

Extract from The United Kingdom Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 – Regulation 5:

“The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of such an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame.”

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

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Millennium Diamond

Contact with Tower Bridge

River Thames

4 June 2014

SUMMARY

At 1153 (UTC¹+1) on 4 June 2014 the passenger vessel *Millennium Diamond* (**Figure 1**) made contact with Tower Bridge, London while on passage from Greenwich to Tower Pier with 126 passengers and 6 crew on board. Ten passengers and crew were injured and the vessel's hull was damaged. *Millennium Diamond* was out of service for 3 days for repairs, Tower Bridge was undamaged.

¹UTC = Universal Co-ordinated Time.

Image courtesy of Ships and Boats in London



Figure 1: Millennium Diamond

The mate was at the helm as the vessel approached Tower Bridge when a VHF² radio broadcast by London VTS³ informed river users that Tower Pier had been temporarily closed for a ceremonial gun salute⁴ at the Tower of London. This was an hour earlier than had been promulgated by the Port of London Authority (PLA) and so the mate decided to use the replay facility on the vessel's VHF to confirm the content of the broadcast. He became distracted by the task and did not notice that *Millennium Diamond* had veered towards the bridge's south pier until it was too late to avoid contact with the structure.

Immediately before *Millennium Diamond* struck the bridge, the vessel's master attempted to warn the passengers and crew of the impending impact. However, the public address system had been set to broadcast an automated tour guide narrative which prevented the master's broadcast from being heard.

City Cruises plc has been recommended to: review the ergonomics of the vessel's wheelhouse to minimise the risk of distraction and; to expedite planned measures designed to address a number of safety issues identified in this report.

Following an internal investigation, the Port of London Authority has taken a number of actions which has included a review of its procedures for informing river users about the schedule for ceremonial gun salutes.

The Maritime and Coastguard Agency has been recommended to take action designed to ensure applicants for Boatmaster's Licences can demonstrate inter alia, awareness about the risks posed by distraction.

FACTUAL INFORMATION

Vessel and environment

Millennium Diamond was operating a scheduled tourist sightseeing service between Greenwich and river piers in central London. The vessel was a Class V passenger vessel certified for operations in category C⁵ waters with a maximum of 599 passengers and 6 crew.

At the time of the accident the weather was cloudy with rain showers and the wind was westerly force 3⁶. The tidal stream was ebbing between 2 and 3 knots⁷, and low water at Tower Bridge was predicted to occur at 1234.

Narrative

The master, mate and four catering crew boarded *Millennium Diamond* at the owner's base in Bermondsey, London at 0800 on 4 June 2014. The crew undertook pre-departure checks and briefings in accordance with the owner's safety management system as they prepared the vessel for service on the River Thames.

² VHF = Very High frequency (radio).

³ VTS.= Vessel Traffic Services

⁴ Gun salutes are fired from the Tower of London to mark major State occasions.

⁵ Category C: Tidal rivers and estuaries and large, deep lakes and lochs where the significant wave height could not be expected to exceed 1.2 metres at any time.

⁶ Beaufort Force 3: Gentle breeze, mean speed 5ms⁻¹

⁷ Knots = a measure of speed in nautical miles per hour

At 0915, the vessel proceeded to Westminster Pier where passengers were embarked for passage to Greenwich, via Waterloo and Tower Piers.

Millennium Diamond arrived at Greenwich at 1055, 126 passengers were embarked for the passage upstream to Tower Pier and the vessel left at 1125. A pre-recorded commentary, known as the *riverguide*, was available to passengers through multilingual headsets, which explained points of interest the vessel passed along the route.

At 1152:52 the vessel was approaching Tower Bridge at a speed of 8.2knots (**Figure 2**). The mate was at the helm and London VTS made a VHF broadcast informing vessels that Tower Pier had been temporarily closed as a gun salute was due to be fired at the Tower of London at 1200. The PLA had previously issued a local notice to mariners, which stated that the gun salute would take place at 1300.

