat, because the leeway was decreasing gradually from around 07:35 to 36, and thereby pressurized flows to the Vessel decreased.

3.2.6 Analysis on Bridge Team

According to 2.1.3, 2.1.5 and 2.7, from the time of exchanging information concerning the mooring place to around the time of the Vessel being lined up with the Moored Vessel, information necessary to deal with pressurized flows were rarely exchanged, and the Master and the Pilot did not share the maneuvering intention with each other, because it

is considered probable that Bridge Resource Management (BRM^{*16}) was not utilized significantly in response to the Vessel being swept away.

3.2.7 Analysis on the intention for maneuvering by the Pilot

According to 2.1.1, 2.1.3, 2.1.5, 2.7, 2.9, 2.11, 3.1.1, and 3.2.2 to 3.2.5, it was as follows.

- (1) It is considered probable that the separation distance was larger than the usual distance between the Vessel and Kasumigaura Minami Wharf, because the Pilot thought that the Vessel would be approaching the Berth at a large angle; therefore he set the course of 278° toward the bridge mark on No.27 berth, which was closer to the Berth than the target for heading stated in the Pilots' Association's reference materials.
- (2) It is considered probable that after changing the course to 278°, the Vessel was sweeping away heavily to port side, because the Pilot maintained the ship speed slightly faster than the standard and navigated the Vessel forward, aiming to secure a separation distance until reaching the planned berthing place, and then after passing the Moored Vessel, subsequently he intended to control the ship speed and the Vessel's attitude by using the main engine and strengthening reverse thrust.
- (3) It is considered probable that at around 07:36, the Vessel had a speed of 2.5 kn, a distance of approximately 260 meters to the planned berthing place and was in the available speed area of *Fig. 3.1.21*, so that the ship speed and the Vessel's attitude were able to be controlled.
- (4) It is considered somewhat likely that at 07:36:04, the Vessel had the separation distance of approximately 90 meters from Kasumigaura Minami Wharf, and then decreased the separation distance by 30 meters for 2 minutes until 07:38:04, because the Vessel was able to be advancing until around 07:42.
- (5) It is considered somewhat likely that if the maneuvering intended by the Pilot had been continued, it is possible that the ship speed and the Vessel's attitude would have been controlled, and that the Vessel would have been advancing until around 07:42 and would have been able to berth at the Berth without colliding with GC S2.
- (6) Although wind momentum differs on a case by case basis, under the situation of the force 5 northwesterly wind, it is considered somewhat likely that the leeway of the Vessel was approximately 3° to 5° when taking the course of 285°, because the Vessel was able to be maneuvered with a sufficient separation distance from the port side by

^{*16} "BRM (Bridge Resource Management)" refers to the effective management of crewmembers, equipment, information, and other available resources on the bridge to maintain and improve operational functions on the bridge.

the course method of 290° described in the Pilots' Association's reference materials.

3.2.8 Analysis on Recognition of the Master concerning Situation for Surroundings of the Vessel and Maneuvering

According to 2.1.3, 2.1.5, 2.8.1, 2.7, 2.9.1, 2.11.2, 2.11.3, 3.1.1, and 3.2.3 to 3.2.6, these were as follows.

- (1) It is considered possible that the Master felt the approaching speed toward the Berth was fast near the Mooring Vessel because of the following things.
 - ① At around 07:34, the leeway of the Vessel was exceeding 10°, the Master caught sight of the state where the Vessel was swept away immediately toward the Moored Vessel on the port side, and thereby he was under pressure.
 - ② On the navigation bridge of the Vessel, information necessary to deal with pressurized flows was exchanged rarely.
 - ③ The Master remembered that the ship speed was displayed as 3.9 kn on the ECDIS screen that he watched before leaving the navigation bridge.
- (2) It is considered probable that the Master was not able to make sufficient trusting relationship with the Pilot, because of the following things.
 - ① The Master thought that the Pilot's explanation was not sufficient and had carefully observed his behavior.
 - ② After the heading-on situation with a domestic cargo vessel, the Master inquired with the Pilot concerning his intention regarding maneuvering, and then the Master confirmed the validity of his maneuvering.
 - ③ The Master felt the ship speed was fast, and then it seemed to him that the Pilot's maneuvering was not appropriate and that the Pilot would not be able to berth at the Berth.
- (3) It is considered probable the Master felt that the Pilot's maneuvering was unreliable and that the approaching speed toward the Berth around the Mooring Vessel was fast, and the Master felt anxiety to the Pilot's maneuvering, because he thought he would abort her movement completely, and then intervened immediately and conducted maneuvering the Vessel himself, and thereby decelerated ship speed using by full astern to control the overlooked ship speed.

