GOVERNMENT LABORATORY

STATEMENT OF WITNESS

Laboratory Reference .....GPW 12835-12843, 13412-13416.....

Source Reference .....MAR RN 12000195.....

Statement of .....Dr. CHENG Yuk Ki (鄭郁棋).....

Age ..... Adult.....**Sex**.....Male .....**Telephone Number** 2762 3739 .....

Occupation: .....Forensic Scientist.....

Address: ..... Forensic Science Division, Government Laboratory, ...

..... 7/F, 88 Chung Hau St., Ho Man Tin, Kowloon, Hong Kong .....

This statement, consisting of 18 pages, and an album of 34 photos, in the English language and each signed by me, has been read over by me and is true to the best of my knowledge and belief. I have made it knowing that if I wilfully make a statement which I know to be false or do not believe to be true, I may be liable to be prosecuted for a criminal offence.

Dated the 12th day of December 2012

Signed:

I, Cheng Yuk-ki, state that I am a Bachelor of Science in Chemistry (B.Sc., Hons.) and a Doctor of Philosophy (Ph.D.) in the Faculty of Science, the University of Hong Kong. I have been employed as a chemist by the Forensic Science Division, Hong Kong Government Laboratory since September 1997. As part of my formal training, I have successfully completed The Road Traffic Accident Reconstruction Course jointly operated by the Hong Kong Police Force and the Government Laboratory (HK). Since then, I have examined and reported on numerous cases of vehicles or vehicle parts examination. I am actively involved in accident investigation, accident reconstruction and training of police officers in Hong Kong in those disciplines. I have handled several cases involving vessel accidents. I have received in-house training in Crime Scene Investigation, and I am currently responsible for attending scenes of crime. I have given evidence as an expert witness in courts of Hong Kong on numerous occasions and have been recognized as an expert witness.

Forensic Investigation Report

1. Introduction

1.1. On 1 October 2012 at about 2020 hours, a Hongkong Electric Company Limited (HKE) pleasure boat "Lamma IV" were conveying HKE employees and their relatives/friends, a total of 127 passengers and 3 crew members, from the HKE Power Station at Lamma

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Island to Victoria Harbour to view the commemorative fireworks display for the National Day. Meanwhile, a Hong Kong & Kowloon Ferry Holdings Limited (HKKF) passenger ferry "Sea Smooth", scheduled service from Central to Yung Shue Wan Pier, was carrying 95 passengers on board. The two vessels collided at 1.2 kilometres from Yung Shue Wan Pier, Lamma Island (Marine Box 1306C). After the collision, the stern of Lamma IV sank in the water with its bow upwards, while Sea Smooth sustaining damage left the scene and safely carried her passengers to Yung Shue Wan Pier. A total of 39 persons from Lamma IV finally died in the tragedy. At the time of the accident, the weather was fine.

1.2. On 3 October 2012, SIP YUNG Man-chuen of RCU 3 of MAR of the Hong Kong Police Force (HKPF) made a request to the Hong Kong Government Laboratory for assisting them in their investigation. Upon the request of the HKPF, I made detailed examination of the two vessels in separate occasions, which were tabulated as follows:-

Date	Time	Vessel	Location
3 October 2012	1050-1155	Sea Smooth	Moored to Yung Shue Wan Pier
	1240-1400	Lamma IV	Beached at Nga Kau Wan
15 October 2012	1430-1710	Lamma IV	On a rack at Government Dockyard[1]
18 October 2012	1450-1650	Lamma IV	On a rack at Government Dockyard
31 October 2012	1020-1130	Sea Smooth	New Yau Ma Tei Typhoon Shelter
	1150-1315	Lamma IV	On a rack at Government Dockyard
9 November 2012	1500-1550	Sea Smooth	On a rack at Government Dockyard
	1555-1645	Lamma IV	On a rack at Government Dockyard
14 November 2012	1550-1640	Lamma IV	On a rack at Government Dockyard

1.3. The purpose of my examination of the two vessels was :-

1.3.1. to collect and preserve traces evidence of forensic values from the two vessels for laboratory examination;
1.3.2. to examine the damage to the vessels;
1.3.3. to make relevant measurements from the vessels, including the damage areas;
1.3.4. to determine whether or not there were seats originally affixed in the upper-deck cabin of Lamma IV[2] before the collision, and if so, how could they be detached from their mounts; and
1.3.5. to determine the drafts[3] of Sea Smooth at different loading.

[1] Government Dockyard at Ngong Shung Road, Stonecutters Island, Sham Shui Po.
[2] According to police information, the seating arrangement in the upper-deck cabin of Lamma IV after the accident disagreed with that recorded on the deck plan.
[3] Draft is the vertical distance between the waterline and the bottom of the hull.

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1.4. During the course of my examination, I had taken a number of photographs. Some of these photographs were selected with annotations added, and were compiled as an album to illustrate my findings in my statement.

2. Sea Smooth Examination

2.1. Sea Smooth was a catamaran passenger ferry, having three decks, namely the under deck, the main deck and the upper deck. The vessel had two parallel hulls held together by the main deck and the upper deck. The under deck was situated in the two hulls on the port side and the starboard side (see Photo 1 & Photo 2 in Photo Album). The two hulls were narrow in a needle shape and designed for wave piercing. There were two passenger cabins, namely the main-deck cabin and the upper-deck cabin, respectively accommodating a maximum of 199 and 134 passengers respectively. Behind the upper-deck cabin was the weather deck, which could accommodate 48 passengers. Excluding the 8 crew members, Sea Smooth could carry a total of 381 passengers.

2.2. The hulls of Sea Smooth were mainly composed of strong fibreboard. The bow of the starboard hull was found to have been protected by additional L-shaped metal plating near the waterline, measuring about 1.6 metres high by 0.8 metres wide and having a pointed protrusion at its corner (see Photo 3). The paintwork of the hulls above the waterline was deep blue and below was brown.

2.3. Contact damage to Sea Smooth was confined to the port hull and the foredeck. The bow of the port hull was badly damaged and its planking was missing, leaving a breach with a maximum extent of about 2.4 metres high, 4.3 metres long by 1.5 metres wide. The structural members reinforcing the fibreboard planking near the breach were broken and bending inwards (see Photo 4). Scratches with white smears were found on the bow of the middle hull, the open section between the two hulls above the water (see Photo 2). These scratches started from the top of the breach on the starboard side of the port hull, travelled upwards and aft, crossed to the middle hull and ended at the bow near the centreline[4]. The scratches were continuous and mostly travelling at a single direction.

2.4. The foredeck of Sea Smooth also sustained severe impact damage to its port bow, including the damage and missing of a triangular side panel and dislodgement of the handrail (see Photo 5). The missing side panel measured about 1.5 metres high by 2.7 metres wide. Debris, including the panel of Sea Smooth and some foreign white, blue and red paint fragments, was scattered on the foredeck. In addition, fresh scratches with white and red paint smears were found on the leading edge of the foredeck at the bow; the direction of the scratches ran aft towards the port side.

[4] An imaginary line down the center of a vessel lengthwise.

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2.5. Behind the foredeck, about 3.5 metres from the bow, was the front panel of the main-deck cabin. Fresh horizontal scratches with blue smears were found on the front panel at a height of about 0.9 metres from the deck and about 1.3 metres from the port side end (see Photo 6).

2.6. The damage to the main-deck cabin was confined to the corner at the port bow, including minor deformation and cracking of the fibreboard panel. No damage to the upper-deck cabin was noted. All the fixtures, including the seats in either cabin, remained in their respective positions.

2.7. The under deck of each of the two hulls was divided into seven compartments, arbitrarily named as Compartments 1 to 7 from bow to stern; Sea Smooth had a total of 14 compartments. Access to Compartments 1 to 5 was through the ten manholes (the compartment lids) inside the main-deck cabin (see Photo 7). To open the manhole lids needed either cross wrench, respectively kept near the stern and a storage space under the stairs in the middle of the main deck (see Photo 8); a crew member took less than half a minute to open one manhole. Compartments 1 to 3 of both hulls were void spaces. Compartments 4 and 5 were respectively the tank and engine rooms. All the compartments from 1 to 5 appeared as separate spaces were divided by the use of vertical walls, called bulkheads, with no access between them, and these compartments therefore could have been watertight. As no damage to the stern was found, Compartments 6 and 7 were not examined.

2.8. Examination revealed no damage to or water ingress into any of the first five compartments of the starboard hull. However, Compartment 1 of the port hull was found badly damaged and almost lost; only a small section of the keel and few fibreboard planking at the top remained (see Photo 9). The bulkhead between Compartments 1 and 2 was also damaged, causing flooding in Compartment 2 of the port hull. Compartments 3 and 4 of the port hull showed no visible damage but some water estimated roughly 10-20 cm deep was found in the bilges[5]. No damage and water ingress were noted in Compartment 5 of the port hull.

2.9. The wheelhouse, situated at the front of the upper deck, had 6 windows in front and 3 windows on each side, enabling a view of almost 180 degrees to the front. In addition, there were two bridges on either side, which allowed crew members to keep a lookout for ships or any danger on both sides. No damage to the wheelhouse was found.

[5] Bilge is the bottom inside part of a ship where water collects or the lowest compartment of a ship, below the waterline. Electric bilge pump is usually equipped to remove the excessive water in the bilge.