The VTS broadcast lasted 14 seconds. Immediately it had finished, the mate used the replay facility on the vessel's VHF radio to verify the time Tower Pier would be closed. As he reached across to activate the VHF replay switch, he also moved the steering joystick to port (**Figure 3**), intending to move the vessel towards the south side of the river, away from Tower Pier. The vessel was about 50m from the south pier of the bridge at this time.

The mate listened to the replay and did not notice that the vessel had veered to port and was heading towards the south pier of Tower Bridge. When he looked up, he realised that the vessel was about to make contact with the bridge, and put the starboard engine astern and the helm to starboard.

At 1153:21 the master, who had been on the port bridge wing, ran into the wheelhouse and used the public address (PA) microphone in an attempt to instruct the passengers to sit down and brace themselves. However, the PA system was still set to the *riverguide* mode and the master's message was not broadcast.

The vessel made contact with the south pier of Tower Bridge at 1153:28.

As a result of the contact, one elderly female passenger received lacerations from a fall down an external stairwell and five others received minor injuries. The four catering crew all received minor injuries when storage equipment moved and stock fell from shelving in the café area.

Emergency response

Following the accident the mate manoeuvred the vessel clear of the bridge and the master went to the main cabin area where the catering staff were assisting the injured passengers.

The mate reported the accident to London VTS and requested medical assistance for the injured passengers. At 1200 the vessel went alongside Saint Katherine's Pier where RNLI⁸, police, PLA and ambulance personnel boarded to assist the passengers and investigate the accident. The mate was breathalysed, and no alcohol was detected.

The injured elderly female passenger was taken to hospital where she received treatment for the lacerations and was discharged after two days. Nine other passengers and crew were given first-aid and, although some also attended hospital, none were detained.

Millennium Diamond was inspected while alongside at Saint Katherine's Pier by a surveyor from the Maritime and Coastguard Agency (MCA) who authorised its passage back to the owner's base, where a hull survey was carried out. The port bow shell plating was found to have been holed above the waterline and the vessel was taken out of service for 3 days while repairs were effected.

