

Report on the investigation of the  
collision between the rigid inflatable boat

***Morfil***

and the passenger vessel

***Sun Clipper***

by Blackfriars Road Bridge, River Thames

on 1 June 2011



**Extract from**  
**The United Kingdom Merchant Shipping**  
**(Accident Reporting and Investigation)**  
**Regulations 2005 – Regulation 5:**

*“The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of 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 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, 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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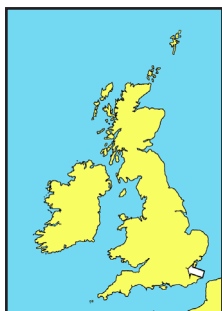
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## GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AIS	-	Automatic Identification System
BWSW	-	British Water Ski and Wakeboard
CCTV	-	Closed circuit television system
COLREGS	-	The Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations 1996
DETR	-	Department of the Environment, Transport and the Regions
DfT	-	Department for Transport
EPIRB	-	Emergency Position-Indicating Radio Beacon
gt	-	gross tonnes
HSC	-	High speed craft
kW	-	kilowatt
m	-	metre
MCA	-	Maritime and Coastguard Agency
MOU	-	Memorandum of Understanding
MPU	-	Marine Policing Unit
NTM	-	Notice to Mariners
PLA	-	Port of London Authority
RATS	-	Railways and Transport Safety Act 2003
RCD	-	Recreational Craft Directive
RIB	-	Rigid-hulled inflatable boat
River Thames	-	As used in this report, means the section of the river over which the PLA has jurisdiction, namely from the Thames Estuary to Teddington Lock
RNLI	-	Royal National Lifeboat Institution
RYA	-	Royal Yachting Association
SBDA	-	Ski Boat Driver Award
SOLAS	-	International Convention for the Safety of Life at Sea 1974, as amended
STCW	-	International Convention on Standards of Training, Certification and Watchkeeping incorporating the 1995 Amendments
t	-	tonnes
Thames VTS	-	Thames Vessel Traffic Services
VHF	-	Very high frequency

**Times:** All times used in this report are UTC+1

## SYNOPSIS



At 2321 on 1 June 2011, the privately owned rigid-hulled inflatable boat *Morfil* collided with the passenger ferry *Sun Clipper* by Blackfriars Road Bridge on the River Thames, London. The vessels were travelling in opposite directions. On impact, *Morfil*'s two crew were pitched into the water but were quickly rescued by the local inshore lifeboat; both were shocked but uninjured. *Morfil* eventually grounded under the road bridge and was a constructive total loss. Damage to *Sun Clipper* was only superficial and there was no pollution.

The investigation identified several factors contributing to this accident, including:

- *Morfil*'s coxswain was under the influence of alcohol and did not take action to avoid *Sun Clipper* until between 1 and 2 seconds before the collision.
- The action taken by *Sun Clipper*'s master to avoid the collision was limited by the proximity of the road bridge and mooring buoys.
- Refurbishment works under the Blackfriars Road Bridge resulted in both vessels using the same bridge arch and their skippers not being able to see each other until about 10 seconds before the collision.
- *Morfil*'s speed was significantly greater than the 12 knot limit recommended by the Port of London Authority.
- *Morfil*'s coxswain had limited knowledge and experience of navigating on the River Thames and was unaware of, or ignored, the local regulations and advice.

There have been at least 45 fatalities resulting from accidents to pleasure vessels over the last 6 years in which alcohol has been a contributory factor. It was extremely fortunate that a further two fatalities did not result from this collision.

The introduction of an alcohol limit for persons in charge of pleasure vessels was first recommended in *The Hayes Report* almost 20 years ago. Although the provision for such a limit was made in the Railways and Transport Safety Act, 2003, the pertinent subsections of the Act have yet to be commenced. The use of byelaws by harbour authorities to deter alcohol consumption on pleasure vessels is largely ineffective.

A recommendation has been made to the Department for Transport aimed at expediting the enactment of a national alcohol limit to persons in charge of pleasure vessels. A recommendation has also been made to the Port of London Authority designed to further enhance the safety of all water users on the River Thames.

## SECTION 1 - FACTUAL INFORMATION

### 1.1 PARTICULARS OF *MORFIL* AND *SUN CLIPPER* AND ACCIDENT

#### SHIP PARTICULARS

Vessel's Name	<i>Morfil</i>	<i>Sun Clipper</i>
Flag	Not applicable	UK
Classification society	Not applicable	Not applicable
IMO number	Not applicable	9232292
Type	Zodiac Medline II Rigid-hulled Inflatable Boat	Category A, passenger craft high speed catamaran
Registered owner	Private ownership	Thames Clippers
Manager(s)	Not applicable	Thames Clippers
Construction	GRP	Aluminium
Length overall	6.0m	30.03m
Registered length	Not applicable	Not applicable
Gross Tonnage	Not applicable	98gt
Minimum safe manning	Not applicable	3
Authorised cargo	Not applicable	138 passengers

#### VOYAGE PARTICULARS

Port of departure	St Katherine's Pier, River Thames	Blackfriars Pier, River Thames
Port of arrival	Cadogan Pier, River Thames (intended)	Bankside Pier, River Thames
Type of voyage	Pleasure trip	Commuter service
Cargo information	Not applicable	35 persons
Manning	2	3

#### MARINE CASUALTY INFORMATION

Date and time	1 June 2011, 2321
Type of marine casualty or incident	Less Serious Marine Casualty
Location of incident	By Blackfriars Road Bridge, River Thames, London



Vessel's Name	<i>Morfil</i>	<i>Sun Clipper</i>
Injuries/fatalities	2 persons overboard	None
Damage/environmental impact	Constructive Total Loss	Superficial damage to fendering
Ship operation	On passage	On passage
Voyage segment	Transit	Transit
Persons on board	2	38
External & internal environment	It was dark. The visibility was good and the river was calm. The flood tide was running at a rate of approximately 3 knots. The water temperature was 11°C. Sunset was at 2107; evening civil twilight was at 2153	



*Sun Clipper*



*Morfil*

## 1.2 NARRATIVE

### 1.2.1 Events preceding the accident

On the evening of 1 June 2011, the co-owners of the rigid inflatable boat (RIB) *Morfil* met unexpectedly during a performance at a London theatre, and agreed to take their boat out for a short trip on the River Thames after the show.

The two men met later at the RIB's permanent berth at Cadogan Pier (**Figure 1**). The co-owner, who normally acted as the RIB's coxswain (herein referred to as 'the coxswain'), remembered that he had removed the lifejackets from the RIB during the previous week, but the two men decided to continue their impromptu trip without them.

At approximately 2230, the coxswain manoeuvred *Morfil* away from her berth and commenced passage downriver towards the Houses of Parliament. He navigated *Morfil* by eye and remained as close as possible to the south riverbank. Both men enjoyed the scenery and the sensation of being out on the river, and decided to extend their trip to St Katherine's Pier (**Figure 1**).

*Morfil* arrived at St Katherine's Pier at approximately 2244 and, as soon as the RIB was securely moored, the owners went ashore and visited a public house in St Katherine's Dock. They returned to the pier at about 2312.

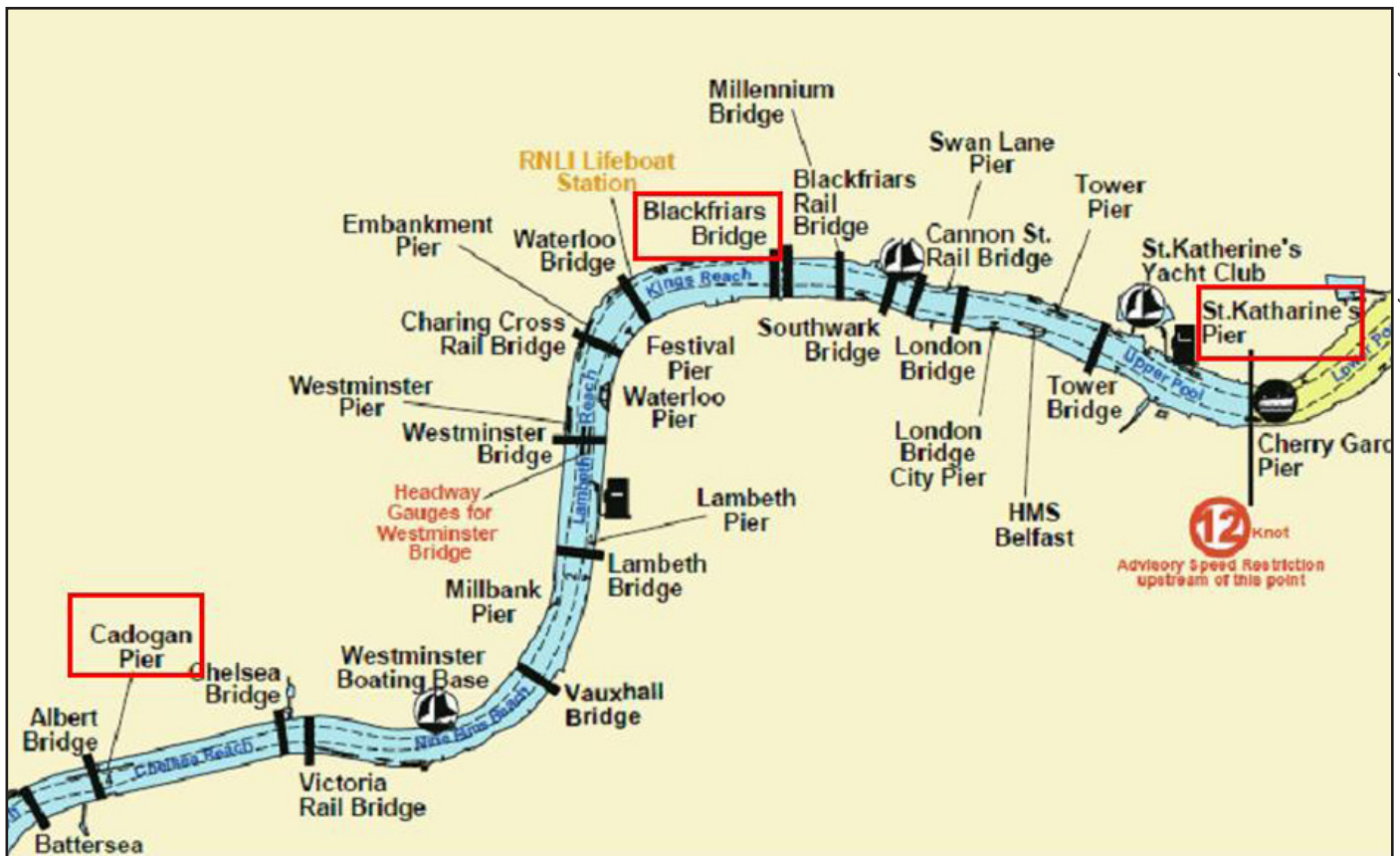


Figure 1: The River Thames

## 1.2.2 The collision

Shortly after 2312 the coxswain started the engine and switched on the navigation lights. He then cleared the lines and, at about 2316, he manoeuvred the RIB clear of the pier and headed upriver. The coxswain stood behind the steering wheel with the co-owner standing to his left (**Figure 2**). It was a dark but clear night, and the river was calm. The tidal stream was flooding at a rate of approximately 3 knots.