3.2.9 Analysis of the accident occurrence

According to 2.1.1 to 2.1.3, 2.1.5, 3.1.1, 3.1.3 and 3.2.3 to 3.2.9, it is considered probable that there were as follows.

- (1) When the Pilot was making the Vessel approach Yokkaichi Port, the Pilot recognized that information on approaching the Berth, etc. was not contained in the pilot information card; therefore the Pilot had the Master visually confirm the Berth, and after that time, the Pilot instructed the Vessel's courses while decelerating ship speed.
- (2) The Pilot transmitted to the Master the bridge mark putting on No. 27 berth, which was on the western side of the Berth, as the target of her heading. Under the situation of winds strengthening, the Pilot turned the course to the port side and set it at 278°, stopped the main engine at 07:33, and from around 07:34, the leeway was exceeding 10°, and thereby the Vessel was swept away heavily to port side.
- (3) The Vessel used the bow thruster at full to starboard and had the tug boat pull on the starboard stern to starboard, and thereby the sweep away of the Vessel began to decrease at around 07:35.
- (4) Information concerning increasing the leeway, changing wind force, pressurized flows, etc. was not exchanged among the Master, the Pilot and the crewmembers which were assigned in the navigation bridge. Furthermore, the intention regarding maneuvering was not shared between the Master and the Pilot, and thereby the concept of BRM was not utilized on board.
- (5) The Master was not able to make sufficient trusting relationship with the Pilot, and felt that the approaching ship speed toward the Berth near the Mooring Vessel was fast, and thereby felt anxiety to the Pilot's maneuvering; because he thought he would take immediate actions due to aborting her movement completely, and then intervened immediately and conducted maneuvering the Vessel himself, and set the main engine to full astern, and thereby the Vessel was lost forward movement.
- (6) The Vessel lost forward movement near the Mooring Vessel before reaching the Berth, because she was swept away closely to the Mooring Vessel and caused the risk of collision with the Mooring Vessel. Even though taking full ahead of the main engine was conducted to avoid collision with the Moored Vessel and she was proceeding forward, she was not able to control her attitude, and thereby her port fore part collided with GC S2 on the Berth.

4 PROBABLE CAUSES

It is considered probable that this accident occurred, at Yokkaichi port, under conditions of

a northwesterly wind blowing at wind force 5 to the Berth, while the Vessel was approaching the Berth for mooring port side head-in by the Pilot's pilotage instruction, and then the Master intervened immediately and conducted maneuvering the Vessel himself, and forward movement of the Vessel was lost due to using by full astern, because the Vessel was swept away toward the Moored Vessel closely, and then taking full ahead was conducted to avoid collision with the Moored Vessel and she was proceeding forward; however, she was not able to control her attitude, with the result that the port fore part of the Vessel collided with GC S2 on the Berth.

It is considered probable that the Master intervened immediately and conducted maneuvering the Vessel himself, and forward movement of the Vessel was lost due to using by full astern, because the Master was not able to make sufficient trusting relationship with the Pilot and felt that the approaching ship speed toward No. 26 berth was fast near the Moored Vessel, and thereby he thought he would abort the Vessel movement completely.