⁸ RNLI = Royal National Lifeboat Association

Image courtesy of Port of London Authority

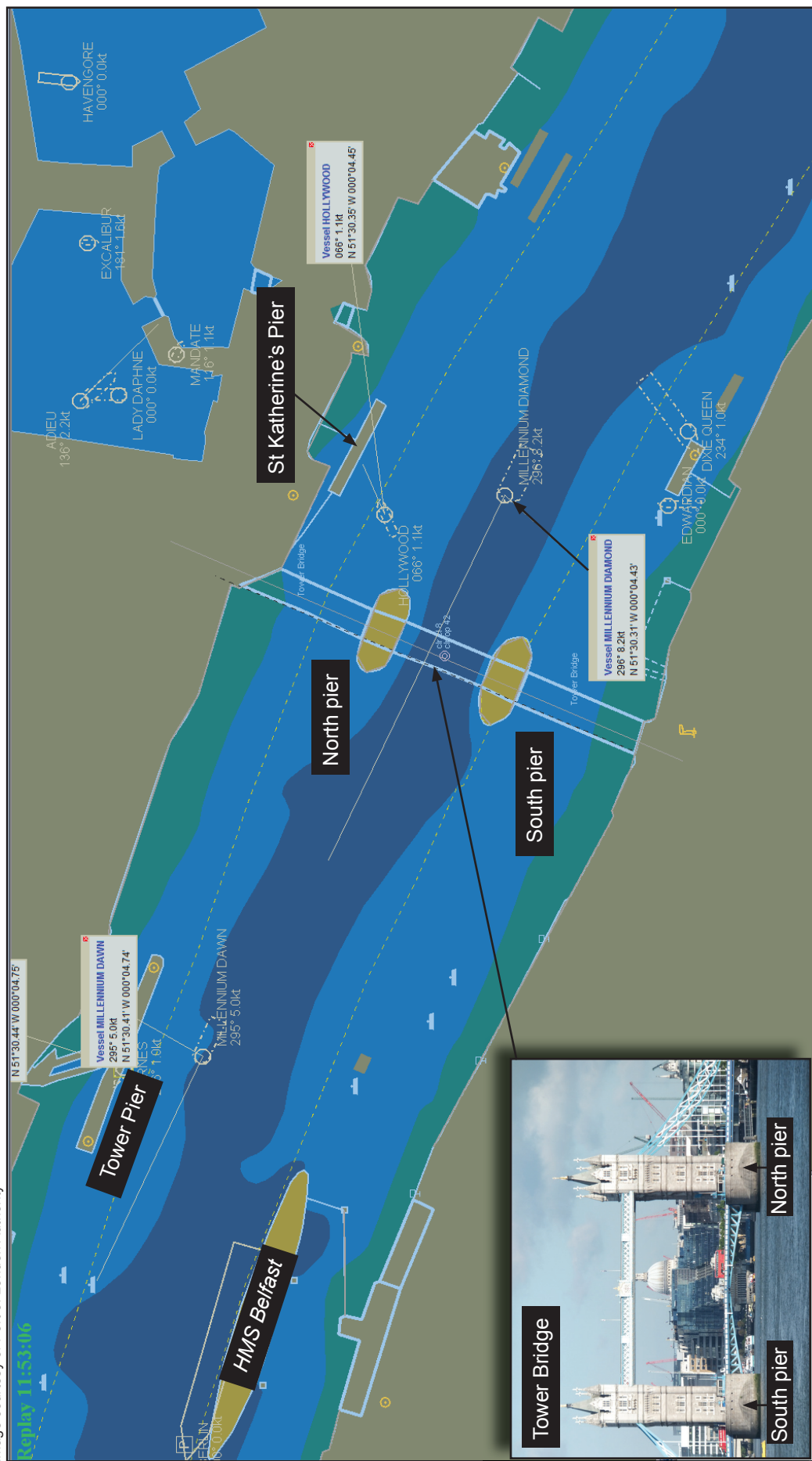


Figure 2: *Millennium Diamond* approaching Tower Bridge at 1152:22 (Automatic Identification System image)



Figure 3: Wheelhouse equipment – looking forward

Crew

The mate held a Boatmaster's Tier 1 level 2⁹ licence, with a local knowledge endorsement for the *London – Thames Waterman* area, which he had obtained in 2010. He had 10 years' experience on the River Thames and held a large passenger vessel endorsement for the area. He had worked for City Cruises for 7 years.

The master also held a Tier 1 level 2 Boatmaster's licence, he had 34 years' experience on the river and had worked for City Cruises for 22 years.

Both men had worked on the vessel since it entered service in 2012.

The men were working the second day of a 3 days on 2 days off duty roster and had finished work the previous day at 1930.

Steering trials

The steering on *Millennium Diamond* was operated through a joystick that provided non follow-up control, i.e. when the joystick was held over to port or starboard, the rudders moved until the joystick was released or the rudders reached their limit of travel. When the joystick was released it returned to its central position but the rudders remained in position and did not return to midships.

The PLA subsequently conducted trials on the vessel to ascertain its rate of turn at a range of helm applications, both with and against the tidal stream. The vessel's speed was set at a consistent 8 knots over the ground for the trials.

Trial number	Tidal Conditions: With or against tide	Helm applied	Time (duration applied)	Change of heading	Average rate of turn
1	With tide	10°	15s	8°	32°/min
2	With tide	15°	10s	20°	120°/min
3	Against	10°	15s	12°	48°/min
4	Against	15°	10s	23°	138°/min
5	Against	20°	10s	27°	162°/min

Table 1 – Results of *Millennium Diamond* steering trials

Gun salutes

The gun salute that took place at 1200 from the wharf at the Tower of London was one of a series of commemorative firings undertaken on State occasions.

The gun salute on 4 June 2014 was held to mark the State opening of Parliament. It was conducted by the Honourable Artillery Company (HAC), who had notified the PLA by email on 2 May 2014 that the firing would take place at 1300.