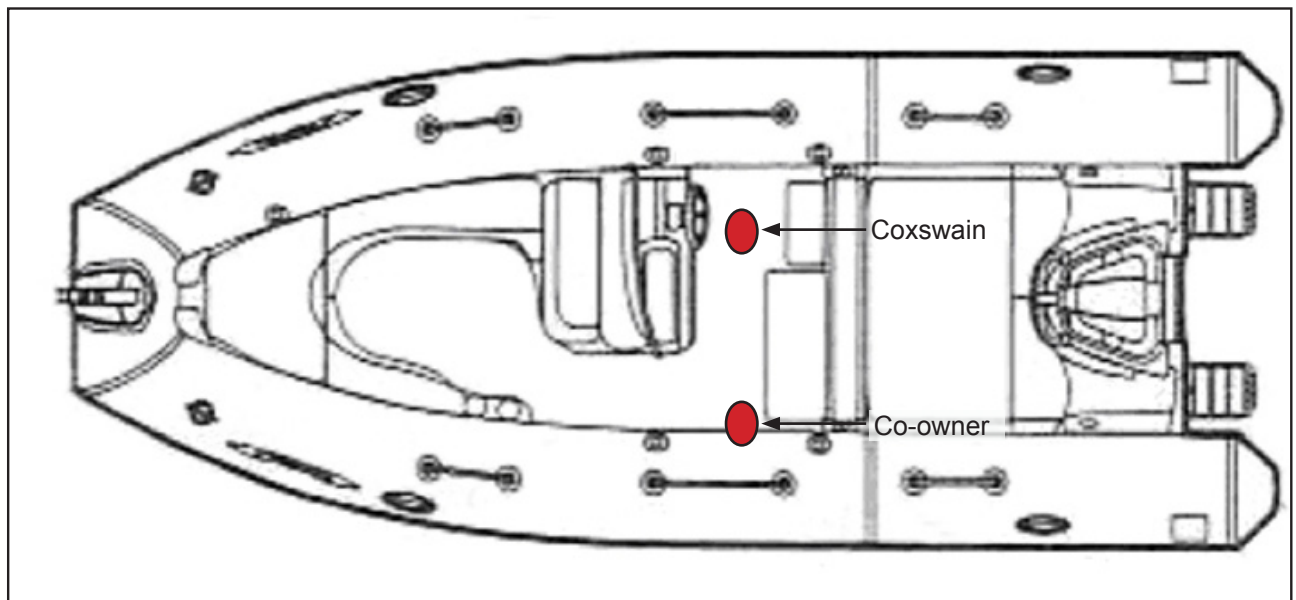
The coxswain increased the engine throttle to about three quarters of full power so that the RIB was travelling on the plane<sup>1</sup> at a speed that he found comfortable to handle. The coxswain kept the RIB close to the bank on his starboard side but did not monitor the boat's progress upriver. *Morfil* passed under several bridges, but the RIB's owners were oblivious to the bridges' names and locations.

At 2319, the high speed craft (HSC) passenger ferry, *Sun Clipper*, departed Blackfriars Pier (**Figure 3**) as scheduled. On board were her three crew and 35 passengers. She was heading downstream towards Tower Bridge on her final service of the day. Her next scheduled stop was at Bankside Pier (**Figure 3**).

*Sun Clipper's* master checked the Thames Automatic Identification System (AIS) display<sup>2</sup> to see if any larger vessels were to the east of the Blackfriars bridges and travelling upstream. No vessels were detected in a position to cause concern, so the master manoeuvred *Sun Clipper* towards No.3 arch of the Blackfriars Road Bridge (**Figure 4**). The mate then joined the master on the bridge.

<sup>1</sup> On the plane may be defined as the vessel moving at speed so that its hull is skimming over the water's surface.

<sup>2</sup> From 1 June 2007 all passenger and commercial vessels on the River Thames, with a length overall greater than 40 metres or over 50gt, were required to carry Thames AIS, which is operated by the Port of London Authority.



**Figure 2:** Plan of *Morfil* showing position of occupants



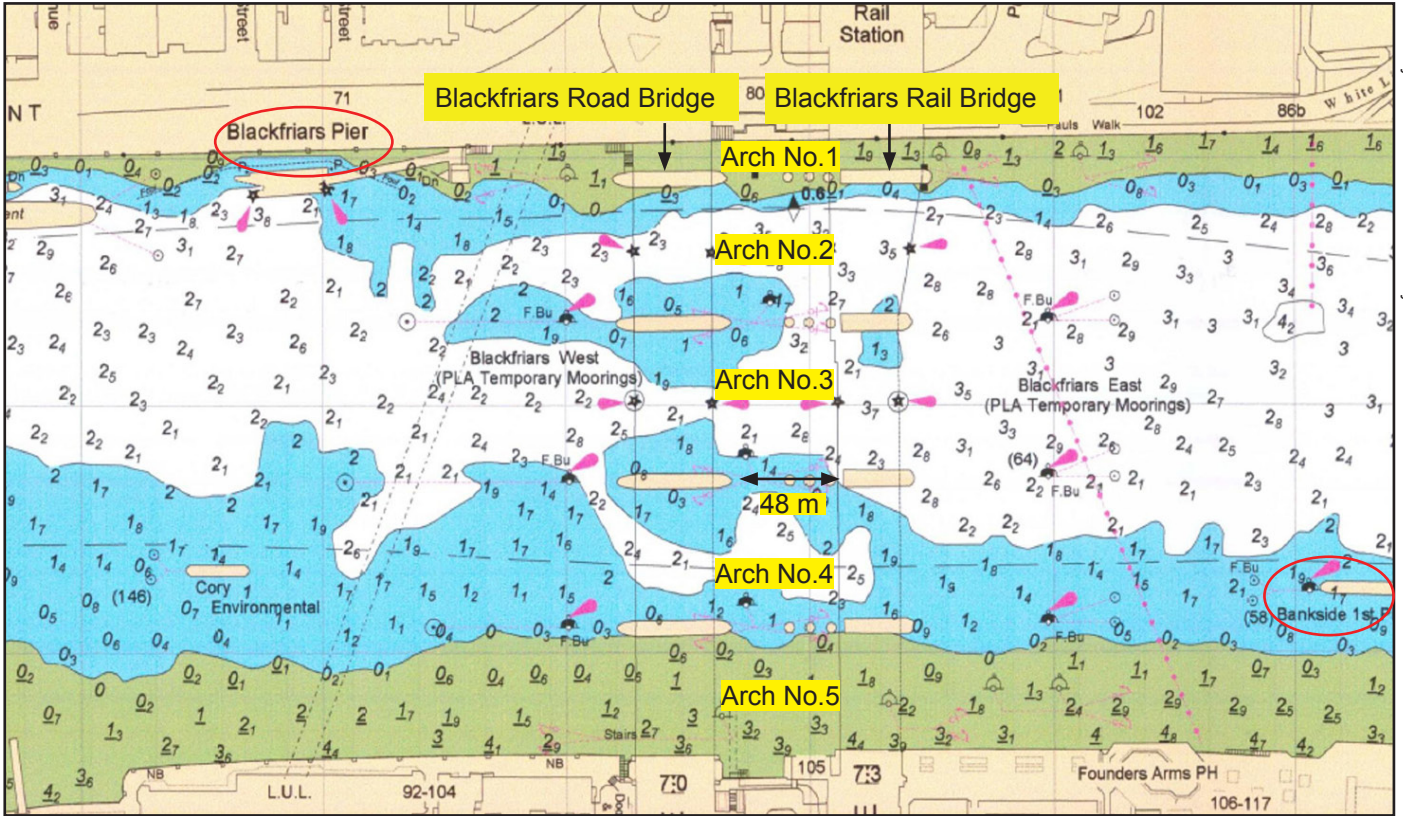


Figure 3: Extract of PLA chart 317

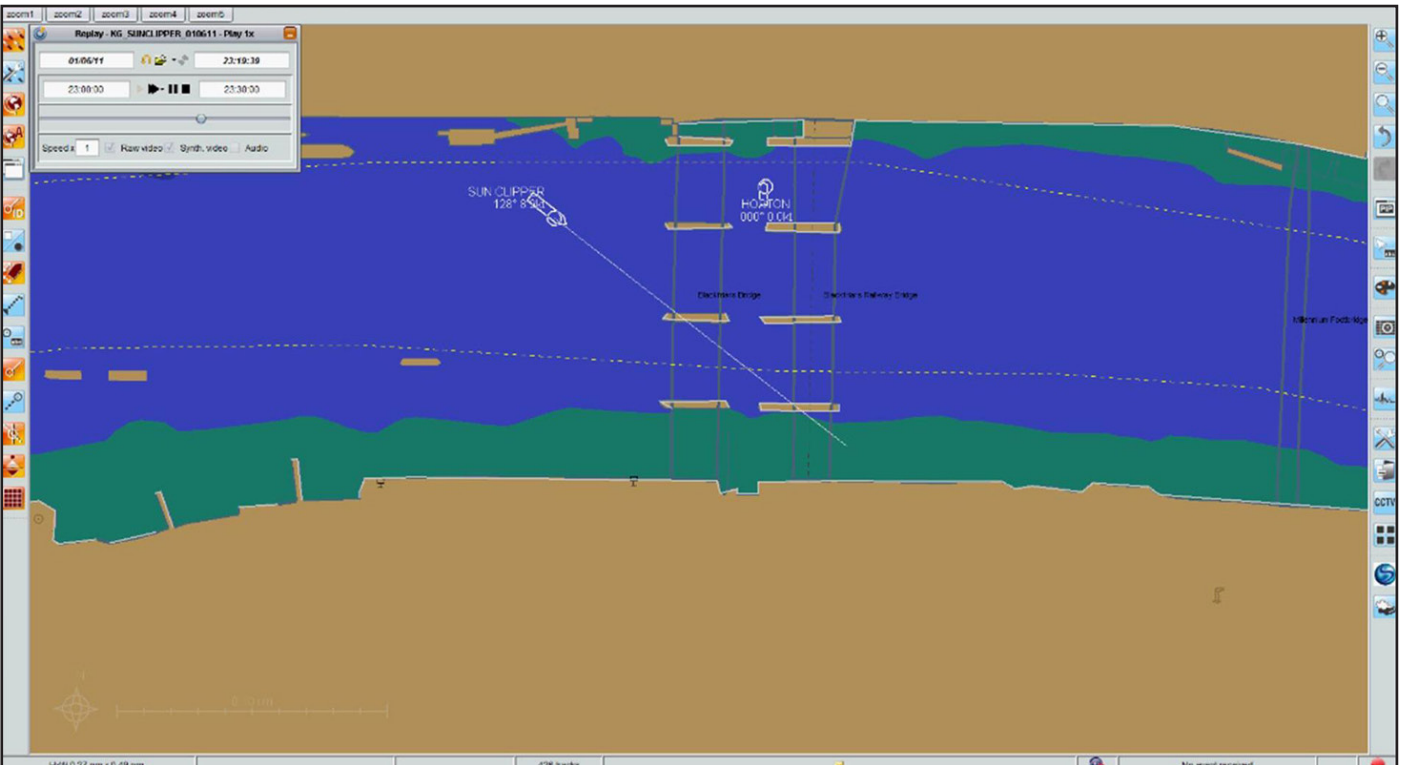
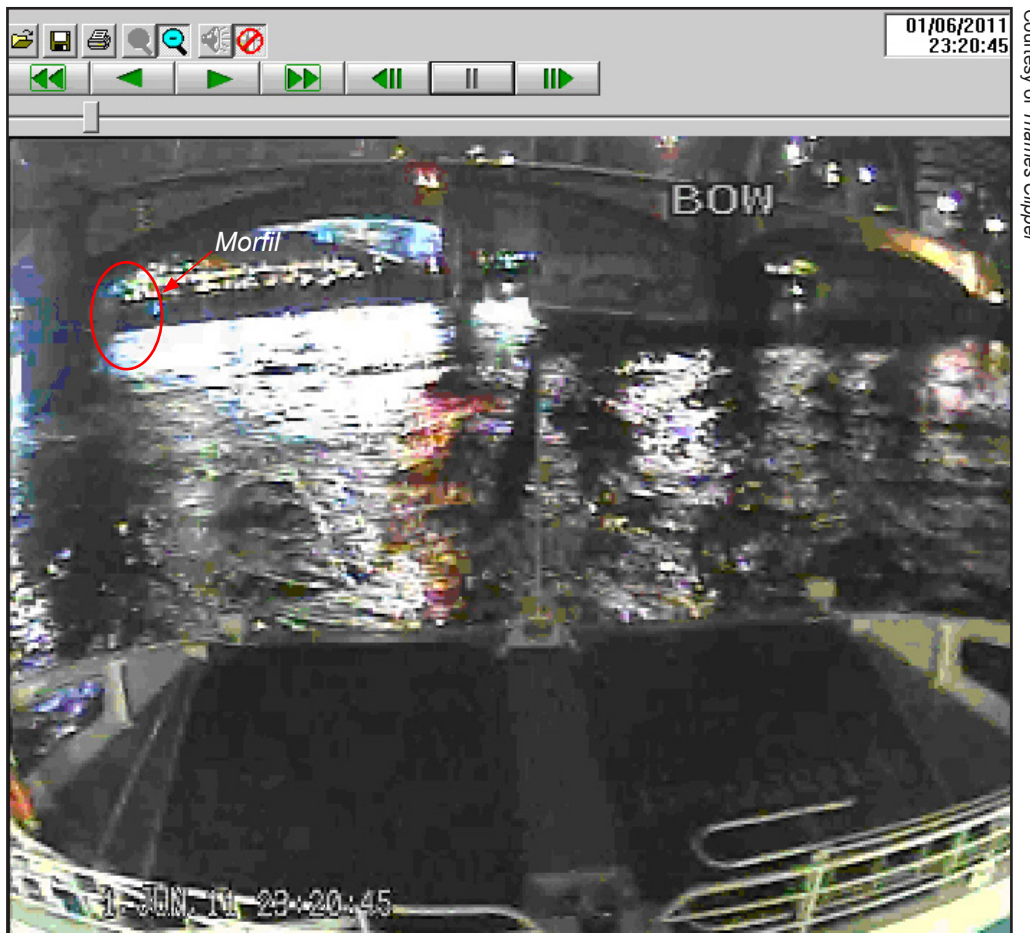