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2.10. As instructed by the police, a crew member aboard turned on the green and red sidelights[6]. I checked from the bridges of the wheelhouse and confirmed that the two sidelights were working properly.

2.11. Draft measurement

2.11.1. The drafts of Sea Smooth at different loading were determined on 31 October 2012 in New Yau Ma Tei Typhoon Shelter. Measurements were made using the draft marks on the bow of the starboard hull and the two sterns. The drafts of Sea Smooth at two scenarios were measured; (i) with no passenger, and (ii) with 99 persons on board, which was approximately the number of persons aboard Sea Smooth at the material time.

2.11.2. Making reference to the code of practice[7], each person had a mass of 68 kilogrammes. Therefore, a total of 6.5 tonnes of sand bags, which was equivalent to the weight of 96 persons, were evenly loaded on the two passageways within the main-deck cabin for the loading test. Including the eight adults on board, the weight of about 104 persons were on board for the loading test. The drafts of the vessel and the levels of the main cabin before and after loading were measured and tabulated as follows:-

Load weight	**Nill**	**104 persons**
Draft on the starboard bow	1.2 metres	1.4 metres
Draft on the port stern	1.9 metres	1.9 metres
Draft on the starboard stern	2.3 metres	2.3 metres
Gradient along the length*	0.5 degrees	0.5 degrees
Gradient along the width^	2.4 degrees	2.5 degrees

Note: No measurement was made on the port bow as the hull bearing the draft marks had been broken and missing.

* Downslope to the bow

^ Downslope to the port side

2.11.3. Using the gradient along the width, the draft at the port bow was estimated to be about 1.5 and 1.7 metres unload and loaded with 104 persons respectively.

3. Lamma IV Examination

3.1. Lamma IV was a passenger ferry, having three decks, namely the under deck, the main deck and the upper deck (see Photo 10). The main deck had a passenger cabin, namely the main-deck cabin. The upper deck had the wheelhouse in the front, the upper-deck cabin amidships, and the weather deck aft. The weather deck was partially covered by awning. According to the deck plan, the total passenger capacity was 224, of which

[6] A red light is mounted on the port side of a vessel and a green on the starboard side.

[7] This code of practice is issued under section 8 of the Merchant Shipping (Local Vessels) Ordinance, (Cap. 548)

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146 seats were on the main-deck cabin, 64 seats on the upper-deck cabin and 14 seats on the weather deck.

3.2. The hull

3.2.1. The hull of Lamma IV was constructed of probably aluminum alloy, having a flat-bottom chined[8] hull with an almost flat bottom and near-vertical hull above the bottom. The height from the chine to the main deck was about 2.4 metres, of which the part above waterline was painted in blue and that below waterline measured about 0.75 metres high was coated in brown.

3.2.2. There was no fresh damage to the bow and the stern. The two slits on both sides of the hull were consistent with that the piece of steel cable used to tow the vessel from the water to the dock had damaged the hull. Therefore, the slits were not examined further. Apart from the slit, no other damage of significance was found on the starboard side.

3.2.3. A gash and a jagged hole were found on the port side of the hull (see Photo 11). The gash on the hull, measuring about 0.3 metres wide, extended from the gunwale at a position of about 10 metres from the transom[9], running about 3.3 metres aft towards the chine (a slanted gash). When the gash reached the chine, it ran parallel to the chine for a distance of about 1.1 metres and ended at a position about 6.1 metres from the transom, where the hull was reinforced by a bulkhead separating two watertight compartments (see paragraphs 3.3). Horizontal scratches, some with deep blue smears, running aft were found on the hull behind the gash (see Photo 12). Of these scratches, those on the brown-painted hull were the deepest, running towards the hole and ending there. These scratches appeared smoothly and uninterrupted, suggested that an object, which was subsequently confirmed to be the broken keel of the port hull of Sea Smooth, had moved from the gash towards the hole in a single swipe.

3.2.4. The hole, measuring 0.4 metres high by 0.6 metres wide, was situated by the chine and about 5.5 metres from the transom next to the aforementioned bulkhead. The deformed hull of the hole was mostly bent inwards. A piece of internal framing immediately behind the hole was badly distorted and buckled inwards to the stern. The thickness of the aluminum alloy hull at the hole and the gash was measured to be about 5-6 mm.

3.2.5. A piece of fibreboard with deep blue paint at the top and brown paint at the bottom was found to have been wedged in the gash. The recovered largest piece of fibreboard, measuring about 2.6 metres high by 1.3 metres wide and having deep blue and brown

[8] A chine refers to a sharp angle in the hull.
[9] The flat surface across the stern of a vessel.

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paintwork, had originated from the bow of the port hull of Sea Smooth. Close examination of the fibreboard fragments revealed an imprint having size and shape, partially agreeing with the L-shaped metal plating on the bow of the starboard hull of Sea Smooth (see Photo 13), but no metal plating was recovered inside the hull of Lamma IV[10]. In addition, the draft marks on the fibreboard fragment matched with those on the starboard hull of Sea Smooth, particularly the mark of "1.2" straddling the waterline (see Photo 3).

3.3. The under deck

3.3.1. The interior area of the hull, the under deck, was divided transversely into a total of six compartments. The compartments from bow to stern were arbitrarily named as Compartment A to Compartment F respectively.

3.3.2. Compartment A was a space beneath the foredeck. The manhole to Compartment A was bolted tightly so I could not open it. Compartment A was probably a void space and it was the only compartment above the water after Lamma IV ended up half submerged with the bow pointing up. Taking into account that there was no damage to the foredeck and the bow, examination of Compartment A was not pursed further.

3.3.3. Compartment B was a void space, which still had water at the time of my examination. No damage to the bulkheads and the hull was found.

3.3.4. Compartment C, having been filled with water, was a room for the crew. No damage to the bulkheads and the hull was found. The bulkheads dividing Compartments A to D extended from keel to main deck and from side to side, suggesting that Compartments A to D were independent watertight sections.

3.3.5. Compartment D was the engine room and the entire compartment, including the engine, was covered in a layer of mud. The identified gash was found in Compartment D (see Photo 14). The piece of fibreboard wedged in the gash had deeply penetrated into the interior of hull, reaching a thick tube from the port side engine. The bulkhead separating Compartment D from Compartment E appeared to be watertight as well.

3.3.6. Compartment E and Compartment F were separated by a non-watertight (open) bulkhead, having an opening of 0.6 metres wide and 1.2 metres high (see Photo 15). Both compartments had deposited with a layer of mud. Compartment E was the tank room and the jagged hole was situated in Compartment E on the port side by the bulkhead (see Photo 16).

[10] According to Police information, the metal plating on the port hull of Sea Smooth was reportedly dismantled for maintenance and no substitute was reportedly installed at the time of accident.

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3.3.7. The substantial damage to the port side of Compartments D and E suggests that water ingress into them was sudden and unstoppable. As the bulkhead between Compartments E and F was not watertight, three out of six compartments in the under deck could have flooded rapidly after the vessel sustained the damage.

3.4. The main deck

3.4.1. The main-deck cabin was encircled by a passageway of 0.9 metres wide along the rub rail, and the passageway was further enclosed by railing (see Photo 17). The cabin had 8 rows and 11 rows of seats respectively situated at the front and the rear. In addition, there were two rows of seats amidships. Each leg of the seats had a rectangular mounting plate, which was found to have been secured on the metal deck with a pair of 2.7-cm bolts (see Photo 18).

3.4.2. There was a staircase in the middle of the main-deck cabin leading to the upper-deck cabin. Another staircase was found at the stern connected the passageway on the main deck leading to the weather deck on the upper deck.

3.4.3. The three doors (exits) of the main-deck cabin all opened to the passageway; viz the two sliding doors situated amidships on either side were 1.1 metres wide and the double doors at the stern were 1.2 metres wide. The main-deck cabin had a total of 27 glass windows, of which 10 were sliding windows and the other were fixed windows. Most of the windows measured 0.9 metres wide by 0.7 metres high. The opening of the sliding windows was measured to be about 0.4 metres wide and 0.7 metres high. A total of 11 windowpanes, which were made up of tempered glass, on either side had shattered after the accident.

3.4.4. The side panel of the main-deck cabin was made up of fiberboards sandwiched with a layer of foam in the middle. The port quarter of the main-deck cabin had sustained severe impact damage, causing collapse of about 5.6-metre side panel and the nearby ceiling frame as well as crushing of the last five rows of seats. The impact damage to the ceiling frame had reached a position near the centerline, where deep blue paint smears, agreeing in colour with the hull of Sea Smooth, were found (see Photo 19). The fallen ceiling frame was heavy and large, measuring about 4.8 metres long and 2 metres wide. Behind the last row of seats on the port side was the central unit of the air-conditioning system, of which the housing was badly deformed and collapsed rearwards (see Photo 20).

3.4.5. The gash on the port side of the hull could be observed on the passageway amidships, which existed as a straight cut of about 50 cm wide and ended by the side panel of the main-deck cabin. The angle of the gash on the passageway was found to be about 30 degrees from the bow (see Photo 17).

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3.4.6. The passageway on either side was covered by porch. On the port side under the ceiling of the porch were U-shaped pipe mounting brackets, which were painted in red (see Photo 21). A horizontal strip of red paint smears was found on the top of the broken side panel. These findings suggest that a red pipe probably mounted below the porch on the port side could have been detached from its mounted and pushed towards the cabin before it was lost. The red paint fragments on the foredeck of Sea Smooth were found to agree in colour with the red paint of the U-shaped pipe mounting brackets.