On 7 May 2014 the PLA issued Local Notice to Mariners M31 of 2014 (**Figure 4**) that informed river users of the dates and timings of gun salutes that would require the temporary closure of Tower Pier. This notice stated that the gun salute on 4 June would take place at 1300, in accordance with the information provided by the HAC.

⁹ Boatmaster's Tier 1 Level 2 licence is required for the masters of passenger ships (carrying more than 12 passengers), when they are operating on inland waterways or in limited coastal areas.

Port of London - River Thames

PORT OF LONDON

AUTHORITY

NOTICE TO MARINERS
M31 of 2014

UPPER POOL

GUN SALUTES AT
THE TOWER OF LONDON
2014 ADVANCE NOTIFICATION

Notice to Mariners M2 of 2014 is hereby cancelled.

On the dates listed below Gun Salutes of varying lengths will be fired from the Tower of London.

During the firing an exclusion zone will be established in front of the gun positions. The exclusion zone will extend to 25 metres either side of the guns and 55 metres in front of the guns.

As a result Tower Pier Lower Pontoon will be cleared of all personnel and boats. No vessel may approach closer than 15 metres to the pier when passing.

A Harbour Service Launch will patrol the vicinity of the pier to control navigation as required during the salute.

All times are approximate:


Wednesday 21 st May	12:00	FGS Niedersachsen
Monday 2 nd June	13:00	HM The Queen's Coronation
Wednesday 4 th June	13:00	State Opening of Parliament
Tuesday 10 th June	13:00	HRH Duke of Edinburgh's Birthday
Saturday 14 th June	13:00	HM The Queen's Official Birthday
Friday 14 th November	13:00	HRH Prince of Wales' Birthday
TBC - November	TBC	TBC

In addition, there may be other salutes at short notice.

These, and any changes to this notice, will be promulgated by London VTS at the time.

7 May 2014

Port of London Authority
London River House, Royal Pier Road,
Gravesend, Kent DA12 2BG



EXPIRY DATE: 30th November 2014

TO RECEIVE FUTURE NOTICES TO MARINERS BY E-MAIL,

PLEASE REGISTER VIA OUR WEBSITE www.pla.co.uk

Telephone calls, VHF radio traffic, CCTV and radar traffic images may be recorded in the VTS Centres at Gravesend and Woolwich.




Figure 4: PLA Notice to Mariners (M31 of 2014)

candidates to demonstrate a knowledge of the speed with which unsafe conditions can develop. There was also no requirement for candidates to understand the importance of ensuring that unnecessary distractions are avoided.

Previous accident

On 5 October 2011 the Thames passenger vessel *Moon Clipper* experienced a steering malfunction and made contact with Tower Pier, resulting in damage to the vessel and minor injuries to 14 passengers and 2 crew. The MAIB investigated the accident and published a report of its findings.¹⁰

The report found that *Moon Clipper* had been about 80m from Tower Pier and closing at between 10 to 12 knots when it veered to port, giving the master less than 15 seconds to react. The master, who had been distracted by paperwork, attempted to set the starboard engine driving astern, but the engine stalled and contact occurred.

Following the accident the vessel's owners took action to prevent recurrence by reducing the potential for distractions on the bridge.

On 27 May 2014 the HAC informed the chief warden at the Tower of London that the gun salute on 4 June would take place at 1200 and not 1300 as originally advised, the PLA was not advised of this alteration.

Safety Management System

Millennium Diamond was operated in accordance with the requirements of the Merchant Shipping (Domestic Passenger Ships) (Safety Management Code) Regulations 2001. These regulations required owners to develop and implement safe practices for the operation of their vessels. At the time of the accident the vessel's operation met the requirements of these regulations.

Tier 1 Boatmaster's Licence syllabus, River Thames

The syllabus for the Tier 1 boatmaster's licence included a generic knowledge section, a safety section, specialist endorsements for the specific type of vessel and a local knowledge endorsement for the area of operation.