Figure 4: Thames AIS still - Sun Clipper departing berth

*Sun Clipper* was approaching No.3 arch at a speed over the ground of 8 knots when the master and mate noticed a small vessel off the port bow, later identified as *Morfil*, heading towards them (**Figure 5**). The RIB was also heading for No.3 arch but from the opposite side. The master and mate saw that *Morfil* was on the plane and estimated that she was travelling faster than 30 knots. *Sun Clipper's* master immediately realised that a collision was imminent, and reduced the engine throttles to zero.



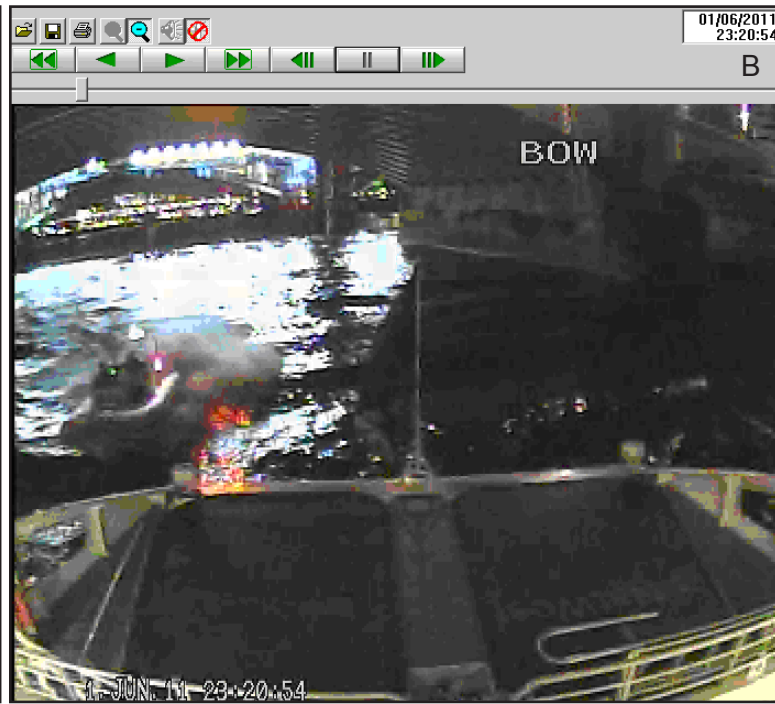
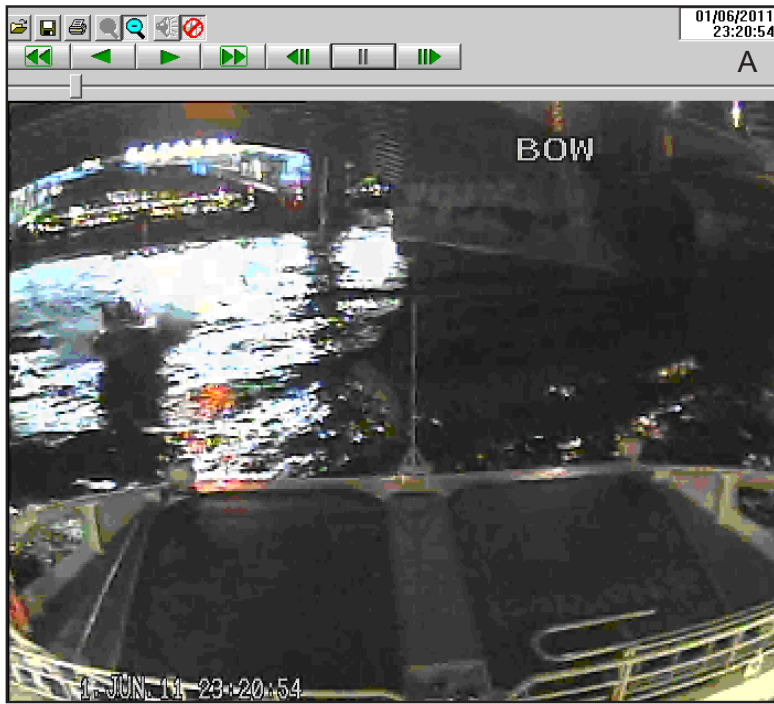
**Figure 5:** CCTV still - first sighting of *Morfil*

Moments later, *Morfil's* coxswain saw *Sun Clipper* directly ahead, and turned the steering wheel to port and then to starboard (**Figures 6a to 6c**). This action caused the RIB to swerve violently. Seconds later, at 2321, *Morfil* collided with *Sun Clipper's* port bow and both the RIB's occupants were thrown overboard.

### 1.2.3 The rescue

*Sun Clipper's* master immediately sent the mate forward to look for damage and to see what had happened to the RIB's crew. From the foredeck, the mate saw two people in the water near the HSC's stern. He shouted to the master not to use the engines, and then proceeded to the aft deck. The master acknowledged the mate's warning and then liaised with Thames Vessel Traffic Services (Thames VTS) via Very High Frequency (VHF) radio, channel 14, in order to initiate a rescue.





Courtesy of Thames Clipper

Figures 6a to c: CCTV still - *Morfil's* swerve to starboard

Meanwhile, some of *Sun Clipper's* passengers gathered on the vessel's open aft deck and threw two lifebuoys to the men in the water. The passengers then used the lifebuoy's lines to pull the men to the vessel's side (**Figure 7**).

*Morfil*, which was now unmanned, continued to turn to starboard at a fast speed until it hit and ricocheted off the stone buttress between the No.1 and No.2 arches of Blackfriars Road Bridge. The RIB then circled back into mid-stream and collided

with *Sun Clipper* for a second time, this time amidships on her port side. *Morfil* then passed close to her two owners in the water before turning towards the road bridge, where the RIB grounded and stopped under No.1 arch.

A Metropolitan Police Marine Policing Unit (MPU) launch and a Royal National Lifeboat Institution (RNLI) inshore lifeboat arrived at the scene at 2325. The RNLI crew had some difficulty manhandling *Morfil's* owners into the lifeboat; they appeared to be in shock and smelt strongly of alcohol. Neither of the owners was aware of the location of the accident.



**Figure 7:** CCTV still - *Morfil's* owners at stern of *Sun Clipper*

#### 1.2.4 Subsequent actions

*Morfil's* owners were recovered from the water and taken ashore to the lifeboat station (**Figure 7**), where they were treated for shock. *Morfil's* co-owner was later transferred to hospital for observation. The police noticed that the coxswain smelt of alcohol and that his speech was slurred. The coxswain was requested to provide a breath specimen, and he was voluntarily breathalysed at 0220 on 2 June 2011. The breathalyser displayed a "fail" result, which indicated that his breath alcohol level exceeded 35 microgrammes of alcohol in 100 millilitres; the test did not provide the actual level of alcohol in the coxswain's breath.

#### 1.2.5 Damage

*Morfil* suffered extensive damage (**Figure 8**) and was a constructive total loss. *Sun Clipper* suffered only superficial damage to her fendering.





**Figure 8:** *Morfil* - damage

### **1.3 MORFIL**

#### **1.3.1 Vessel description**

*Morfil* was a Zodiac Medline II RIB built in 2000 by Zodiac International, Spain. She had a single hull constructed of glass reinforced plastic (GRP), which had an inflatable tube attached to the upper part of the outer hull that passed around the bow and along both port and starboard sides.

*Morfil* was certified under the Recreational Craft Directive (RCD) to carry a maximum of 11 persons in inshore<sup>3</sup> waters, and 5 persons in offshore<sup>4</sup> waters. The RIB was equipped with a Mercury Optimax 135 hp engine, which provided a maximum output of 99.3kW and an approximate top speed of 35 knots when carrying 2 persons.

The RIB's console included a steering wheel, rocker switches for the navigational lights and bilge pump, and throttle control lever. The console was also fitted with a VHF radio, a chart plotter, a magnetic compass, an unserviceable speedometer, and an engine revolution gauge. The chart plotter was not fitted with a chart card but it was still capable of displaying the RIB's global positioning system (GPS) position and its course and speed over the ground. The chart plotter had not been switched on at the time of the accident. The RIB was fitted with a kill switch but there was no kill cord<sup>5</sup> attached.

Safety equipment included: a flare pack, a first-aid kit, a man overboard recovery line and four inflatable lifejackets. Coastal charts and an additional hand-held VHF radio were also carried.

### 1.3.2 Owners' marine experience and qualifications

*Morfil*'s owners purchased the RIB through a brokerage service in Poole, England in May 2011 with the intention of using it for pleasure trips on the River Thames. Rather than transport the RIB to London by road trailer, the new owners decided to relocate *Morfil* by sea. During the trip, the coxswain was assisted by three friends, one of whom was an experienced boat-handler. The co-owner did not embark for the trip, which was completed without incident.