3.4.7. Fallen ceiling panels, life jackets and the stowage of the life jackets were scattered inside the main-deck cabin.

3.5. The wheelhouse

3.5.1. The wheelhouse, situated at the front of the upper deck, had 3 windows in front and 2 windows on each side, enabling a view of almost 180 degrees to the front. It could only be assessed from the upper-deck cabin via an entrance.

3.6. The upper-deck cabin

3.6.1. The upper-deck cabin had a 0.7 metre-wide door aft, which opened out to the weather deck. There was another 0.7 metre-wide door at the front which opened out to the wheelhouse. The centre of the upper-deck cabin was the staircase to the main-deck cabin. There were a total of 12 windows on both sides, of which 4 were sliding windows and 8 were fixed windows. Most of the windows measured 0.9 metres wide by 0.7 metres high. Only the first sliding window on the starboard side was open and its opening was measured to be about 0.4 metres wide by 0.7 metres high (see Photo 22). A total of four windowpanes, respectively the 2nd and 3rd on the starboard side and the 3rd and 4th on the port side, were shattered.

3.6.2. The upper-deck cabin was almost bare and had only one seat near the entrance to the wheelhouse, which disagreed in the seating arrangement with the deck plan. The only seat, with an appearance agreed with those in the main-deck cabin, had a white plastic seat and back with four metal legs, each having a rectangular mounting plate at the base, which was secured to the deck by a pair of 2.7-cm screws (see Photo 23; bolts were used in the main-deck cabin; see Photo 18). Rectangular imprints (see Photo 24) with a pair of holes agreeing in size and shape with the mounting plates of the legs were found on the deck of the upper-deck cabin, and the arrangement of the imprints was found to agree with the seating arrangement as depicted in the deck plan, having eight rows. Numerous screws, agreeing in dimension and general appearance with those for securing the only seat in the upper-deck cabin, were found at the rear end of the cabin. Further examination of the rectangular imprints revealed most of them each having a pair of holes 6-cm apart, but at least 10 of them having one or two

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additional holes, suggesting that the seats for these positions could have been re-mounted for at least once previously (see Photo 25).

3.6.3. The deck of the upper deck was made up of material similar to that of the side panel of the main-deck cabin, having vinyl tiles over approximate 3-mm thick fibreboard on top of approximate 3-cm thick green foam (see Photo 26). Therefore, the anchorage of 2.7-cm screws for securing the only seat in the upper-deck cabin depended on the strengths of the fibreboard and foam.

3.6.4. Examining the row of 5 connected seats, reportedly salvaged from the scene on 31 October 2012, revealed the two holes of its middle front mounting plate attached with heads of two rivets and their snapped cylindrical shafts (see Photo 27). On the deck, corresponding to the position of the middle front leg of the last third row of seats on the port side was a rectangular metal plate of about 12 cm by 5 cm, which had been screwed to the deck by four pieces of screws. In the middle of the rectangular metal plate were two holes 6-cm apart each engaged with a snapped rivet tail. When the 5-seated bench was placed according to the rectangular imprints on the deck, the two rivet heads matched with the two rivet tails in positions, strongly indicated that the middle front leg of the bench had been affixed to the deck using two rivets. Removing the rectangular metal plate revealed two holes on the deck, which appeared larger than the other screw holes for mounting the seats.

3.6.5. Near the centre of the cabin was a supporting column, of which the mounting holes of the base were empty with its bolts/screws missing (see Photo 28). The column was found to have been displaced from its original position, exposing the corresponding mounting holes on the deck. These mounting holes on the deck had deformed and elongated towards the displaced position of the column, which could have been made when its mounting bolts/screws were pushed aside, and the bolts/screws were loosen from their mounting holes.

3.6.6. Some of the thin false ceiling panels were fallen and missing. Life jackets and its stowage as well as a life buoy were scattered inside the upper-deck cabin.

3.7. The weather deck

3.7.1. Half of the weather deck by the upper-deck cabin was covered with awning. The weather deck had a pair of about 2-metre long benches with backs against each other along the centreline. In addition, a short bench was found along the edge of the weather deck on the starboard side. The benches were also secured to the deck via similar mounting plates and screws for the seats in the upper-deck cabin. Two mounting plates and their screws were found to have been detached from the deck.

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3.7.2. Two dislodged rows of seats, respectively having five connected seats and two seats, were found on the weather deck. The rectangular mounting plates of the legs were found to agree in appearance with those of the seat in the upper-deck cabin. The mounting plates of the seats were found to agree in relative positions with the rectangular imprints on the deck, suggesting that the two rows of seats could have originated from the upper-deck cabin.

3.7.3. A piece of fibreboard fragment roughly triangular in shape, having deep blue, red and white paintwork and measuring about 1.6 by 2.4 metres, was found on the weather deck (see Photo 29). This fragment agreed in shape and dimension with the missing side panel on the port bow of Sea Smooth. Therefore, this fiberboard had originated from Sea Smooth.

3.7.4. The weather deck was paved with blue plastic flooring and the edge of the deck painted in white. The blue and white paint fragments recovered from Sea Smooth were found to agree in colour with the corresponding paints on the weather deck of Lamma IV.

3.8. Lifesaving apparatus

3.8.1. A life raft, which had been launched, was found on the dock by Lamma IV. An empty rack probably for the container of a life raft was found on the starboard side of the weather deck.

3.8.2. There was a detached white rack of about 0.9 metres high lying on the weather deck. The base of the rack was found to match with the voids situated aft of the weather deck, indicating that the white rack was likely detached from there. Making reference to the deck plan of Lamma IV and its appearance, the rack was used to hold life buoys. Only 6 life buoys were found on board.

3.8.3. Beneath some seats of the main-deck cabin were strong orange plastic bags, the life jacket stowage (see Photo 30), measuring about 35 cm high, 25 cm long and 15 cm wide, some of these carrying an orange life jacket, which was contained in a tied white garbage bag (see Photo 31). The life jacket stowage each was attached to the two longitudinal bottom rails of the seat frame by pieces of Velcro, leaving a gap of about 10 cm between the opening of the stowage and the bottom of the seat. The front and the back of each life jacket were made up of 10-cm thick foam and they were folded to a total of 20 cm thick and tied by the waist strap in order to fit the stowage, so they could not be taken out through the gap without unfastening the pieces of Velcro.

3.8.4. Only one type of life jackets was found in Lamma IV, which was the one shown on safety instruction notices for donning a life jacket. A total of three notices of donning instructions (see Photo 32), showing how to don a life jacket, were found inside the

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passenger cabins; two were on the main-deck cabin near the door on the port side and the aft door, and the last one near the aft door on the upper-deck cabin. The donning instructions were printed in both Chinese and English illustrated with photos. No children's life jacket was found on the vessel. At the time of my examination, a total of 98 life jackets were found on the vessel.

3.8.5. At least 6 and 4 exit signs (see Photo 33), denoting the location of the nearest emergency exit, were found in the main-deck cabin and the upper-deck cabin respectively. In addition, imprints, agreeing in size with the exit signs, were noted in the two passenger cabins, which suggests that some exit signs might have been posted on these positions but were detached.

3.9. Navigation lights

3.9.1. Lamma IV had a pair of sidelights installed on the roof of the upper deck; the sidelight on the starboard side was green and that on the port side was red. The mast on the roof was found detached from its anchorage point. The mast had an all-round navigation light[11] and a masthead light[12] (see Photo 34).

3.9.2. The housings of the green and red sidelights were found intact, but traces of water were found inside them. The light bulb of the red light was found broken and that of the green light snapped in the middle.

3.9.3. The housing of the masthead light was wet and its light bulb was found snapped. The housing of the all-round navigation light was found jammed and the light bulb inside could not be examined further.

3.9.4. Another light housing mounted on the transom was the sternlight, which was heavily covered with mud. No further examination was conducted on the sternlight and its housing.

3.10. Simulation of detaching a seat

3.10.1. According to police information, the upper-deck cabin should have seats as shown in the deck plan before the accident, but all the seats, except the one as described in paragraph 3.6.2, were detached from their mounts. To determine the force needed to detach a seat from the deck of the upper-deck cabin, the row of two connected seats on the weather deck was used for the simulation. The two seats were mounted on a single metal frame with four legs each having a mounting plate, so a total of eight screws, which were collected from the upper-deck cabin and examined free of any thread damage, were used to secure the seats to the fiberboard deck of the upper-

[11] "All-round light" means a light visible from 360 degrees of the horizon.

[12] "Masthead light" means a white light on the centreline of the vessel showing from right ahead to 22.5 degrees abaft the beam on either side of the vessel.

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deck cabin. The screws could be easily driven into the fibreboard by an electric screwdriver. The top of the back of the seats measured about 89 cm high and the top of the seat frame was about 38 cm high. One of the backs of the seats was found slightly damaged and cracked.

3.10.2. The row of seats was then pulled horizontally towards the stern by a ratchet tightener which force was monitored by a calibrated balance. The first test was conducted by pulling a piece of webbing tied near the top of the seats, but the test was aborted when the pulling force reached about 110 kilogrammes due to the start of yielding of the originally damaged back of the seats. The second test was then conducted by pulling the top of the seat frame. When the pulling force reached about 190 kilogrammes, the row of seats was detached from its mounts.