It is considered probable that the Master was not able to make sufficient trusting relationship with the Pilot, because the Master felt that the Pilot's explanation was not sufficient for him.

It is considered probable that the accident was occurred by involving in lack of BRM including effective communication, etc. in the navigation bridge between the bridge team including the Master and the Pilot, while the Vessel was in a situation of being imminently swept away toward the port side where No. 25 berth and the Moored Vessel were located by the leeway exceeding 10°.

5 SAFETY ACTIONS

It is probable that this accident occurred, at Yokkaichi port, under condition of a northwesterly wind blowing at wind force 5 to the Berth, while the Vessel was approaching the Berth for mooring port side head-in by the Pilot's pilotage instruction, and then the Master intervened immediately and conducted maneuvering the Vessel himself, and forward movement of the Vessel was lost due to using by full astern, because the Vessel was swept away toward the Moored Vessel closely, and then taking full ahead was conducted to avoid collision with the Moored Vessel and she was proceeding forward; however, she was not able to control her attitude, with the result that the port fore part of the Vessel collided with GC S2 on the Berth.

It is considered probable that the Master intervened immediately and conducted

maneuvering the Vessel himself, and forward movement of the Vessel was lost due to using by full astern, because the Master was not able to make sufficient trusting relationship with the Pilot and felt that the approaching ship speed was fast near the Moored Vessel, and thereby he thought he would abort the Vessel movement completely.

Accordingly, the following measures should be taken in order to prevent reoccurrence of similar accident.

- (1) Even when a pilot is maneuvering, the master should recognize that the master is responsible for safe navigation, command while sharing the intention of maneuvering and necessary information for maneuvering with the pilot, and furthermore require the pilot to make clear explanations if there is anything unclear concerning the pilot's intention regarding vessel maneuvering.
- (2) A Master should utilize BRM through daily education and training for crewmembers so that information necessary for maneuvering is able to be shared in a navigation bridge.
- (3) A pilots should significantly explain not only the pilotage plan but also the intention regarding maneuvering in order to recognize the conditions surrounding the vessel and respond to these conditions, such as maneuvering to avoid other vessels, situation of external forces and dealing with those effects, and furthermore the pilot should certainly share information with the master to establish a relationship in which the master places trust in the pilot without feeling uneasy.
- (4) The pilots should join in BRM on vessels on which they conduct pilotage.

5.1 Safety Actions Taken

5.1.1 Safety Actions Taken by Company A

According to Company A's response, it seems to Company A that the accident occurred because, although there had been enough time available to take evasion actions, they were not taken when facing sudden changes of external forces, so that the approaching course taken by the Pilot was a steeper angle than standard, and Company A directed the following corrective measures with regard to the Vessel.