The Bridge watchkeeping section of the generic syllabus requirements for the Boatmasters' Licence did not require

¹⁰ http://www.maib.gov.uk/cms_resources.cfm?file=/MoonClipper.pdf

ANALYSIS

Wheelhouse ergonomics

VHF radio

Millennium Diamond was about 50m from Tower Bridge when the mate replayed the VHF message regarding the closure of Tower Pier, which was the vessel's destination. When he pressed the VHF replay switch he also applied port helm as his intention was to manoeuvre the vessel to the south side of the river to await the re-opening of Tower Pier. The vessel turned quickly to port; analysis based on the steering trials conducted by the PLA suggests that the mate applied about 20° of helm during the replay of the VHF message.

The action of reaching to press the VHF replay switch, which was at arm's reach on his right hand side, and then concentrating on the content of the message he needed to check, was sufficient distraction to ensure that the mate did not monitor the rudder angle indicators or notice that *Millennium Diamond* had turned towards the south pier of Tower Bridge.

The location of the VHF radio did not enable the mate to operate the set while maintaining a lookout ahead and monitoring the rudder angle indicators at the same time (**Figure 5**).

Public address system

The master attempted to use the PA to warn passengers to brace themselves just before *Millennium Diamond* struck the pier. Unfortunately, with the PA system set to the *riverguide* mode the microphone was not active and the master's warning was not heard.

The master was very familiar with the vessel but, with contact imminent, he forgot that the selector switch on the port side had to be changed to enable the microphone, located on the starboard side, to become active.

This arrangement was ergonomically poor, as the selector switch could not be reached by a person standing at the microphone and the activation of the microphone did not automatically take priority over all other PA transmissions.

Speed of encounter

The amount of helm applied combined with the effect of the ebb tide pushing on *Millennium Diamond's* starboard bow altered the vessel's heading by 35° in 12 seconds. At a speed of 8.2 knots the vessel would have covered the 50m to the pier in about 12 seconds; 2 seconds less than the duration of the VHF message that was distracting the mate at that time.

Analysis of the *Moon Clipper* accident identified that the master had about 15 seconds to react before the vessel made contact with Tower Pier and concluded that the master probably lost situational awareness while attempting to prevent the accident.

Both this and the *Moon Clipper* accidents occurred when experienced boatmen allowed themselves to be distracted for a matter of seconds. They had not appreciated the risks resulting from the speed with which their vessels could encounter shore infrastructure. The boatmasters' licence examination did not test a candidates understanding of the risks arising from distraction and the speed at which unsafe conditions can develop between vessels and shore infrastructure in inland waters and harbours.

Passage plans

Tower Pier is closed temporarily (for up to 30 minutes) on at least 6 occasions annually to enable the firing of ceremonial gun salutes.



Figure 5: Operation of VHF radio replay switch while also moving steering joystick

The mate put the helm to port as an instinctive reaction to the VHF broadcast that Tower Pier was closed, based on his local knowledge. His intention was to take the vessel under Tower Bridge to a suitable holding position on the south side of the river, east of the historic warship HMS Belfast, to await the reopening of the pier.

Despite the density of vessel traffic in the area and the proximity to Tower Bridge and HMS Belfast, the company's generic passage plans did not contain details of potential holding areas for its vessels in the event that river piers became temporarily unavailable.

Gun salutes

On 2 May 2014, the HAC advised the PLA that the gun salute on 4 June would take place at 1300 and the PLA issued a local notice to mariners based on that information. On 27 May the HAC revised this timing to 1200 and informed the chief warder at the Tower of London. However, the PLA were not informed of the change.

The effect of pier closures on passenger vessels on the Thames is potentially significant but, with appropriate notice, vessels' passage plans can be revised in good time to maintain safety of navigation. In this case there was insufficient notice of the closure and so the PLA was not able to provide adequate warning to river users.

Injuries

The catering crew members received minor injuries when they were struck by cans of drink that fell from unsecured storage shelves that shifted when the contact occurred. Sudden vessel movement can occur without warning at any time. Although the vessel does not operate at sea, the interaction with other vessels underway in the tidal waters of the Thames can result in unexpected movements.