3.10.3. Another test was conducted by pulling the only single seat in the upper-deck cabin. Pulled at the metal seat frame, the seat was found to be detached from its mounts at force of about 230 kilogrammes. The mounting holes on the deck of this seat were examined, and they were found to agree in appearance with the other mounting holes found on the deck.

4. Laboratory Examination

4.1. Paint Examination

4.2. During the course of my examination on 3 October 2012, I had collected a number of relevant paint samples from Lamma IV and Sea Smooth each assigned with a unique scene reference tabulated below for laboratory examination:-

Scene Reference	Laboratory Reference[13]	Item
Collected from Sea Smooth		
LM1	GPW 12835	Recovered blue fragments from the foredeck
LM2	GPW 12836	Recovered red fragments from the foredeck
LM3	GPW 12837	Recovered white fragments from the foredeck
LM4	GPW 12838	Control white paint from the foredeck
LM5	GPW 12839	Control deep blue paint from the bow of the port side hull
Collected from Lamma IV		
LM6	GPW 12840	Control blue paint from the weather deck at the port side
LM7	GPW 12841	Control white paint from the weather deck at the port side
LM8	GPW 12842	Control red paint from the U-shaped pipe mounting bracket at the port side beneath the porch
LM9	GPW 12843	Recovered deep blue paint smears from the gash

[13] *Items subsequently submitted to this laboratory for examination each was assigned with a unique Laboratory Reference with a prefix "GPW"*

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4.3. I then handed the above exhibits, which had been sealed and labelled accordingly, to DSPC 20778 of RCU 3 MAR of the Hong Kong Police Force on 3 October 2012.

4.4. On 5 October 2012, DSPC 20778 delivered the aforesaid exhibits to this Laboratory. I had examined these items. The purpose of my examination was to determine whether or not evidence of contact in the form of paint transfer could have been established.

4.5. Results of Paint Examination

4.5.1. The recovered blue, red and white paint fragments (GPW 12835-12837) from Sea Smooth were found to agree in colour and chemical composition in the top layer of the corresponding control paint samples (GPW 12840-12842) taken from Lamma IV, indicating that the respective samples could have originated from the same source.

4.5.2. The recovered deep blue smears (GPW 12843) from Lamma IV were found to agree in colour and chemical composition with the control paint sample (GPW 12839) take from Sea Smooth, indicating that the respective samples could have originated from the same source.

4.6. Bulb Examination

4.7. On 19 October 2012, DSPC 20778 further delivered the following items to this Laboratory:-

Laboratory Reference	Item
GPW 13412	One light bulb from the red light (port) of Lamma IV
GPW 13413	One light bulb from the green light (starboard) of Lamma IV
GPW 13414	One light bulb from the all-round navigation light of Lamma IV
GPW 13415	One light bulb from the masthead light of Lamma IV
GPW 13416	One control light bulb

4.8. I have examined the above items. The purpose of my examination was to determine whether or not the filaments of the bulbs in the above items (GPW 13412-13415) were illuminated at the time of the accident.

4.9. Results of bulb examination

4.9.1. The glass bulbs and the filaments of the red light, the green light and the masthead light (GPW 13412-13413, 13415) were all found broken. Numerous white/black powders were found deposited on the inner side of the glass bulbs and the contact wires. These findings, together with the scene observation that water was found inside their respective housings, indicate that the filaments of the light bulbs could

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have been illuminated when the glass bulbs were cracked probably due to water ingress into the housings of these navigation lights.

4.9.2. No damage to the light bulb (GPW 13414) from the all-round navigation light was found. The filament was intact and the light bulb was found to be functional. I could neither confirm nor disprove whether the filament of the light bulb was illuminated at the time of the accident.

5. Analysis

5.1. The results of forensic paint examination, the agreement in size and shape of the damage to the both vessels, the transfer of fibreboard panel of Sea Smooth's hull to Lamma IV, particularly the bow of the port hull of Sea Smooth, strongly indicate that Sea Smooth's port bow had come into contact with Lamma IV's port quarter.

5.2. The gash on the port side passageway of Lamma IV suggests that the centrelines of the two vessels against each other at the moment of collision were at an angle of approximately 30 degrees. The foredeck of Sea Smooth had breached the side panel of the main-deck cabin of Lamma IV, and went in and reached the centreline of the main-deck cabin, crushing the seats and the central unit of the air-conditioning system on the port quarter and causing collapse of a large piece of ceiling frame. At the same time, the bow of the port hull of Sea Smooth had pierced open the hull of Lamma IV, causing the slanted gash in the engine room at Compartment D. The strong force of collision had torn the fibreboard planking of the port bow of Sea Smooth apart. Then, Sea Smooth remained its forwards momentum and the broken keel, which was hardest part of the hull, further sideswiped the port side hull of Lamma IV so the gash on the hull of Lamma IV changed direction, running along the chine, leaving the set of smooth and continuous scratches on the hull of Lamma IV. When the broken keel of Sea Smooth reached the position of the bulkhead between the engine and tank rooms of Lamma IV, the gash on Lamma IV ended and replaced by deep scratches on the hull surface, probably due to the hull having been reinforced by the bulkhead. Without reinforcement of the bulkhead, the hull of Lamma IV at the tank room yielded again and the broken keel of Sea Smooth ripped it open and left the hole there. At that moment, the foredeck of Sea Smooth had probably reached the air-conditioning unit at the rear of the main-deck cabin of Lamma IV, while the port side of the weather deck of Lamma IV had come into contact with the front panel of the main-deck cabin of Sea Smooth. Therefore, the impact between the main-deck cabins stopped Sea Smooth moving forwards after ripping the hole in the tank room of Lamma IV, probably resulting in the disengagement of the two vessels.

5.3. The gash and the hole were respectively in the engine room and tank room (Compartments D and E) of Lamma IV. The lower half of the gash and the hole were

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below the waterline and they were large, so flooding of the engine room and tank room, including Compartment F, which was separated from the tank room by a non-watertight bulkhead, could have been immediately and unstoppable. Flooding of the three aft compartments out of a total of six would finally cause the bow of Lamma IV to tilt up and the stern immersed in water vertically.

5.4. The rectangular imprints on the deck of the upper-deck cabin of Lamma IV and the presence of detached seats strongly indicate that the seats had been originally affixed to the deck but they were detached from their mounts recently. Recovery of numerous 2.7-cm long screws and the examination of the remaining seat in the upper-deck cabin indicate that the 2.7-cm long screws were used to secure the seats on the fibreboard deck, which was made up of 3-mm fibreboard on top of 3-cm thick foam.

5.5. The findings in paragraphs 3.6.2-3.6.5, particularly more than two screw holes in one mounting position, indicate that the fibreboard deck of the upper-deck of Lamma IV was not strong enough to maintain the shape of the mounting holes to grip the screws tightly. The mounting holes could have been enlarged/deformed over time such that the grip of the screws would be reduced, and the screws would be loosened. Therefore, the loosened screws had to be re-mounted to the fibreboard deck at new positions, resulting in more than a pair of holes in some of the mounting positions of the seats in the upper-deck cabin.

5.6. The force (weight) required to detach seats with four mounting plates, affixed to the fibreboard deck, was found to be less than 230 kilogrammes force when pulling at the bottom frame. If the force was evenly exerted on the seats, *viz*, a person sitting or hanging on it while the vessel was vertical, the force needed to detach the seat might be reduced by half to less than 115 kilogrammes. Therefore, had two adults of normal built been grabbing the back of the seats hanging themselves up or sitting on it when Lamma IV sank vertically, this could have provided sufficient force to detach the seats from their mounts. The force would be further reduced if the mounting holes of the seats were enlarged/deformed over time.

5.7. When the bow of Lamma IV started titling up, the fallen false ceiling panels, the detached seats and victims not having grabbing some fixtures would roll to the rear end of the upper-deck cabin, probably blocking the door to the weather deck, which was the only exit as indicated by the exit signs. At that juncture, the only available exit should be the opening of the sliding windows on either side, of which only the first one on the starboard side was open.

5.8. The seats in the main-deck cabin of Lamma IV were secured to the metal deck by 2.7-cm long bolts, and they remained in their places after the tragedy, indicating that the metal deck was strong enough to hold the bolts as well as the seats.

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5.9. The bulbs of the two sidelights and the masthead light of Lamma IV all could have been on before their glass bulbs were cracked, probably due to rapid cooling of the hot glass bulbs by water ingress.

5.10. No stowage of life jackets was found on the weather deck of Lamma IV. Passengers on the weather deck had to return to either cabin to get life jackets or use the life buoys on the weather deck.

5.11. After the collision, the port hull of Sea Smooth had totally lost its first watertight compartment below the foredeck, causing flooding of the second compartment as well. Therefore, the non-watertight manholes in the main-deck cabin to these two compartments were exposed, and were about 1.5 metres above the water. Therefore, water splashing onto them, probably by either the movement of the vessel or waves, could have leaked into the main-deck cabin.

5.12. The watertight bulkhead of the third compartment (Compartment 3) of the port hull of Sea Smooth could have successfully prevented substantial water ingress from the damaged compartments. The bilge water in Compartments 3 and 4 of the port hull was minimal, and should not threaten to sink the vessel.