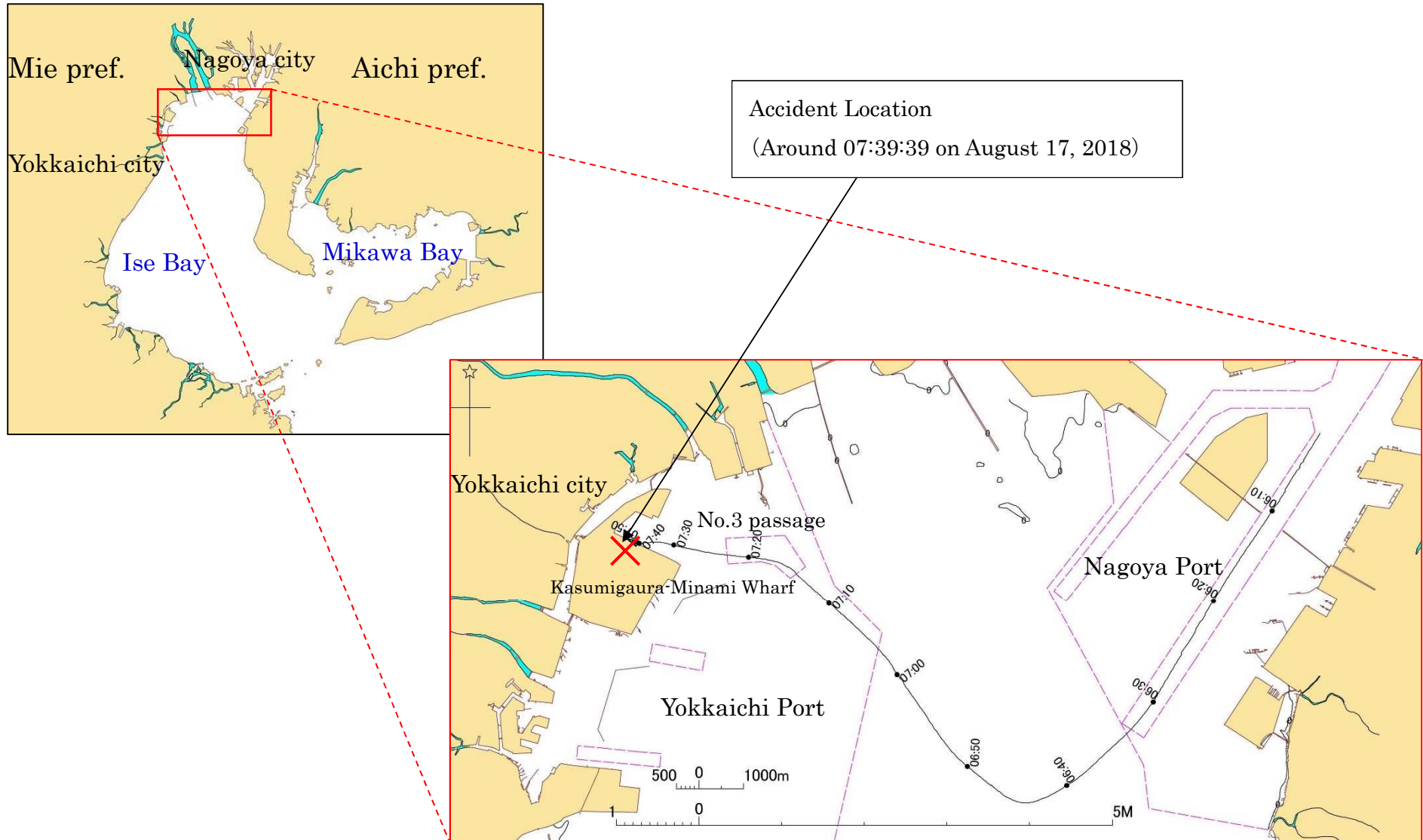
“The Bridge Team must always pay more attention to changes whenever they feel that something is strange. The team members, especially the bridge team members at the wheelhouse assignment, for example, must report any risks and/or adverse events that may lead the Vessel to danger, such as sudden changes in wind direction and/or speed, currents, setting of own vessel.”

5.1.2 Countermeasures by the ISE-MIKAWA-WAN Pilots' Association

The Pilots' Association conducted the following countermeasures after the accident.