As such, it would have been appropriate to ensure that all loose equipment was stowed securely to prevent its uncontrolled movement in the event of vessel motion.

CONCLUSIONS

- The mate became distracted while replaying a VHF message about the closure of Tower Pier.
- The layout of wheelhouse equipment resulted in the mate not maintaining a proper lookout while replaying the VHF message.
- No Public Address announcement was made as activating the microphone did not automatically take priority over pre-recorded broadcasts.
- The vessel's proximity to Tower Bridge and the speed of encounter was such that there was insufficient time in which to prevent the contact once the vessel had veered off course.
- There was no agreed holding area for the vessel to use when Tower Pier was temporarily closed.
- The syllabus for the Boatmasters' licence examination did not test a candidate's understanding of the risks arising from distraction and the proximity of hazards and the speed of encounter of vessels in the confined waters of the river.
- The Honourable Artillery Company did not inform the PLA that the time of the gun salute had been changed.
- Unsecured storage equipment and drinks cans caused injuries to crew members when they became dislodged as a result of the contact.

ACTION TAKEN

City Cruises plc has conducted an investigation into the accident and intends to:

- Ensure the Public Address microphone is able to override all other transmissions.
- Ensure bar equipment is appropriately secured on all its vessels.
- Consider the relocation of the wheelhouse VHF set.
- Investigate the relocation of the rudder angle indicators to a more central position.
- Include in its vessels' generic passage plans the provision of suitable holding areas in the event of unexpected pier closures.

The **Port of London Authority** has conducted an investigation into the accident and has:

- Reviewed the Tower of London gun salute process in conjunction with the Honourable Artillery Company to ensure the accuracy of published information relating to future firings.
- Developed a VTS instruction for non-emergency closures of piers to ensure river users receive adequate notification.
- Reviewed its risk assessment for vessels making contact with bridges on the river Thames.

RECOMMENDATIONS

2015/114 **City Cruises plc** is recommended to:

- Complete the intended actions listed in its investigation report in a timely manner.
- Undertake a thorough review of the wheelhouse equipment layout on *Millennium Diamond* to ensure its use does not create distraction and prevent its officers from conning the vessel safely.

2015/115 The **Port of London Authority** is recommended to:

- Promote the inclusion of potential holding areas in the port passage plans of commercial vessels operating in the Thames that may be used in the event of temporary pier closures.

2015/116 The **Maritime and Coastguard Agency** is recommended to:

- Include in the Boatmasters' Licence generic syllabus a requirement for candidates to demonstrate an awareness of the risks of distraction and the speed with which unsafe conditions can develop on inland waterways and in harbours.

SHIP PARTICULARS

Vessel's name	<i>Millennium Diamond</i>
Flag	United Kingdom
Classification society	Bureau Veritas
Official number	918501
Type	Passenger ferry, Class V
Registered owner	City Cruises plc
Manager(s)	City Cruises plc
Year of build	2011
Construction	Steel catamaran, Croatia
Length overall	37.00m
Registered length	35.18m
Gross tonnage	458
Minimum safe manning	4
Maximum number of passengers	599

VOYAGE PARTICULARS

Port of departure	Greenwich pier, London
Port of arrival	Tower pier, London
Type of voyage	Domestic passenger service
Cargo information	126 passengers, No cargo
Manning	6

MARINE CASUALTY INFORMATION

Date and time	4 June 2014, 1153
Type of marine casualty or incident	Less Serious Marine Casualty
Location of incident	Tower Bridge, River Thames, London
Place on board	Navigating bridge
Injuries/fatalities	6 passengers suffered minor injuries
Damage/environmental impact	Port hull stem damaged and holed above the waterline/ no environmental impact
Ship operation	Inland waters passenger service
Voyage segment	Arrival
External & internal environment	Daylight, good visibility, wind West force 3, sheltered waters, ebb tide, tidal stream 2 knots
Persons on board	132 (126 passengers, 6 crew)