5.13. After the collision, crew of Sea Smooth could access and check the damage to the under deck, the compartments, via the manholes in the main-deck cabin, using either cross wrench, respectively kept near the stern and a storage space under the stairs in the middle of the main-deck deck. It would take a crew member about 5 minutes to check all the first ten compartments for any damage or leakage.

5.14. The draft measurements showed that after Sea Smooth lost the first two watertight compartments of the port hull, its buoyancy was only slightly affected and the vessel was slanted about 2.4 degrees to the port hull whether it was loaded with 104 persons or not. In addition, the draft of Sea Smooth almost did not change after the weight of 104 persons was loaded onto the empty Sea Smooth.

6. Conclusion

6.1. The bow of the port hull of Sea Smooth had hit the port quarter of Lamma IV at an angle of approximately 30 degrees, ripping a gash of 0.3 metres wide by 4.4 metres long in the engine room of Lamma IV. After collision, the bow of the port hull of Sea Smooth had wedged in the gash on Lamma IV. When Sea Smooth continued to slide along the port hull of Lamma IV aft, the fibreboard planking of the bow of Sea Smooth that was wedged in the gash was torn apart from the hull, leaving behind in the gash, and the broken keel of the port hull of Sea Smooth pierced a hole of about 0.5 metres in the tank

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room of Lamma IV before the two vessels totally disengaged from each other. As a result of the collision, Sea Smooth had lost the first compartment of the port hull.

6.2. During the collision, the foredeck of Sea Smooth had breached the side panel of the main-deck cabin of Lamma IV on the port side and jammed into the cabin, crushing the seats on the port quarter and causing collapse of the false ceiling frame. At that juncture, the side panel on the port bow of Sea Smooth was torn and detached.

6.3. As the tank room and the last compartment of Lamma IV were separated by a non-watertight bulkhead, the bottom part of the gash and the hole on Lamma IV below the waterline caused rapid flooding of its three aft compartments. When the stern of Lamma IV lost its buoyancy, its stern started sinking with its bow tilting up nearly vertically.

6.4. In the upper-deck cabin of Lamma IV, rows of seats were originally secured to the fiberboard deck by screws. However, when the bow of Lamma IV was tilting up, it would have taken the weight of only two or three adult passengers, who might have been sitting on, standing on and/or holding the row of seats to get balance, to cause the seats to be broken off from its mounts on the fibreboard deck as the fibreboard was not strong enough to grip the mounting screws and yielded under such pulling force. The upper-deck cabin had only an exit at the rear. Passengers losing balance and the detached seats rolling to the rear end of the upper-deck cabin when Lamma IV sank vertically could have blocked the only exit, rendering escape from the cabin difficult.

6.5. The sidelights and masthead light of Lamma IV were highly likely to have been lit before their housing was flooded and the glass bulbs were cracked by sea water.

6.6. The damage to Sea Smooth was mainly confined to the port hull at the first two watertight compartments, which had been flooded. However, the watertight bulkheads of the intact compartments had prevented further flooding of the port hull. To assess the damage to the compartments of the vessel, crew members of Sea Smooth could have done so through the ten manholes in the main-deck cabin.

6.7. After Sea Smooth lost its first two compartments of the port hull, the vessel was tilting slightly downwards to the port side and the front, probably by about 2.4 and 0.5 degrees respectively.

*****End of Statement*****

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GOVERNMENT LABORATORY

Photo Album

The collision between Sea Smooth and Lamma IV on 1 October 2012

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Source Reference : MAR RN 12000195

Prepared by Dr CHENG Yuk-ki

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Photo 1: The port view of Sea Smooth

Photo 2: The front view of Sea Smooth showed the scratches with white smears on its port hull and middle hull.

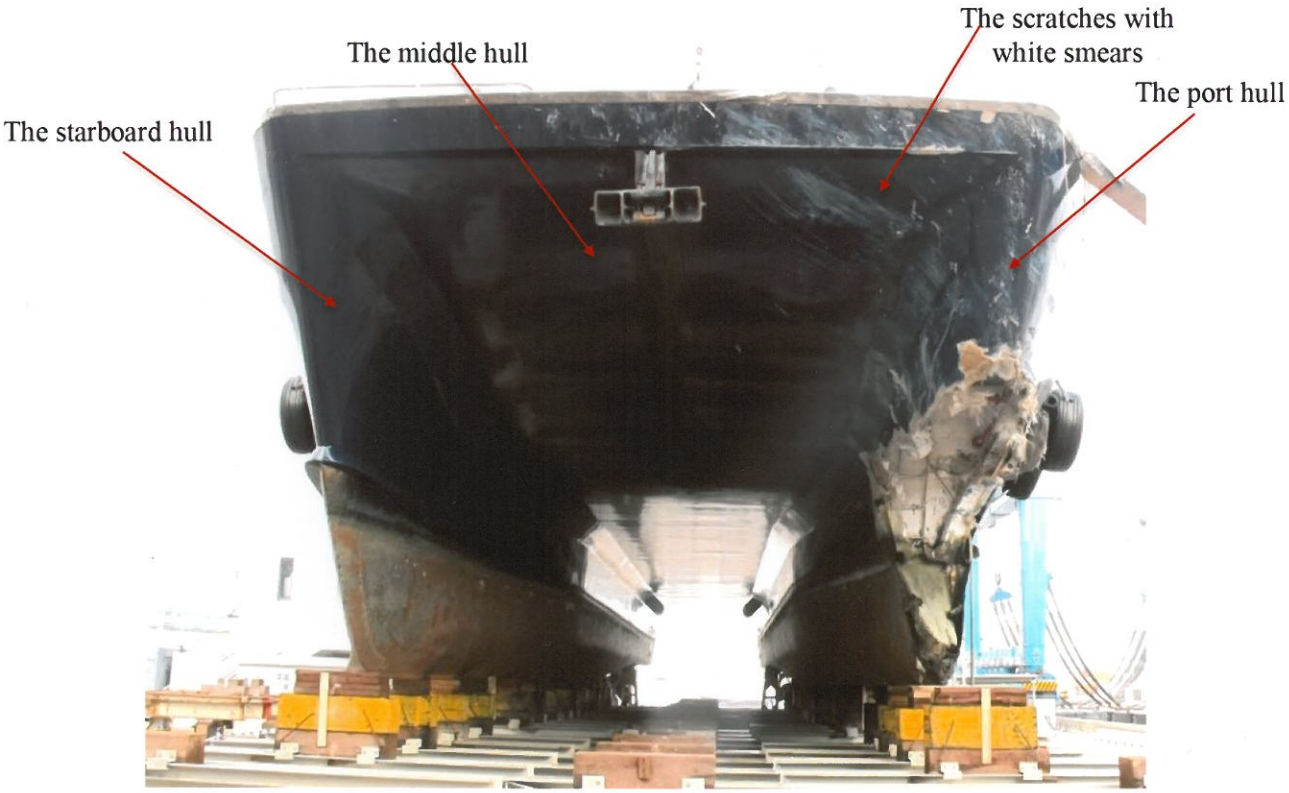

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Photo 3: The L-shaped metal plating on the bow the starboard hull

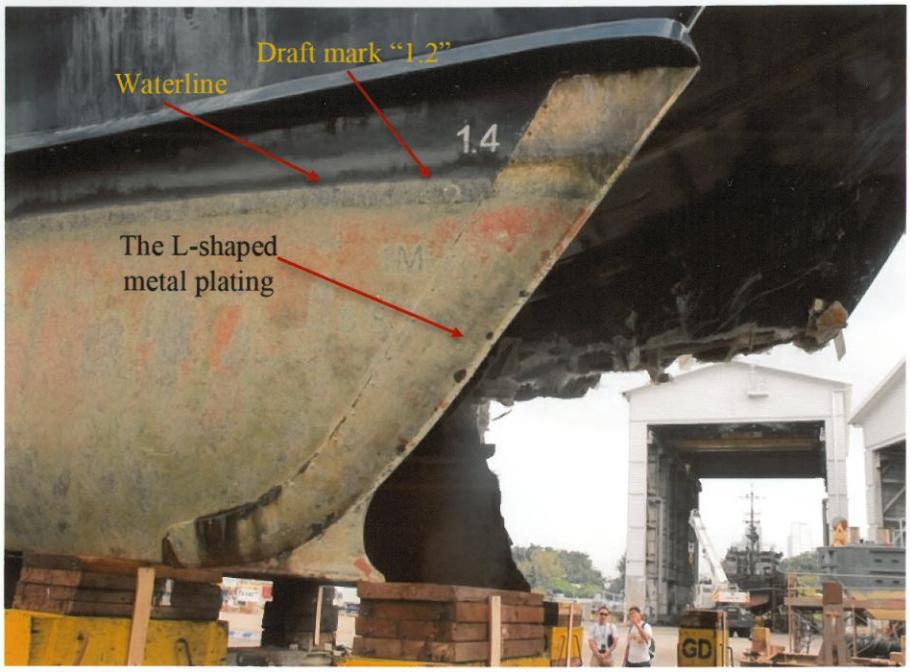

Photo 4: The structural members reinforced the fibreboard planking near the breach of the port hull of Sea Smooth. This area was a void belonging to Compartment 1 of the port hull in the under deck.