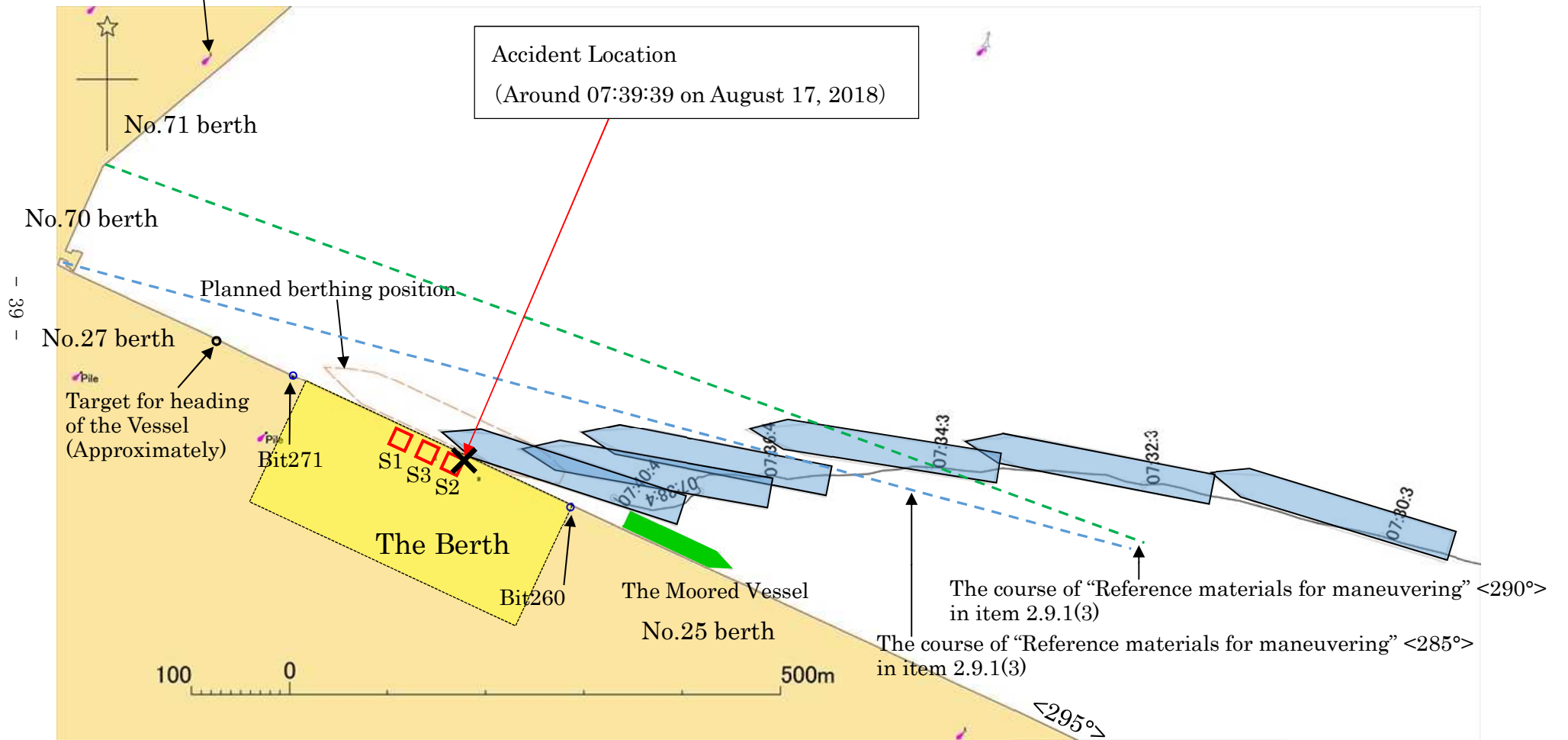
- (1) In order to re-train the Pilot, the Pilots' Association had the Pilot take re-training concerning the importance of BRM activities and BRM techniques, and in addition, under the supervision of the Training Committee chairperson, he underwent berthing maneuvering training under conditions of strong winds and winds blowing against the Berth utilizing a ship-handling simulator.
- (2) For all members belonging to the Pilots' Association, the pilots must enforce punctual BRM activities to ensure that masters do not become uneasy and that understandings are shared. Furthermore, the Pilots' Association notified all members that pilots should confirm the maneuvering reference materials before their pilotage, and practice maneuvering vessels in accordance with the maneuvering methods described in the materials as much as possible. The Pilots' Association will further enrich the maneuvering reference materials.

Annex Figure 1: Navigation path



Annex Figure 2: Navigation path in Yokkaichi Port

Yokkaichi-ko Kanrikumiai Kasumigaura
No.1 range light (front light)



Annex Table 1

List of Gantry Crane Collisions by Container vessels

* The enclosed numbers in the number column indicate that a pilot was on board.