*Morfil*'s coxswain held a Ski Boat Driver Award<sup>6</sup> (SBDA) for inland and coastal waters, issued by British Water Ski and Wakeboard (BWSW) in 1994. Since then, his boat driving had been limited to water skiing during family holidays, the delivery trip from Poole, and several excursions in *Morfil* on the River Thames. The co-owner had no boat-handling experience and the night of the accident was the first occasion he had been in the RIB since its arrival in London. Both the coxswain and the co-owner reported that they intended to complete a boat-driving course.

### 1.3.3 Alcohol consumption

*Morfil*'s owners had met unexpectedly at the theatre. During the interval, which started at about 2010, the coxswain consumed several glasses of wine and agreed with the co-owner to take *Morfil* out for a short trip after the show. After the show the two men were taken to Cadogan Pier by friends. The coxswain was aware that he had exceeded the alcohol limit applicable to drivers of road vehicles, but felt confident that he would be able to drive *Morfil* safely.

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<sup>3</sup> Inshore: coastal waters, large bays, estuaries, lakes and rivers where conditions up to, and including, wind force 6 and significant wave lengths up to, and including 2m may be experienced.

<sup>4</sup> Offshore: offshore voyages where conditions up to, and including, wind force 8 and significant wave heights up to, and including, 4m may be experienced.

<sup>5</sup> The purpose of a kill cord is to stop the engine should a boat's driver become disconnected from the driving position.

<sup>6</sup> BWSW aims to improve the driver standards by its promotion of two drivers' awards, the first of which is the Ski Boat Driver Award (SBDA). The syllabus is based on the SBDA manual and includes rule of the road, emergency procedures and buoyage. The award's primary purpose is to provide a basic level of navigation and safety education for persons driving boats.



While in the public house in St Katherine's Dock, the owners each drank a double measure of spirits, before returning to St Katherine's Pier to commence their return trip upriver to Cadogan Pier.

## **1.4 SUN CLIPPER**

### **1.4.1 Vessel description**

The 98gt HSC catamaran *Sun Clipper* was built in 2001 by North Queensland Engineers and Agents (NQE), Australia, and was constructed of aluminium, with rubber fendering attached to the hull just below the main deck level. She had a length overall of 30.03 metres, a breadth of 7.8 metres, and had a service speed of 26 knots. *Sun Clipper* operated in Ireland and Nigeria before she was bought by Thames Clippers in 2005. The HSC was authorised to carry a maximum of 138 passengers.

### **1.4.2 Crew**

*Sun Clipper's* three crew comprised her master, mate and passenger cabin attendant. The master held a boatmaster's licence with endorsements that allowed him to work on board vessels operating on the River Thames. He had joined Thames Clippers in 2009 and held an HSC type-rating certificate. He also had STCW<sup>7</sup> qualifications in sea survival, first-aid, global maritime and distress radio, and radar.

The mate also held a boatmaster's licence with River Thames endorsements, along with STCW qualifications in sea survival, first-aid, and VHF radio. He had joined Thames Clippers in 2001 as an apprentice and, although a qualified master, he occasionally served as a mate. The passenger services attendant was new to the company. The day of the accident was her second day of duty following the completion of her training.

All of the crew had completed the Thames Clippers' crowd control training. The master and mate had also completed the company's in-house training course in crisis management.

### **1.4.3 Thames Clippers**

Founded in 1999, Thames Clippers operates a fleet of 13 vessels on a commuter service along the River Thames. The vessels are also used for private hire. Thames Clippers was purchased in 2006 by the Anschutz Entertainment Group.

### **1.4.4 Passage under the Blackfriars Bridges**

Thames Clippers' risk assessment/routeing document covering its timetabled passenger services included:

*When leaving Blackfriars Pier ensuring its safe and clear, navigate down through the number two arches of Blackfriars Bridges, then immediately cross over to the starboard side of the fairway and line the vessel up for the approach into Bankside Pier. [sic]*

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<sup>7</sup> International Convention on Standards of Training, Certification and Watchkeeping incorporating the 1995 Amendments

The risk assessment had not been updated to reflect the use of Blackfriars Bridges' No.3 arches while the No.2 arches were closed. Thames Clippers' vessels did not usually sound one prolonged blast when leaving Blackfriars Pier, which is 125m upstream of Blackfriars Road Bridge, as required by River Byelaw 36.

## 1.5 THE PORT OF LONDON

### 1.5.1 River Thames

The River Thames is the longest river in England. It is tidal from its estuary to Teddington Lock and is crossed by 29 bridges along this stretch. Blackfriars Road Bridge spans the River Thames from Blackfriars on the north bank to Southwark on the south bank (**Figure 3**). The road bridge was built in 1869 and has five steel frame arches that are supported by stone faced buttresses (**Figure 9**). Blackfriars Rail Bridge is 48m downriver from the road bridge and also has five arches. The bridges' No.3 arches are normally used by larger vessels; smaller vessels generally use No.2 and No.4 arches.

Courtesy of Port of London Authority



**Figure 9:** Blackfriars Road Bridge

Refurbishment of Blackfriars Rail Bridge started in March 2009, which required each of the rail and road bridge arches to be closed at various times. Mariners were advised of the current works taking place via the Port of London Authority (PLA) Notice to Mariners (NTM) M3/2011 (**Annex A**), which included:

*Persons in charge of vessels are to navigate with particular care and proceed at slow speed when passing the works*

On the evening of 1 June 2011, the No.2 arches on both Blackfriars Road and Rail bridges were closed to navigation. The work barge, *Haven Seafield*, and tug *Horton* were positioned under the No.2 arch of Blackfriars Road Bridge. The closure of the No.2 arches on the Blackfriars Road and Rail bridges was indicated by a triangle (apex down) of three red lights in accordance with PLA River Byelaw 29.

### 1.5.2 Port of London Authority

The PLA was established in 1909 by the Port of London Act and is the statutory harbour authority for the 95 mile tidal stretch of the River Thames from Teddington Lock to the Thames Estuary<sup>8</sup>. The PLA's area of responsibility is divided into two

<sup>8</sup> For the purpose of this report, future references to the River Thames means the stretch of the river over which the PLA has jurisdiction, namely from the Thames Estuary to Teddington Lock

districts, Upper (from Teddington Lock to Crossness) and Lower (from Crossness to the Thames Estuary). Each of the districts is administered by a harbourmaster, both of whom report to a chief harbourmaster.

The Port of London is the UK's second largest port. In 2010, 39.8 million tonnes of goods were imported through the port and 8.3 million tonnes of goods were exported. Approximately 40 passenger boat operators trade on the River Thames, resulting in around 200,000 passenger pleasure vessel movements carrying 6.5 million passengers each year; about 750,000 people a year commute to work using the regular shuttle services. Over 70 pleasure vessel clubs and marinas are located on the River Thames, in addition to a large number of rowing clubs. The PLA approves and monitors about 300 organised events on the river each year.

### **1.5.3 Key events in 2012**

In 2012, London is hosting two major events that will have a significant impact on the River Thames and its users. The first event is the Queen's Diamond Jubilee in June, which includes a procession of 1000 vessels. The second event, the Olympic Games, is expected to substantially increase vessel activity on the Thames between 27 July and 12 August.

## **1.6 LOCAL REGULATION**

### **1.6.1 General**

The River Byelaws 1978, as amended, specify the requirements for both commercial and pleasure users on the River Thames. The PLA issues NTMs to provide information and advice on works and events as well as changes to rules and regulations which may affect river users. NTMs may be either temporary or permanent. The PLA is also empowered by the Port of London Act to issue navigational instructions to masters of vessels through General Directions<sup>9</sup>.

### **1.6.2 Alcohol and drugs**

River Byelaw 9 states:

*The master of a vessel shall not navigate the vessel when unfit by reason of drink or drugs to do so.*

*The master of a vessel shall not navigate, attempt to navigate or be in charge of a vessel after consuming so much alcohol that the proportion of it in his breath when tested in accordance with paragraph (5) below records a reading of 35 microgrammes of alcohol or more in 100 millilitres of breath.*

*If the harbourmaster has reasonable cause to suspect that the master of a vessel has drugs or alcohol in his body which may impair his fitness to navigate, he may direct the vessel to proceed to a designated berth or mooring or, if already on a berth or mooring, to remain in that position.*

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<sup>9</sup> A vessel's master may choose not to comply with a General Direction if he can prove that he has reasonable grounds that compliance would imperil his vessel or that compliance was impractical.

*The harbourmaster may permit a vessel to proceed notwithstanding that the master is suspected of being unfit to navigate through drink or drugs, if the harbourmaster considers that satisfactory arrangements have been made to replace the said master and to ensure safe navigation.*

*A vessel directed under paragraph (3) above shall remain in the position designated until such time as either a substitute master is on board and takes command of the vessel or the master suspected of having alcohol in his body submits to a breath test on equipment provided by the harbourmaster and approved by the Secretary of State for the purpose of the Road Traffic Act 1988 and the said breath test indicates a reading of less than 35 microgrammes of alcohol in 100 millilitres of breath.*

*It is an offence for the master of a vessel to fail to comply with a direction made under paragraph (3) above.*

The PLA has initiated 5 successful prosecutions in the last 12 years, following alcohol-related accidents. Of these, two were, inter alia, against River Byelaw 9. Notwithstanding these successful prosecutions, the PLA has received legal advice that River Byelaw 9 is not an effective and robust piece of legislation.

### **1.6.3 Speed limits**

River Byelaw 48 imposes an 8 knot speed limit on the River Thames above Wandsworth Bridge, the creeks that are linked to the tidal section of the River Thames, and the area off Southend. The section of the Thames from Wandsworth Bridge to Cherry Garden Pier (**Figure 1**) has an advisory speed limit of 12 knots, which was established through the PLA's NTM No.12 of 2009 (**Annex B**). The authority's decision to recommend a speed limit of 12 knots in this area was made following careful consideration of several factors, including the navigable water available, reaction times, navigational hazards, and vessel types.

### **1.6.4 Revision of byelaws**

In 2008, the PLA consulted informally with port and river users on new draft byelaws intended to replace all of the existing River Byelaws with the exception of River Byelaw 9. The PLA intends to revoke River Byelaw 9 when national legislation covering alcohol limits for pleasure users is introduced.

The revised byelaws, known as the Thames Byelaws, include Byelaw 16 – Speed Limits, which introduces a mandatory 12 knot speed limit (with provision of exceptions for certain vessels) between Wandsworth Bridge and Margaretness (**Annex C**). The Thames Byelaws were submitted to the Department for Transport (DfT) for approval in June 2009. The PLA received DfT's response in June 2011 and, following the completion of changes requested by DfT, the draft was resubmitted to the PLA board in July 2011.

In August 2011, the PLA commenced a period of formal public consultation on the draft byelaws. In response, the PLA has received 18 objections, which it is currently addressing. A timeline of the introduction of the Thames Byelaws is shown in **Table 1**.

2008	June	Informal consultation with users
2009	April	Revised proposals to the PLA Board - agreed
2009	June	Draft submitted to DfT Legal Department (as 'Thames Byelaws') for their consideration (and wider consultation within Government and major stakeholders)
2011	June	DfT legal changes completed
2011	July	Resubmission of amended draft to board
2011	August/September	Formal public consultation for amended byelaws
2011	October	Following public consultation, PLA is currently addressing 18 objections to the drafted byelaws.

### **1.6.5 Enforcement**

The PLA has a fleet of harbour service launches available to enforce the River Byelaws, which are equipped with breathalysers compliant with the Road Traffic Act 1988. In addition, its marine officers are trained in the use and operation of the breathalysers and are permitted to take samples under River Byelaw 9.