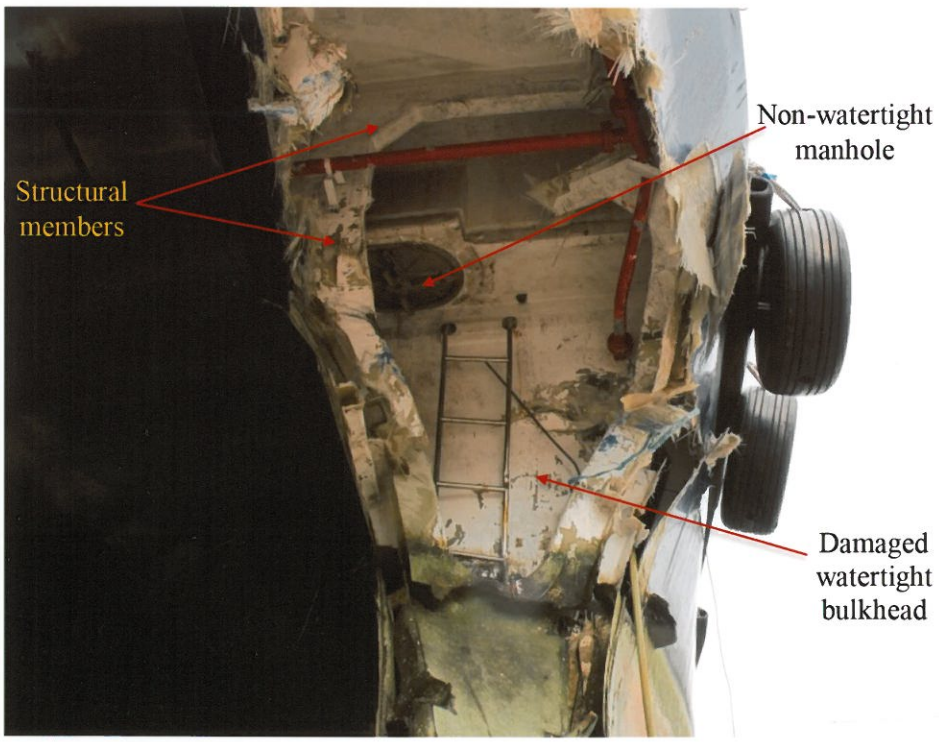

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Photo 5: This showed the foredeck of Sea Smooth on the port bow. The side panel at the port bow was missing and the handrail was dislodged.

Photo 6: The blue smears (red circled) on the outer front panel of the main-deck cabin of Sea Smooth at the port side.

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Photo 7: The manholes in the main-deck cabin of Sea Smooth access to Compartments 4 and 5 of the port hull.

Photo 8: The cross wrench (red circled) at the stern of Sea Smooth for opening the manholes in the main-deck cabin for access to the compartments in the under deck.

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Photo 9: The damage to Compartment 1 of the port hull of Sea Smooth

Photo 10: The general view of Lamma IV

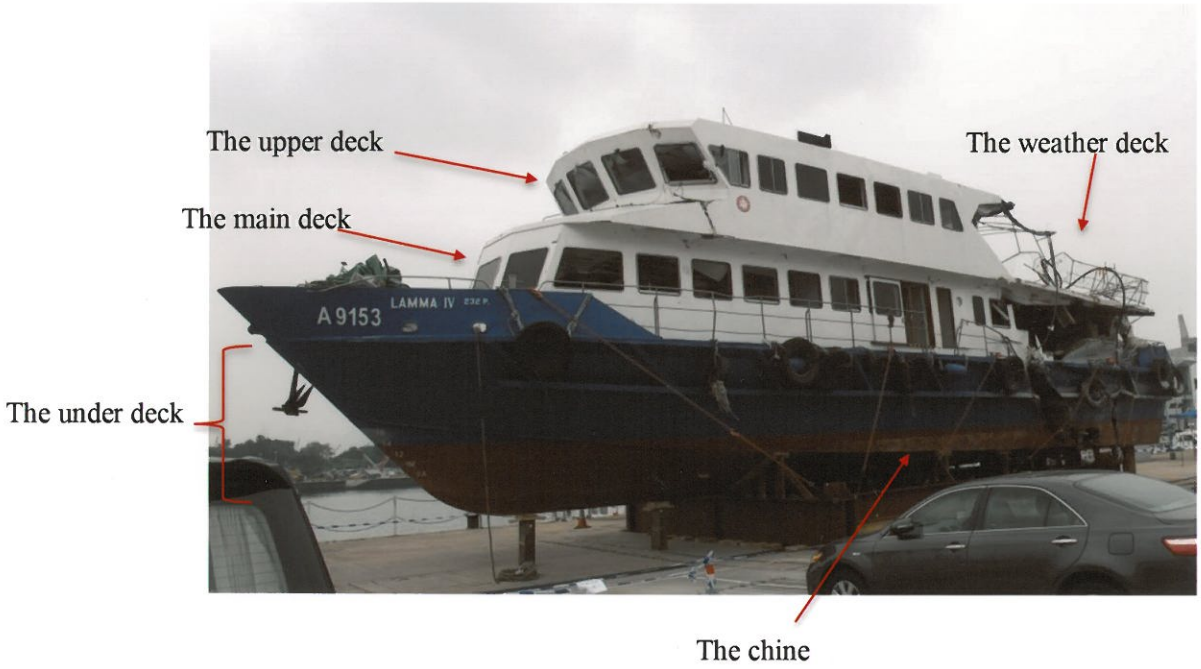

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Photo 11: The gash and the jagged hole on the port side of the hull of Lamma IV

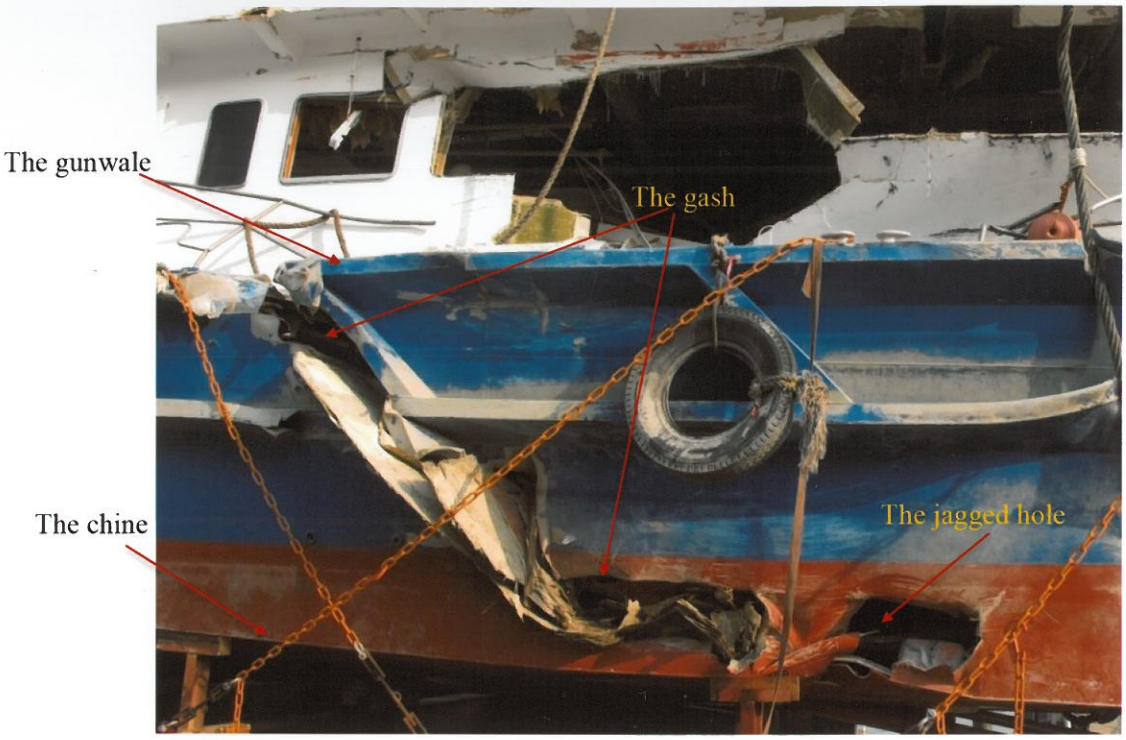

Photo 12: The horizontal scratches with deep blue smears (red circled) on the port side of the hull of Lamma IV

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Photo 13: The imprint, marked by dotted line, on the fibreboard fragment belonging to the bow of the port hull of Sea Smooth

Photo 14: The fibreboard fragment wedged in the gash of the engine room of Lamma IV

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Photo 15: The non-watertight bulkhead between Compartments E and F with an opening