No.	Date of occurrence and location	Gross tonnage (T)	Wind direction / wind force, etc.	PROBABLE CAUSES (Damage of gantry crane)
1	December 1, 2018 3rd district of Tokyo, Keihin Port	141,635	East/ Wind force 2	It is considered probable that this accident occurred when, while making a tug boat push the port stern part of the vessel for aiming to gain forward movement, the vessel collided with a gantry crane because her port stern had entered above the berth much more diagonally than intended during berthing with port side head-in. (Shaft of cable reel was bent)
2	March 10, 2018 3rd district of Tokyo Ku, Keihin Port	18,485	NNE/ Wind force 3	It is considered probable that the accident occurred at nighttime when, while the pilot commanded a tug boat to prepare for pulling the vessel's port stern, the bow of the vessel contacted with the berth and then her starboard fore collided with a gantry crane, because her stern part swung to port side and then her fore part approached the berth, even though the bow thruster was used full to port when the vessel was leaving the berth from which she was moored along the starboard side. (Shaft of cable reel was bent)
3	October 29, 2017 3rd district of Yokohama Ku, Keihin Port	18,485	NNW/ Wind force 4	It is considered probable that the accident occurred at dawn before sunrise when, while the pilot used the bow thruster to starboard and then made the tug boat pull the starboard stern of the vessel, which was moored at the berth along her port side, the port fore part of the vessel swung to port and then collided with a gantry crane, because the pilot did not confirm the condition of the port fore part of the vessel's approach to the berth and did not notice that the tug boat was pulling strongly. (Shaft of cable reel was bent)
4	April 13, 2016 Tomakomai Port, Tomakomai City, Hokkaido	9,520	SSW/ Wind force 5	It is considered probable that the accident occurred when, while the vessel body was in parallel along the center wharf of 4th district, Tomakomai Port, the starboard stern of the vessel collided with a gantry crane, because the vessel turned to starboard. (Cable reel was bent, etc.)

No.	Date of occurrence and location	Gross tonnage (T)	Wind direction / wind force, etc.	PROBABLE CAUSES (Damage of gantry crane)
5	April 1, 2016 3rd district of Tokyo Ku, Keihin Port	75,246	NE/ Wind force 3	It is considered probable that this accident occurred when, while the vessel was mooring at the berth in No.3 Tokyo district of Keihin Port, the stern of the vessel collided with a land crane on the wharf due to approaching at a crossing angle of 5° against the line of the berth, because the pilot did not confirm the operation of the bow thruster after his instruction to use the bow thruster at full to starboard. (Cable reel, etc. were broken)
6	October 2, 2014 Tanoura Ku, Kanmon Port	13,246	East/ Wind force 4 Current E 4.7kn	It is considered probable that this accident occurred when, while the vessel was mooring at the berth of Tanoura ku, Kanmon Port, the bulwark on the starboard fore part of the vessel collided with a cable reel, because the line from fore to stern was intersected by the line to the Berth at approximately 16°. (Cable reel was broken)
7	April 21, 2013 Hakata Port, Hakata City, Fukuoka Prefecture	16,776	NNW/ Wind force 5	It is considered probable that this accident occurred when, while the vessel was berthing at Kashii No. 4 berth, the starboard side of the vessel collided with the gantry crane on Kashii No. 4 berth, Hakata Port, because the vessel was swept away by winds from port side, although the pilot commanded to let go the port anchor and to operate the bow thruster at full to port. (Depression in frame, wheel derailed)
8	April 26, 2010 Tomakomai Port, Tomakomai City, Hokkaido	8,229	North/ Wind force 3	It is considered probable that the accident occurred when the handrail of the starboard fore of the vessel collided with the gantry crane on the berth in the 4th district of Tomakomai Port, because the characteristic of the vessel during moving backward added to strengthen the wind force toward the berth, and caused the bow of the vessel to approach the berth. (Cable reel was broken)