The PLA does not enforce River Byelaw 36, which requires vessels to sound one prolonged blast when leaving a berth and entering a fairway primarily because the frequent sounding of whistles in busy areas could lead to uncertainty and confusion between vessels. There are also many residential properties in the vicinity of riverside piers.

### **1.6.6 Promulgation of information**

The PLA uses several methods to publicise the requirements of its byelaws and regulations, and general safety information. In addition to established systems and initiatives, such as river user consultative forums, NTMs, notices to agents, berths and ships' operations, and the PLA website ([www.PLA.co.uk](http://www.PLA.co.uk)), the authority has also introduced other measures. These include:

- A dedicated website ([www.boatingonthames.co.uk](http://www.boatingonthames.co.uk)) aimed at pleasure boat users that provides navigational advice, including the precautions that should be taken while using the river, and applicable NTMs.
- The publication and distribution of a recreational user guide and codes of practices for both commercial and recreational activities.
- Public meetings with user groups, and close liaison with the many clubs and associations based on the River Thames.
- Presentations at events, such as boat shows, to promote good practice and to raise awareness of the PLA's regulations.
- Broadcasts every 30 minutes by Thames VTS, on VHF channel 14, providing details of works and restrictions in place on the river.



## 1.7 METROPOLITAN POLICE MARINE POLICING UNIT

In 1798, the Marine Police Establishment was formed to police the Port of London. Today, its modern equivalent, the Metropolitan Police MPU is based at Wapping and has two main objectives:

- To be a visual police presence on the River Thames
- To provide specialist marine support to the Metropolitan Police Service.

The MPU has a fleet of vessels, which are supported by shore vehicles. The MPU and PLA have a memorandum of understanding (MOU) that defines how the two organisations will co-operate when responding to marine-related incidents. The MOU is complemented by the MPU's own procedures for dealing with mariners that are suspected of being under the influence of alcohol while in charge of a vessel. Currently, the application of these procedures is restricted by legislation to professional mariners only (see 1.9.1).

## 1.8 MARCHIONESS/BOWBELLE DISASTER

In the early hours of 20 August 1989, the dredger *Bowbelle* collided with the passenger vessel *Marchioness* on the River Thames. There were 131 passengers and crew on board the *Marchioness*, 51 of whom died as a result of the accident.

In 1992, Mr John Hayes, the Secretary General of the Law Society, published his report on safety on the River Thames. The report, known as *The Hayes Report*, dealt with DETR<sup>10</sup>'s handling of its responsibility for the safety of vessels on rivers and inland waterways. The report made 22 recommendations, one of which was for new legislation for the breath testing of mariners on all vessels.

In 1989, the River Byelaw 9 was limited to:

*The master of a vessel shall not navigate the vessel when unfit by reason of drink or drugs to do so.*

After the *Marchioness/Bowbelle* disaster, the byelaw was expanded to its current form (**paragraph 1.6.2**) to address public concern about persons navigating on the River Thames while under the influence of alcohol.

In 1999, following extensive public pressure, a public inquiry, known as the *Thames Safety Inquiry* into the *Marchioness/Bowbelle* disaster was commenced. The inquiry was chaired by Lord Justice Clarke, who also then chaired a formal investigation into the disaster under the Merchant Shipping Act 1985. In his findings of the formal investigation, Lord Justice Clarke included a recommendation that primary legalisation should be used to introduce alcohol consumption legalisation in the same vein as the existing legalisation for road traffic users. Extracts of the formal investigation report are at **Annex D**.

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<sup>10</sup> DETR: Department of the Environment, Transport and the Regions



## 1.9 NATIONAL LEGISLATION

### 1.9.1 Merchant Shipping Act 1995

Under Section 58 of the Merchant Shipping Act 1995, it is an offence for a master or seaman employed on a UK registered vessel, or a foreign vessel within UK waters or in a UK port, to endanger his own or other vessels when under the influence of drugs or alcohol. The provision does not prescribe any blood alcohol content limits and does not apply to pleasure vessels.

### 1.9.2 The Railways and Transport Safety Act 2003

In 2003, the Railways and Transport Safety Act (RATS) was enacted. Part 4 of RATS prescribes the alcohol and drugs regulations for persons engaged in shipping.

Section 78 stipulates that professional masters, pilots and seamen commit an offence if their ability to carry out their duties is impaired because of drink or drugs, and if the proportion of alcohol in their breath, blood and urine exceeds the prescribed limit.

Section 81 specifies the prescribed limits as follows:

*In the case of breath, 35 microgrammes of alcohol in 100 millilitres*

*In the case of blood, 80 milligrammes of alcohol in 100 millilitres*

*In the case of urine, 107 milligrammes of alcohol in 100 millilitres.*

For the purposes of this section, a master, pilot or seaman is professional if (and only if) he is fulfilling that role in the course of a business or employment.

Section 79, *Professional staff off duty* states that an offence is committed when a seaman's ability is impaired and, in the event of an emergency, he would or might be required by the nature or terms of his engagement or employment, to take action to protect the safety of passengers.

Section 80, *Non-professionals*, states:

(1) *This section applies to a person who-*

*(a) is on board a ship which is underway,*

*(b) is exercising, or purporting or attempting to exercise, a function in connection with the navigation of the ship, and*

*(c) is not a person to whom section 78 or 79 applies.*

(2) *A person to whom this section applies commits an offence if his ability to exercise the function mentioned in subsection (1)(b) is impaired because of drink or drugs.*

- (3) *A person to whom this section applies commits an offence if the proportion of alcohol in his breath, blood or urine exceeds the prescribed limit.*
- (4) *The Secretary of State may make regulations providing for subsection (3) not to apply in specified circumstances.*
- (5) *Regulations under subsection (4) may make provision by reference, in particular-*
- (a) to the power of a motor;*
- (b) to the size of the ship;*
- (c) to the location.*

Only subsections (4) and (5) of Section 80 have been commenced. The offences which apply to non-professional mariners have not yet been commenced pending consideration on what, if any, exceptions to the subsections (3) offence there should be for certain categories of non-professional mariners in accordance with subsections (4) and (5).

A comparison of the maximum penalties that may be imposed through the Merchant Shipping Act 1995 and RATS with the legislation available for use by the PLA is at **Table 2**.

<b>Table 2</b>	National Legislation		The Port of London		
	Merchant Shipping Act 1995, section 58	Road and Traffic Safety Act 2003, Part 4	General Direction	1968 Act	Byelaw
Summary conviction	A fine up to £5000	A fine up to £5000	A fine up to the level 5 <sup>11</sup> on the standard scale	A fine up to £5000 <sup>12</sup>	Maximum fine of £1000 plus a daily fine of £100
Conviction on indictment	Maximum 2 years imprisonment, or a fine <sup>13</sup> , or both	Maximum 2 years imprisonment, or a fine <sup>14</sup> , or both	Not applicable	Not applicable	Not applicable

### 1.9.3 Progress

In 2004, the Government issued a consultation to determine whether any non-professional mariners should be exempt from the offence at RATS subsection (3) and, if so, how those exceptions should be framed. The consultation responses

<sup>11</sup>Level 5 fine maximum is currently £5000

<sup>12</sup> The statutory maximum is currently £5000

<sup>13</sup> Up to £25000

<sup>14</sup> Up to £25000

received were broadly in favour of an exception for non-professional mariners, using a combination of parameters, although views differed on how to frame the exception and who should be subject to the prescribed alcohol limits.

In July 2005, as a result of the fatality in the *Carrie Kate* and *Kets* collision, the MAIB recommended that the DfT:

*“work closely with the RYA, MCA and other relevant stakeholders to realise the urgent introduction of national regulations to establish limits on the amount of alcohol which may be consumed by operators of pleasure vessels”.*

In 2007, following the results of the consultation in 2004, ministers announced the Government’s intention to proceed with bringing into force Section 80 of RATS and to draft regulations for a limited exception from the prescribed alcohol limits for non-professional mariners on vessels of less than 7 metres length overall that are not capable of a maximum speed of more than 7 knots.

In February 2009, the Government issued a further public consultation inviting views on the draft regulations for such an exception for non-professional mariners on ships that have a length overall of less than 7 metres and a maximum design speed not exceeding 7 knots. The consultation ended on 6 May 2009.

In October 2009, the MAIB published its report on the fatality that resulted from the grounding at high speed of the RIB *Sooty*. The report identified that *‘the coxswain’s decision making and his coordination and cognitive skills were adversely affected by his consumption of alcohol.’* The report also stated:

*In view of the MAIB’s previous recommendation regarding the introduction of national regulations establishing limits on the amount of alcohol which may be consumed by the operators of pleasure vessels, work currently being undertaken by the DfT in respect of the proposed implementation of Section 80 of the Railways and Transport Safety Act 2003, no further recommendations are considered necessary.*

The Royal Yachting Association<sup>15</sup> (RYA), in its role as the national governing body<sup>16</sup> for boating, objected to the introduction of alcohol limits for pleasure vessels during the public consultations held in 2004 and 2009.

There is currently no date proposed for the commencement of Section 80, as priority is being given to other measures which are largely focused on the transposition of European legislation. The timeline of events relevant to the introduction of national alcohol limits for pleasure vessels is at **Table 3**.

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<sup>15</sup> The RYA has about 102,000 members, which equates to approximately 20% of the private boat owners in the UK. This figure has been derived from data in the Watersports Participation Survey 2010 produced by Arkenford Ltd in May 2011 on behalf of the British Marine Federation, Maritime and Coastguard Agency, Royal National Lifeboat Institution, Royal Yachting Association and the British Canoe Union.

<sup>16</sup> RYA Articles of Association, 2011 Part 2, Paragraph 3.1 (b).

<b>Table 3 - Alcohol limits legislation timeline</b>	
1989 18 August	Marchioness/ Bowbelle disaster.
1991 August	MAIB report on Marchioness/ Bowbelle collision published.
1992 July	Hayes Report – recommendation for breath tests for seafarers on all vessels.
1999 December	Thames Safety Inquiry Interim Report published, included a recommendation for the control of alcohol for people in charge of vessels.
2000 November	DfT <sup>17</sup> inform official inquiry of proposed legalisation that includes the prevention of alcohol abuse aboard vessels including those on recreational craft underway, who have an essential role in its navigation or propulsion.
2000 December	Queen’s Speech announces new safety bill.
2001 March	Formal Investigation report on the Marchioness/ Bowbelle, found that there was a need for alcohol legalisation to be enforced for all vessels. Indeed, the first recommendation made in the report was for alcohol, drugs and fatigue and provided that: <i>We endorse the proposed legalisation<sup>18</sup> and recommend that it be enacted as soon as possible.</i>
2004	RATS (Commencement no2) Order 2004 imposes alcohol limits on professional mariners
2004	Consultation launched by the government to determine whether any exceptions to RATS subsection 80 (3) should be in place.
2007 June	Government announced its formal intention to proceed with the enactment of RATS section 80 and to draft regulations for a limited exception from the prescribed alcohol limits for non-professional mariners on vessels of less than 7 metres and not capable of a maximum speed of 7 knots.
2009 February	Further public consultation inviting views on the draft for the exemption.
2009 May	End of public consultation
2011 June	Secretary of State for Transport advises “no timetable” for the enactment of RATS section 80.
2012 April or October	<b>Amended alcohol limits for professional mariners due to be introduced<sup>19</sup></b> <small>[see 1.10.3]</small>
TBC	<b>Enactment of section 80</b>

<sup>17</sup>Current title for the responsible department

<sup>18</sup> Refers to paragraphs 37.3 to 37.6 of the Formal Investigation Report which may be found at Annex D

<sup>19</sup> Proposed date.