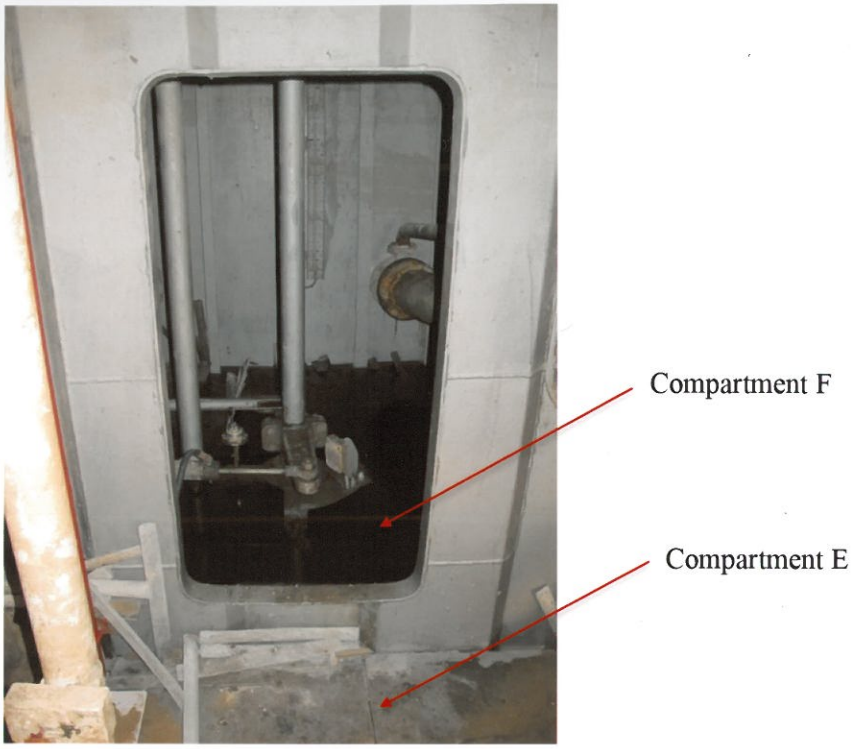

Photo 16: The jagged hole (red circled) in the tank room (Compartment E) of Lamma IV

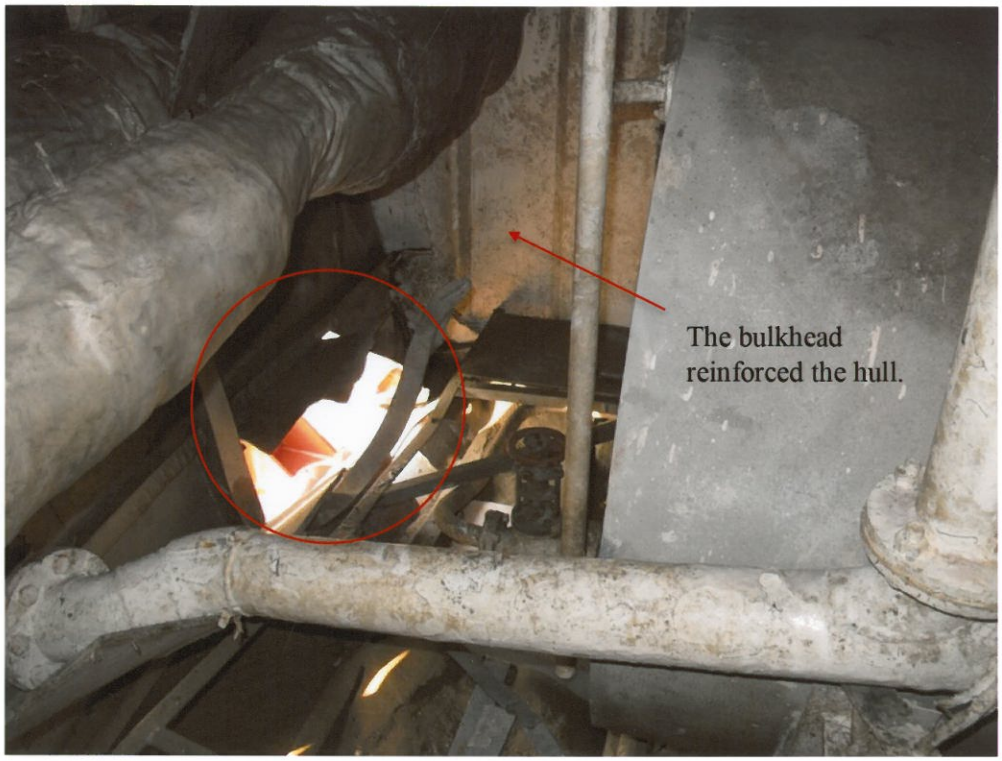

Photo 17: The passageway along the rub rail of Lamma IV on the port side.

Photo 18: The rectangular mounting plate at the base of each leg of the seat in the main-deck cabin of Lamma IV. A pair of bolts was used to secure it to the metal deck.

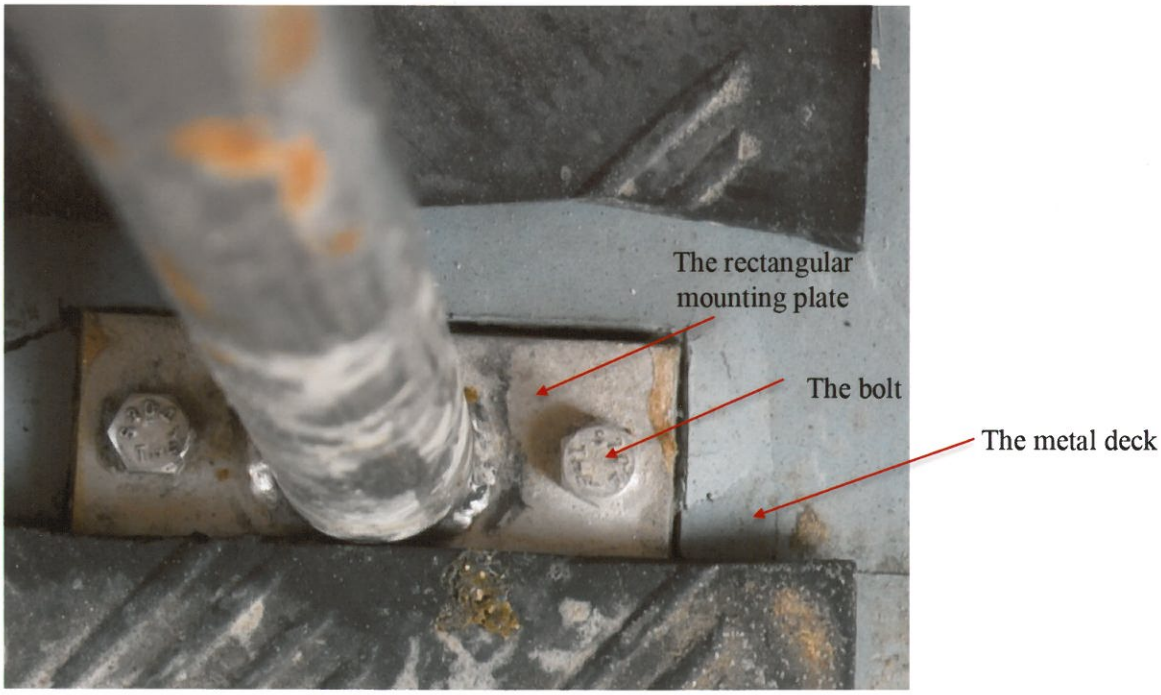

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Photo 19: The deep blue paint smears found at the ceiling frame above the rear doors of the main-deck cabin of Lamma IV near the centreline

Photo 20: The crushed central unit of the air-conditioning system (red circled) and the collapsed seats at the port quarter of the main-deck cabin of Lamma IV

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Photo 21: The U-shaped pipe mounting bracket (red circled) under the porch of the passageway

Photo 22: The only opened sliding window on the starboard side (red arrow). The upper-deck cabin was bare, and only one seat remained.

Photo 23: The rectangular mounting plate at the base of the leg of seat in the upper-deck cabin of Lamma IV and the screw for affixing the seat.

Photo 24: The rectangular imprint on the deck of the upper-deck cabin of Lamma IV

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Photo 25: The mounting place had more than a pair of mounting holes.

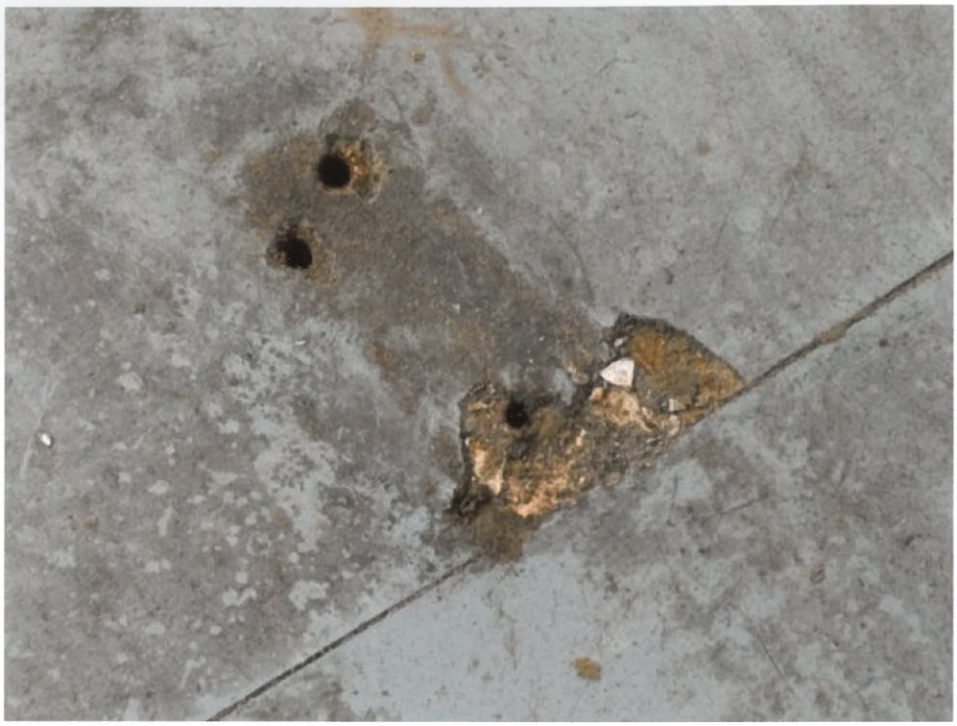

Photo 26: The construction of the fibreboard deck in the upper-deck cabin of Lamma IV