## 1.10 INTERNATIONAL REGULATION

### 1.10.1 Safety of Life at Sea

The requirement for recreational boat users to carry out voyage planning is laid down in the Safety of Life at Sea Convention (SOLAS) Chapter V regulation 34, which entered into force in 2002. Regulation 34.2 states:

*The voyage plan shall identify a route which:*

- *Takes into account any relevant ships' routing systems*
- *Ensures sufficient sea room for the passage of the ship throughout the voyage*
- *Anticipates all known navigational hazards and adverse weather conditions*
- *Takes into account the marine environmental protection measures that apply. And avoids, as far as possible, actions and activities which could cause damage to the environment. [sic]*

### 1.10.2 The International Regulations for Preventing Collisions at Sea, 1972

The International Regulations for Preventing Collisions at Sea, 1972, are made law in the UK by The Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations (COLREGS). The COLREGS apply to all vessels on the high seas, and in all waters connected to the high seas navigable by seagoing vessels. Rule 5 (lookout) and rule 6 (safe speed) are at **Annex E**.

### 1.10.3 Alcohol limits for professional seafarers

The International Maritime Organization has agreed amendments to STCW, effective from 1 January 2012, that will require administrations to establish limits of not greater than 0.05% blood alcohol level or 0.25mg's alcohol in the breath for masters, officers and other seafarers while performing designated safety, security and marine environmental duties. The limit will apply only to those vessels covered by the Convention.

## 1.11 GENERAL GUIDANCE TO PLEASURE VESSEL OWNERS

The MCA leaflet '*MCA Guidance for Pleasure Vessels*' (MCA/222), advises owners and crew of the legislation that is applicable to pleasure vessels. The leaflet also advises owners and crew to:

- *Contact the national governing body for your activity and get trained by the experts.*
- *Wear a lifejacket or buoyancy aid.*
- *Check the tides and weather forecast.*
- *Carry a communications device and detection aids (for example VHF radio and EPIRB). Make sure that you know how to use them and who to call in an emergency.*
- *Avoid alcohol – don't drink and drown.*

The RYA promulgates guidance to pleasure boat owners on its website under *Pleasure Craft Regulation & Equipment*, and includes information on key regulatory areas including: the COLREGS, SOLAS, manning, and equipment. It also highlights the possibility that harbour authorities may have byelaws that require leisure boats to observe speed limits and monitor VHF channels. The RYA website also draws the attention of leisure users to the information available on the websites of harbour authorities, notably the PLA.

## 1.12 PLEASURE VESSEL ACCIDENTS

**Table 4** shows the number of fatalities from accidents where alcohol consumption has been established as a causal or contributing factor that have been reported to the MAIB between 2005 and 2010.

	Where	2005	2006	2007	2008	2009	2010	Total
<b>Pleasure vessels (non-commercial)</b>	Alongside or moored	0	1	6	0	1	0	8
	At anchor	0	0	1	0	0	0	1
	Entering or leaving port	4	0	0	0	1	0	5
	Mooring operations	1	0	0	0	0	0	1
	Not under command	0	1	0	0	0	0	1
	On passage	3	2	2	1	4	2	14
	Other offshore operations	0	0	2	0	0	0	2
	Pleasure trip	0	4	2	2	1	2	11
	<b>Total</b>	<b>8</b>	<b>8</b>	<b>13</b>	<b>3</b>	<b>7</b>	<b>4</b>	<b>43</b>
<b>Small commercial Pleasure vessels</b>	Alongside or moored	0	0	0	0	1	0	1
	Unknown	1	0	0	0	0	0	1
	<b>Total</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>
<b>Total commercial &amp; non commercial pleasure vessel fatalities involving Alcohol</b>		<b>9</b>	<b>8</b>	<b>13</b>	<b>3</b>	<b>8</b>	<b>4</b>	<b>45</b>
<i>Source: Marine Accident Investigation Branch.</i>								

## SECTION 2 - ANALYSIS

### 2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

### 2.2 THE COLLISION

It is evident from **Figures 5 and 6a, 6b and 6c** that *Sun Clipper* and *Morfil* were potentially in sight of each other for approximately 10 seconds prior to the collision. However, the lack of reaction by *Morfil*'s coxswain indicates that he did not see the oncoming ferry until he took action to try and avoid a collision between 1 and 2 seconds before the impact. By then, the two vessels were too close and closing too quickly for his instinctive attempt to manoeuvre clear to be effective. Although *Sun Clipper*'s master immediately reduced speed when he saw *Morfil* approaching, he was prevented from taking any further avoiding action by the close proximity of the temporary mooring buoys and the No.3 arch buttresses (**Figure 3**).

After the collision, *Morfil*'s owners were extremely fortunate that the RIB, the engine of which continued to run because the coxswain had not fitted a kill cord, did not strike them and cause serious injury – or worse – as it passed close by. They were also fortunate that their rescuers were close at hand, otherwise their chances of survival in the strong flowing river, without lifejackets and while under the influence of alcohol, would have been reduced significantly.

### 2.3 INFLUENCE OF ALCOHOL

The breath specimen provided by *Morfil*'s coxswain nearly 3 hours after the RIB's collision with *Sun Clipper* indicated that the concentration of alcohol in his breath exceeded 35 microgrammes in 100 millilitres. Assuming that:

- 35 microgrammes equals approximately 3 alcohol units<sup>20</sup>;
- the concentration of alcohol was only marginally in excess of 35 microgrammes; and
- an average healthy male can metabolize one unit of alcohol per hour

it is likely that *Morfil*'s coxswain had at least 6 units of alcohol in his body system when the vessels collided. This was at least double the alcohol limit prescribed for motorists and professional mariners. Consequently, given that the coxswain's breath specimen was tested 6 hours after he first consumed alcohol at the theatre, he is likely to have consumed in the region of 9 alcohol units during the course of the evening.

The effects of alcohol vary between individuals and depend on a range of factors including: weight, gender, age, metabolism, stress levels and the amount of alcohol consumed. Nevertheless, the effects can generally be considered to impair motor co-ordination and judgment, affect cognitive ability, slow down reaction times, and reduce peripheral and night vision. Alcohol can also affect a person's mood by

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<sup>20</sup> In the UK, one unit of alcohol is equal to 10 millilitres of pure alcohol. Alcohol concentrations in the human body depend on a number of factors, including gender, body mass, and speed of absorption into the bloodstream.



reducing levels of anxiety, relaxing inhibitions, and increasing their confidence levels. This frequently results in a person being more likely to take risks. Motorists have been found to be 10 times more likely to have an accident when they are 1.5 times over the legal alcohol limit.

In this collision, it is likely that alcohol consumption influenced several of *Morfil's* coxswain's decisions, actions and omissions, including:

- Deciding to take the RIB out for a trip on the River Thames at short notice without any preparation or planning.
- Accepting the risk of operating on the river, at night, without wearing lifejackets.
- Not wearing a kill cord.
- Extending the trip to St Katherine Docks to consume more alcohol.
- Proceeding at a fast speed in the dark without a chart plotter or speedometer to assist with navigation.
- Not noting the vessel's position on the river in relation to key landmarks such as the bridges.
- Not maintaining a VHF radio watch.
- Being slow to react to *Sun Clipper's* presence near the bridge until between 1 and 2 seconds before the collision
- Indecision when taking avoiding action.

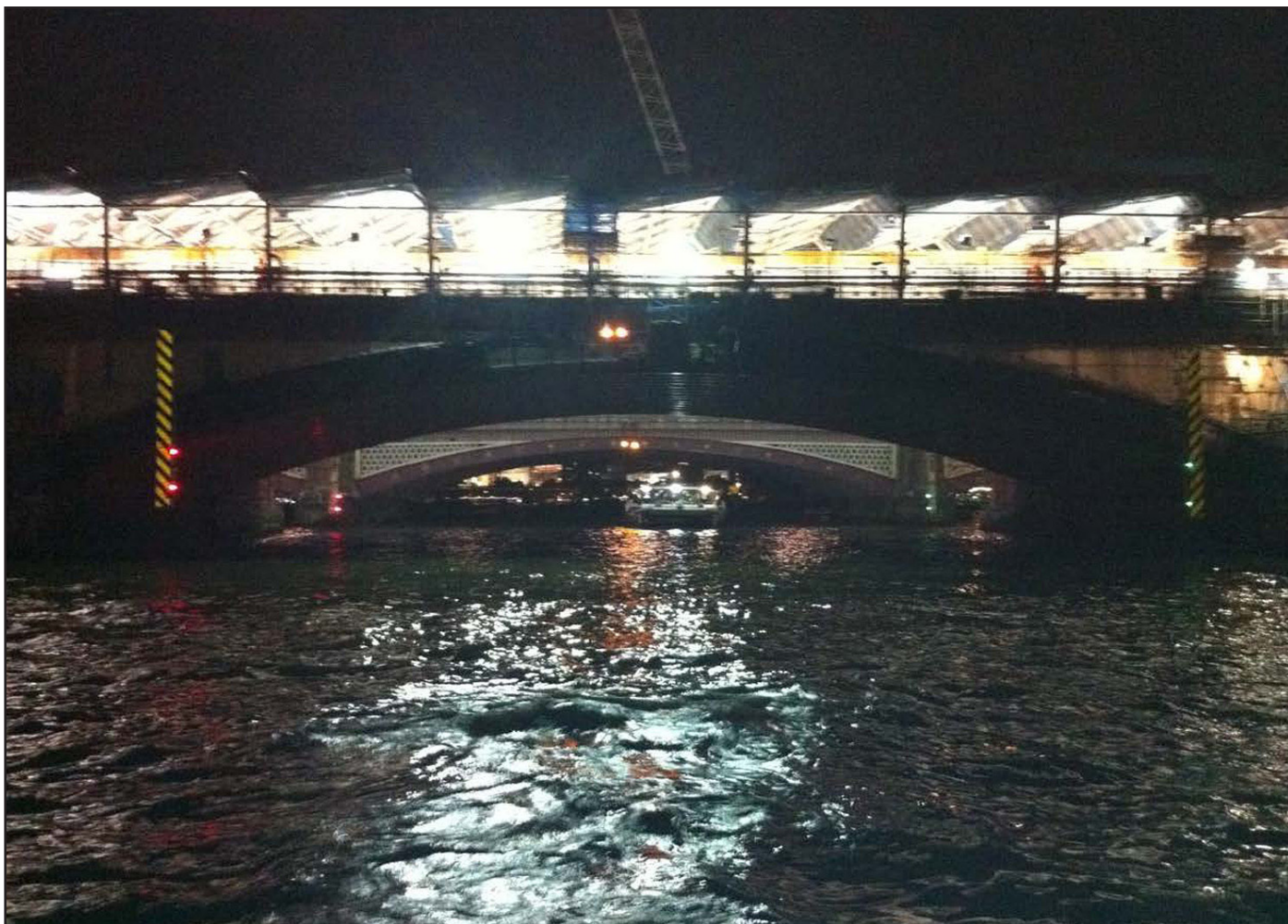
*Morfil's* speed when the RIB collided with *Sun Clipper* cannot be accurately determined. However, given that the boat's engine throttle lever was set to three quarters of full power, and taking into account the estimates of *Sun Clipper's* master and mate, and CCTV footage (**Figures 5, 6a, 6b and 6c**) it is clear that the RIB was travelling significantly in excess of the 12 knot speed limit advised by the PLA. Consequently, *Morfil's* coxswain had only 10 seconds to see *Sun Clipper*, assess her movement, and to take avoiding action.

Nevertheless, given the RIB's manoeuvrability, 10 seconds should have been sufficient time to avoid the collision if *Morfil's* coxswain had not been impaired by alcohol and had he kept a proper lookout ahead. Although there would inevitably have been some luminescence from the lights on the riverbanks, it is unlikely to have been significantly detrimental to the coxswain's night vision. Furthermore, **Figure 10** shows that the Thames Clippers' vessels are well lit and quite conspicuous at night, even under a bridge arch.

## 2.4 DETERRENCE

*Morfil's* coxswain was aware that when he set off on his river trip, he had consumed too much alcohol to be able to drive a car without breaking the law. Yet he considered that the consumption of alcohol, and then driving a boat, was acceptable. Such behaviour is not uncommon, with a number of pleasure craft owners viewing boating and drinking as compatible social activities.





**Figure 10:** Thames Clipper at Blackfriars Bridges at night

However, it is clear from this and other alcohol-related accidents and fatalities in recent years (**Table 4**), that operating pleasure craft while under the influence of alcohol is dangerous. The need to deter the drivers and coxswains of pleasure craft from consuming alcohol is compelling. While education is an important tool in this respect, the imposition of alcohol limits has a major role to play in changing attitudes towards operating pleasure craft while under the influence of alcohol.

At the moment, local harbour authorities may impose and enforce alcohol limits on pleasure vessel users through byelaws, such as River Byelaw 9. However, notwithstanding the efforts of the RYA to publicise<sup>21</sup> the existence of byelaws affecting pleasure vessels, it is highly likely that the majority of pleasure vessel users are unaware that such byelaws exist. Moreover, if, as the PLA has experienced: local police forces are reluctant to assist with the enforcement of byelaws; legal advice suggests that prosecutions under these byelaws are not likely to be successful; and, the penalties applicable through byelaws are significantly less than under national legislation (**Table 2**), then byelaws are of little value as a deterrent. The piecemeal application of byelaws by harbour authorities can never be an efficient way of restricting the consumption of alcohol by pleasure vessel users, and the byelaws have no deterrent value whatsoever in waters which lie outside a harbour authority's jurisdiction. The only effective way of deterring excessive alcohol consumption would appear to be through national legislation.

<sup>21</sup> The RYA website section on regulation draws the attention of the user to Byelaws and Local regulations.

## 2.5 IMPLEMENTATION OF NATIONAL LEGISLATION

Despite recommendations to introduce national alcohol limits for pleasure vessels made by *'The Hayes Report'* in 1992, Lord Justice Clarke in 1999, and the MAIB in 2005, this action remains outstanding. Notwithstanding the time taken to complete the public consultations in 2004 and 2007 and to consider the objections raised, the failure to introduce the planned legislation in a timely manner is disappointing. By comparison, it took only 2 years (1965 to 1967) to introduce alcohol limits for motorists.

That the RYA, as the national governing body, continues to object to the introduction of alcohol limits for pleasure craft operators may be partly responsible for the Department's apparent reluctance to introduce the legislation. Although the association does not condone the operation of pleasure craft while under the influence of alcohol<sup>22</sup>, and many of its members are unquestionably responsible in this respect, it represents the views of only a minority, albeit a significant minority, of pleasure vessel owners in the UK. The collision between *Morfil* and *Sun Clipper*, together with the 45 fatalities identified in **Table 4**, clearly indicates that other pleasure vessel owners do not share similar values. While the imminent lower alcohol limits for professional mariners might not be appropriate for pleasure craft operators, by exempting from the alcohol limit vessels which are less than 7m in length and not capable of a maximum speed of more than 7 knots, the proposed legislation is reasonable and proportionate, and merits the support of all industry stakeholders.

The continued absence of alcohol limits for pleasure vessels not only increases the uncertainty of harbour authorities, such as the PLA, regarding the revision of existing byelaws, but it also jeopardises the safety of all water users. It is imperative, therefore, that the national legislation limiting the consumption of alcohol for non-professional mariners is enacted as soon as is practicable.

## 2.6 ARCH CLOSURE

The closure of the No.2 arches of Blackfriars road and rail bridges for refurbishment resulted in *Sun Clipper* using the No.3 arches. This was contrary to Thames Clippers' risk assessment, and meant that as the HSC left Blackfriars Pier, the visibility from her wheelhouse towards *Morfil* was obstructed by the vessels working under the No.2 arches, and by the buttress between Blackfriars Road Bridge No.2 and No.3 arches. The obstructions would have also prevented *Morfil's* coxswain from seeing *Sun Clipper*.

Nevertheless, *Sun Clipper's* use of the No.3 arches was reasonable. The only alternative option available would have been to use the No.4 arches, but this would have been impractical given the strong tidal streams in the area and the short distance from Blackfriars Pier to the Blackfriars Road Bridge. However, a review of Thames Clippers' risk assessment in response to the closure of the No.3 arches might have prompted a reiteration of the requirement to sound one prolonged blast,

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<sup>22</sup> The RYA's latest position on the introduction of alcohol limits for pleasure craft was posted on its website ([www.RYA.org.uk](http://www.RYA.org.uk)), on 7 April 2011 and states:

*The RYA does not condone being drunk whilst in charge of a boat, but believes there is no evidence to suggest new legislation is required in this area.*

in accordance with River Byelaw 36, as its vessels left Blackfriars Pier in order to warn any vessels not participating in the Thames AIS of their presence and movement.

Unfortunately in this instance it is unlikely that *Morfil's* coxswain would have heard the sound signal due to the distance between the vessels and the noise from *Morfil's* engine. Even if he had, he is unlikely to have reacted to the sound signal due to his intoxicated state and his lack of familiarity with the local byelaws.

## 2.7 CONTROL OF PLEASURE VESSELS

Although persons in charge of pleasure vessels are obliged to comply with international regulations such as SOLAS and the COLREGS, they are not required to demonstrate any knowledge of these regulations. Moreover, in the UK, coxswains of pleasure vessels are not required to demonstrate competency in the key skills required, such as boat-handling, navigation and general safety precautions. Although several organisations such as the RYA provide training courses leading to qualifications for pleasure vessel users, the courses are not mandatory.

Consequently, an individual can purchase a vessel and operate it without any training or qualifications providing the vessel is not used for commercial purposes. Although the guidance and advice promulgated by the MCA and the RYA (paragraph 1.11) is invaluable, unfortunately it is not always read or heeded.

To try and mitigate the risks that pleasure craft users can pose to themselves, to others, and to the environment, many harbour authorities have adopted registration schemes for vessels moored on and/or using their waters. Such schemes allow the authorities to check that the vessels are covered by third party insurance, and facilitate the dissemination of harbour safety guides, byelaws and other instructions. However, registration schemes are not always popular with pleasure craft owners as a registration fee is usually levied.

To date, the PLA has considered that registration or licensing of pleasure vessels on the River Thames would be unviable. It considers that any attempt to seek additional powers in this respect would be strongly opposed by interested parties such as the RYA. Therefore, although the PLA promulgates its regulations and guidance in numerous ways (paragraph 1.6.6), this information is less likely to reach new and infrequent river users, who are not affiliated to a club, and who also potentially have little appreciation or understanding of the knowledge, skills and competencies necessary to navigate in a congested tidal environment.

In this case, *Morfil* was capable of carrying up to 11 persons and of speeds over 30 knots. The vessel was, therefore, potentially a danger to its occupants and to other river users unless operated safely. Although the RIB's coxswain had held SBDA certification since 1994, his boat driving during the following 17 years was infrequent, and his knowledge of the River Thames was limited. It is evident that he was oblivious to, or ignored, the local regulations and guidance regarding the consumption of alcohol, the 12 knots speed limit, the need to slow down when passing the refurbishment works on the Blackfriars bridges, and the PLA's recommendation to use kill cords.



The shortcomings in *Morfil's* coxswain's observance of official guidance strongly indicate that the PLA must continue to explore innovative methods of promulgating local regulations and navigational advice to its users, possibly including an increased use of signage on the River Thames's banks and bridges. The effective promulgation of information will be pivotal to the safety of vessels during the increased activity on the River Thames expected in 2012.

## 2.8 SPEED ON THE RIVER THAMES

Rule 6 of the COLREGS (**Annex E**) requires vessels to “*proceed at a safe speed*” in order to enable proper and effective action to be taken to avoid a collision. However, many harbour authorities also impose an upper speed limit for vessels operating in their areas of responsibility. The PLA's use of speed limits to control shipping movements in some of its waters is not unusual.

Although some vessel owners and operators might consider the recommended 12 knot speed limit between Wandsworth Bridge and Cherry Garden Pier (**Figure 1** and **Annex B**) to be unnecessarily restrictive, it was identified as a control measure through risk assessment, and was based on the careful consideration of a number of factors, including reaction times and the proximity of dangers. Indeed, by allowing vessels to close head on at speeds up to 24 knots (12.5m per second) the limit is considerably more generous than the speed limits imposed by many other harbour authorities. In this case, had *Morfil* been adhering to the speed limit, the RIB's coxswain and *Sun Clipper's* master would have had more time, albeit only seconds, for them to see each other and to take more effective avoiding action.

At present, the 12 knot speed limit is only an advisory limit due to the significant delays the PLA has experienced in introducing the Thames Byelaws (**Table 1**). Similar delays have been experienced by many harbour authorities, largely due to the length of time taken by the DfT to process the port authorities' application for changes.

It is almost certain that the 12 knot speed limit between Wandsworth Bridge and Cherry Garden Pier will further contribute to the safe navigation of vessels on the River Thames when it is made mandatory and enforced. Therefore, should the PLA encounter any further delays in revising its byelaws, particularly the introduction of Thames Byelaw 16 (**Annex C**), it would be prudent for the authority to use other means to make the speed limit mandatory, possibly by issuing a General Direction.

## SECTION 3 - CONCLUSIONS

### 3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENDATIONS

1. At the time of the accident, *Morfil's* coxswain is likely to have had at least 6 units of alcohol in his body, over double the alcohol limit prescribed for motorists and professional mariners. It is therefore likely that his decision making and actions were impaired by alcohol. [2.3]
2. The need to deter persons in charge of pleasure vessels from consuming alcohol over defined limits is compelling. [2.4]
3. The current byelaw imposing an alcohol limit for persons in charge of pleasure vessels is not an effective deterrent. [2.4]
4. It is of utmost concern that, despite first being recommended almost 20 years ago, a national alcohol limit for persons in charge of pleasure vessels has not yet been introduced. [2.5]
5. The continued absence of an alcohol limit for persons in charge of pleasure vessels compromises the safety of all water users. [2.5]
6. *Morfil's* coxswain was oblivious to, or ignored, several of the PLA's local regulations and recommendations applicable to vessels navigating on the River Thames. [2.7]
7. The effective promulgation of information will be pivotal to the safety of vessels during the increased activity on the River Thames expected in 2012. [2.7]
8. *Morfil's* speed significantly exceeded the recommended 12 knot limit. Had *Morfil's* coxswain complied with the 12 knot speed limit recommended by the PLA, both he and the master of *Sun Clipper* would have had more time to take more effective avoiding action. [2.8]
9. The 12 knot speed limited recommended by the PLA is unlikely to be effective until it is made mandatory and is enforced. [2.8]

### 3.2 OTHER SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION ALSO LEADING TO RECOMMENDATIONS

None

### 3.3 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE BEEN ADDRESSED OR HAVE NOT RESULTED IN RECOMMENDATIONS

1. As *Morfil's* coxswain was not using the kill cord effectively, the RIB's crew were extremely fortunate to avoid serious or even fatal injuries from the RIB as it passed close by them while they were in the water. They were also fortunate not to drown in the fast flowing water, despite not wearing lifejackets, because their rescuers were close at hand. [2.2]

2. The vessels did not see each other until about 10 seconds before the collision due to the vessels operating under the No.2 arches and the bridge buttresses. [2.3, 2.6]
3. Although *Sun Clipper* did not sound one prolonged blast on leaving Blackfriars Pier, had the sound signal been made it is unlikely to have been either heard or understood by *Morfil's* coxswain. [2.7]

## SECTION 4 - ACTION TAKEN

The **Port of London Authority** has:

- Prosecuted *Morfil's* coxswain for navigating in a manner liable to injure or endanger persons, or other vessels, under Section 108 of the Port of London Act 1968. The coxswain pleaded guilty to navigating in a manner liable to injure or endanger persons and other vessels before City Magistrates and was fined £2500, with £3366 costs plus a victim surcharge of £15.
- Commenced the formation of the 'Thames Navigators' Club' through which it aims, directly and proactively, to supply the club's members with navigational updates, NTMs and other navigational information.