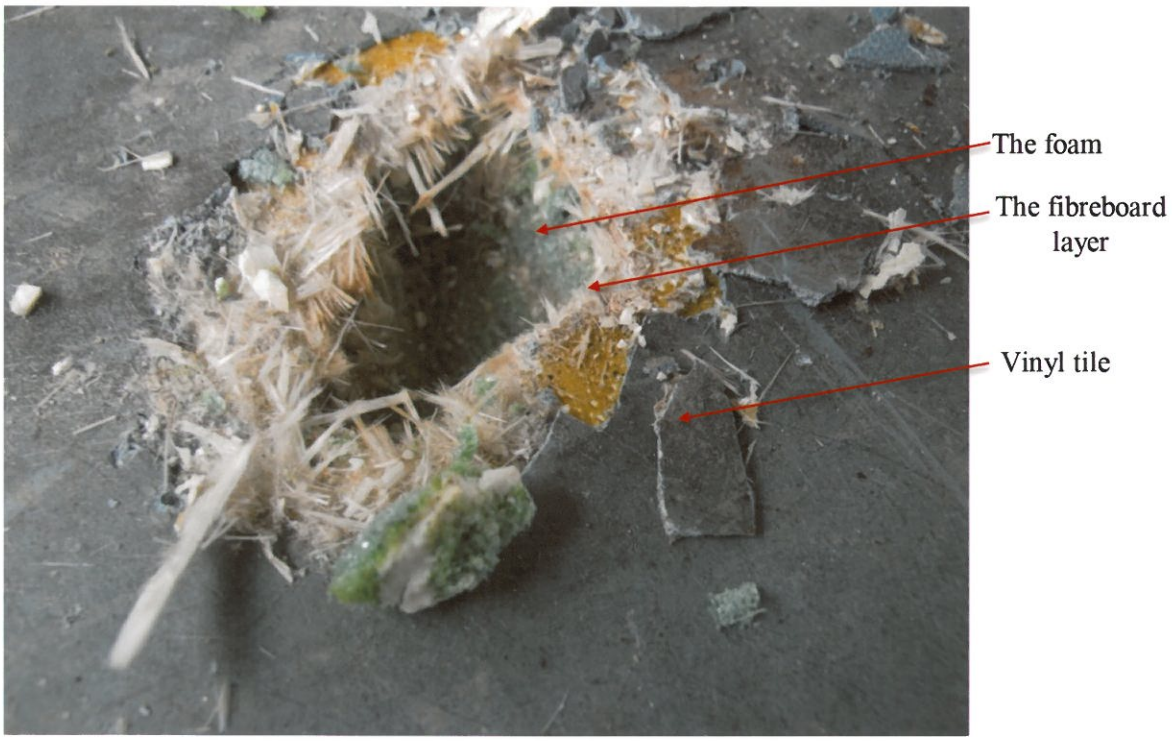

Photo 27: The mounting plate of the leg attached with heads of two rivets and the rectangular metal plate attached with rivets tail

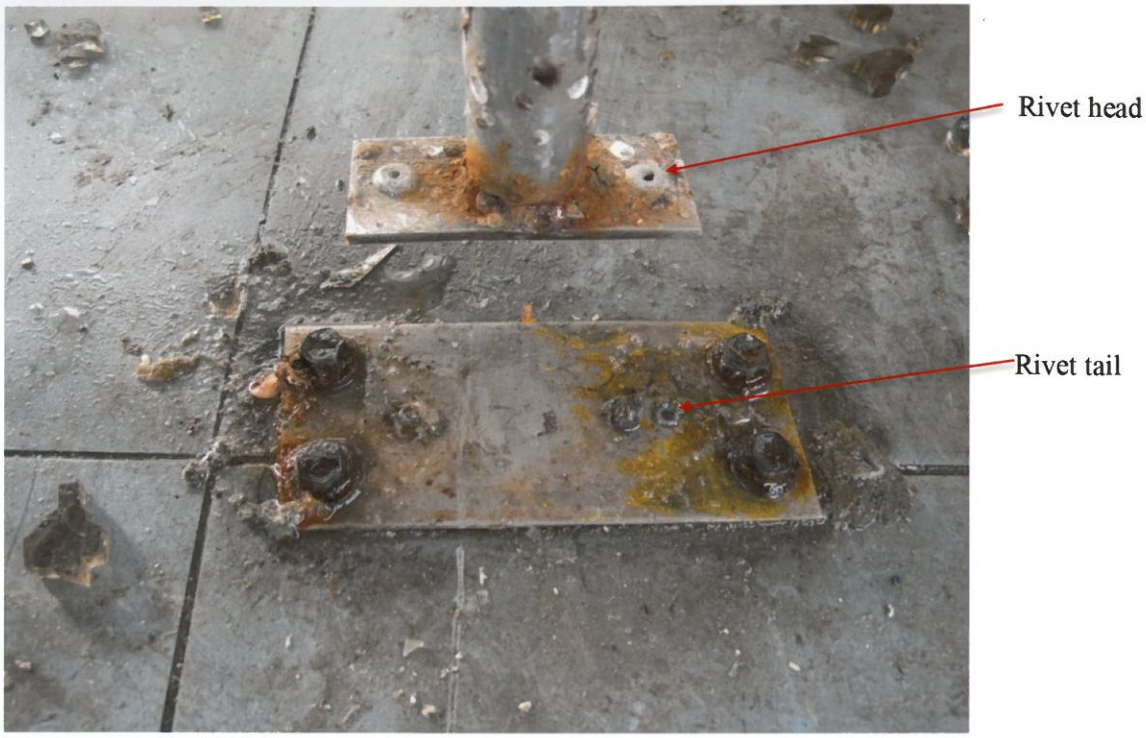

Photo 28: The mounting holes of a support column in the upper-deck cabin of Lamma IV

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Photo 29: The piece of fibreboard fragment (red circled) on weather deck of Lamma IV

Photo 30: The life jacket stowage beneath the seats in the main-deck cabin of Lamma IV

Photo 31: The white garbage carried the life jacket.

Photo 32: The donning instruction sheet in the cabin of Lamma IV

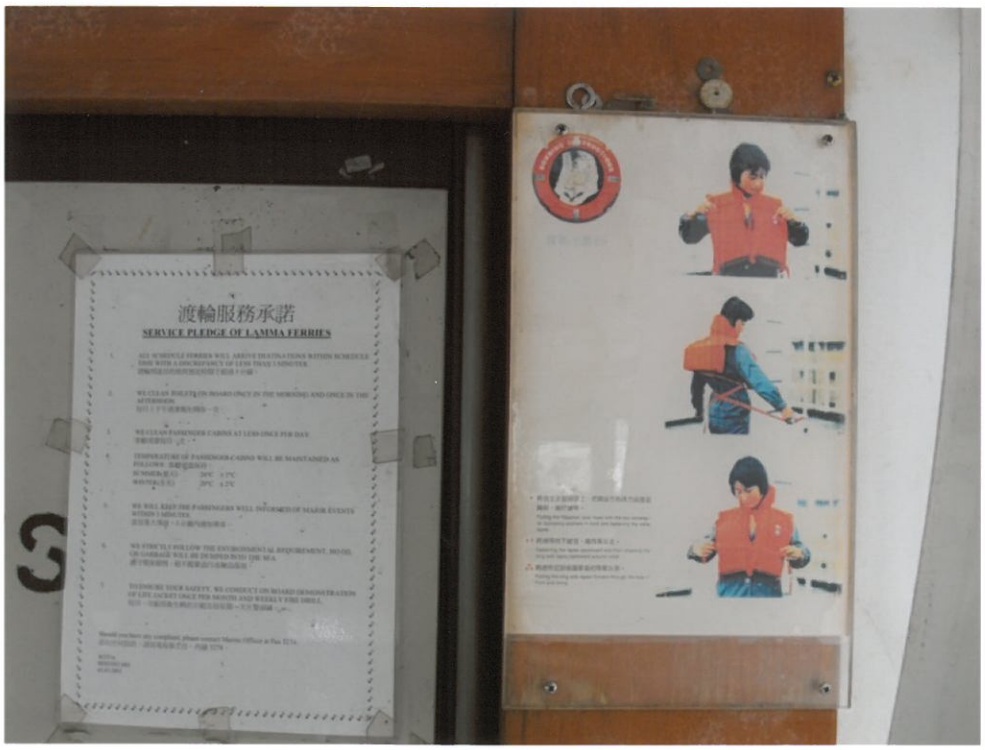

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Photo 33: The exit signs (red circled) in the upper-deck cabin of Lamma IV. An imprint agreed in size with an exit sign (green circled).

Photo 34: The all-round navigation light (red arrow) and the masthead light (green arrow) on the mast

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