## SECTION 5 - RECOMMENDATIONS

The **Department for Transport** is recommended to:

2012/109 Expedite the commencement of the subsections to Section 80 of the Railways and Transport Safety Act 2003, in order to implement the limits on the amount of alcohol which may be consumed by persons in charge of pleasure vessels.

The **Port of London Authority** is recommended to:

2012/110 Take action to further enhance the safe navigation of all vessels on the River Thames, taking into account the increased activity expected on the river during 2012, by:

- Introducing as quickly as possible a mandatory speed limit on the areas of the River Thames where such limits have been determined to be necessary by risk assessment.
- Exploring and implementing further means of effectively promulgating local regulations and navigational and safety advice to recreational users of the River Thames, particularly those who are not members of, or affiliated to, the river's established clubs and associations.

**Marine Accident Investigation Branch**  
**April 2012**

Safety recommendations shall in no case create a presumption of blame or liability



PLA Notice to Mariners M3/2011

## **NOTICE TO MARINERS No.M3 of 2011**

### **KINGS REACH**

### **BLACKFRIARS RAIL & ROAD BRIDGES**

### **NIGHT TIME ARCH CLOSURES TO NAVIGATION**

**This Notice supersedes Notice to Mariner M78 of 2010 which is now cancelled.**

Further and in addition to Notice to Mariners M4 of 2010, Contractors working on behalf of Network Rail will continue working at night in two closed navigable arches at Blackfriars Rail and Road Bridges until further notice, subject to the time constraints below.

1. Closure of a second navigable arch **may** occur forthwith between 0030 and 0530.
  - a. From **Friday 28<sup>th</sup> January 2011**, daily until further notice, these hours will be extended so that the second arch may close from 2330.
  - b. If the tide rises above (or is predicted to rise above) 6.2 metres between 2330 to 0030 the arch shall not close until 0030.
  - c. Reporting vessels giving 24 hours notice may request the Harbour Master to delay this earlier closure up until 0030.
2. Monday to Friday the closure shall extend from 0530 to 0630. From 0530 (but not before), reporting vessels giving 24 hours notice may request the Harbour Master to restore two open navigable arches.
3. Saturday and Sunday the night closure shall extend beyond 0530, to 0900. From 0530 (but not before), reporting vessels giving 24 hours notice may request the Harbour Master to restore two open navigable arches.

Outside these times **at least two arches will be maintained open to navigation.**

When two navigable arches are closed to navigation, local traffic control will be established from a Port of London Authority Harbour Service Launch operating in the area. Vessels wishing to pass through the remaining open navigable arch of Blackfriars Road and Railway Bridges or operating between London and Waterloo Bridges are to call "Thames Patrol" on VHF Channel 14 as follow:

- Inbound at London Bridge.
- Outbound at Waterloo Bridge.
- Prior to leaving a berth or mooring between London and Waterloo Bridges.

Arches closed to navigation will be marked on the downstream side on the Blackfriars Rail Bridge and from the adjacent arch on the upstream side of Blackfriars Road Bridge in accordance with the Port of London Authority River Byelaws 1978 (as amended) namely:

- By day, three red discs 0.6 metres in diameter at the points of an equilateral triangle with the apex downwards and the base horizontal.
- By night, three red lights in similar positions to the discs displayed by day.

Construction barges will display the lights and shapes as prescribed in Rule 27 of the International Regulations for Preventing Collisions at Sea 1972 namely:

- By day, three black shapes in a vertical line the highest and lowest of which are balls and the middle one a diamond.
- By night, three all round lights in a vertical line the highest and lowest of which are red and the middle one white.

In addition to closed arch signs suspended from the bridge arches and as back-up; an additional and highly-visible sign will be placed on the barge or barges at least 0.6m above the barge coaming to indicate the arch she is working in is closed.

Additionally, safety boats will be in attendance maintaining a continuous VHF watch on VHF Channel 14.

Further details will be broadcast by London VTS on VHF Channel 14.

Persons in charge of vessels are to navigate with particular care and proceed at slow speed when passing the works.

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**21 January 2011**

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



EXPIRY DATE: TBC  
TO RECEIVE FUTURE NOTICES TO MARINERS BY E-MAIL,  
PLEASE REGISTER VIA OUR WEBSITE [www.pla.co.uk](http://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.



PORT OF LONDON  
AUTHORITY

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PLA Notice to Mariners 12/2009

## 12 of 2009

### **12 of 2009 Lower Pool to Wandsworth Reach - Advisory 12 Knot Speed Limit.**

Over the past eighteen months the Port of London Authority has been reviewing the Port of London River Byelaws 1978 (as amended) in consultation with river users. As part of this process Byelaw 48 (Speed Limits) has been carefully re-examined and it is proposed to introduce a blanket 12 Kt speed limit between Cherry Garden Pier and Wandsworth Bridge in the new Port of London Thames Byelaws (2009).

The risks of collision or contact resulting from growing freight and passenger traffic, the increasing speed differential between different types of vessels and the major construction works in the area, requires action to be taken pending the introduction of the new Thames Byelaws.

### **An advisory speed limit of 12 Kt between Cherry Garden Pier and Wandsworth Bridge is therefore introduced with immediate effect.**

Safety is the responsibility of all those navigating on and using the River, for whatever purpose. All mariners should recognise the significant risks that navigating in central London at high speed brings, and to act responsibly by adhering to the new advisory speed limit.

Attention is also drawn to The International Regulations for Preventing Collisions at Sea 1972 (as amended) Rule 6 (Safe Speed) and the Port of London Act 108 (General rules for navigation) which provides:

A Master who navigates his vessel on the Thames:

- a without due care and attention; or
- b in a manner liable to injure or endanger persons, other vessels, the banks of the Thames (whether above or below mean high water level) or any structure or installation in or beside the Thames;

shall be guilty of an offence and liable to a fine upon conviction.

Date Published: 18-May-09

### **Ends**

Owners, Agents and Charterers should ensure that the contents of this Notice are made known to the masters or persons in charge of their vessels or craft.

Draft Thames Byelaw 16 (Speed limits)



## 16. SPEED LIMITS

16.1 The master of a power-driven vessel navigating in a part of the Thames to which this byelaw applies must ensure that it does not exceed a speed of 8 knots through, on or over the water, provided that this byelaw does not apply:

- a) where the vessel is being used for search and rescue, fire brigade, ambulance, law enforcement, public or recreational safety, security or police purposes or for training for such purposes or for the purposes of the harbourmaster, if the observance of this byelaw would be likely to hinder that use of the vessel; or
- b) where a vessel, having for the purpose of this byelaw been approved by a harbourmaster as one which may exceed a speed of 8 knots through the water, is engaged in  
escorting a rowing boat in training;
- c) where the vessel is being used in connection with any activity involving the use of personal water craft, waterskiing, parakiting or aquaplaning in an area authorised by the PLA or;
- d) where the vessel has been approved by the harbourmaster to exceed a speed of 8 knots through the water, in connection with a river event that is subject to the requirements of byelaw 9, and if it does so in accordance with such approval.

16.2 The parts of the Thames to which byelaw 16.1 applies are:

- a) the Thames above Wandsworth Bridge;
- b) Deptford Creek;
- c) the River Lee or Bow Creek;
- d) Barking Creek;
- e) Dartford Creek;
- f) the creeks to the north and west of Canvey Island and of the island known as Leigh Marsh or Two Tree Island, which are:
  - i) Holehaven, Vange and Pitsea creeks north of line drawn from Holehaven Point on a bearing 270°T; and
  - ii) Leigh Creek, Hadleigh Ray, Benfleet and East Haven Creeks west of a line drawn from Canvey Point on a bearing 000°T to the Leigh-on-Sea shore; and
- g) Yantlet Creek.

16.3 The master of a power-driven vessel navigating between Wandsworth Bridge and Margaretness limit must ensure that it does not exceed a speed of 12 knots through, on or over the water, provided that this byelaw does not apply:

- a) if the vessel falls within the exceptions described in byelaw 16.1 a), or
- b) where a vessel, having for the purpose of this byelaw been approved by the harbourmaster as one which may exceed a speed of 12 knots through the water, is engaged in:
  - i) escorting a rowing boat in training;
  - ii) escorting a boat race or regatta; or
- c) where the vessel has been approved by the harbourmaster to exceed a speed of 12 knots through the water, in connection with a river event that is subject to the requirements of byelaw 9, and if it does so in accordance with such approval.
- d) where the harbourmaster has issued a certificate of compliance, which allows the vessel, subject to continued compliance with the International Collision Regulations (as amended by these byelaws), to navigate up to but not exceeding a speed of:
  - i) 25 knots through, on or over the water in the area of the Thames between Wandsworth Bridge and Lambeth Bridge, and
  - ii) 30 knots through, on or over the water in the area of the Thames between Cherry Garden Pier and the Margaretness limit.

16.4 The master of a power-driven vessel operating under a valid certificate of compliance referred to in byelaw 16.3d) ii), must ensure that it does not exceed a speed of 15 knots through, on or over the water when navigating through the Thames Barrier in the area between Barrier Point Pier and the eastern end of Barrier Gardens Pier, provided that this byelaw does not apply if the vessel falls within the exceptions described in byelaw 16.1 a).

- Notes:*
1. *A certificate of compliance will only be issued when a vessel operator can demonstrate, as a minimum, compliance with the relevant provisions of the High Speed Craft Code and the Small Commercial Vessel Code together with the International Safety Management Code, and the carriage and use of AIS.*
  2. *Further details of the requirements to be met for the issue of a certificate of compliance can be obtained from the district harbourmaster.*
  3. *If, as a result of compliance with a mandatory speed limit, a planing vessel produces unacceptable wash at 12 knots, the master should reduce speed further to ensure that the vessel produces safe levels of wash.*



Extracts from Lord Justice Clarke's recommendations from the 'Formal Investigation into the *Marchioness/Bowbelle* Disaster'

**Extracts from the Formal Investigation report (2001) on the collision between the passenger vessel Marchioness and the dredger Bowbelle, and subsequent sinking of the Marchioness leading to the loss of 51 lives.**

**Part 5 – The Future**

***Alcohol, Drugs and Fatigue***

37.3 Five of the recommendations related to the introduction of legalisation in respect of the control of alcohol and drugs consumption by the seafarers and the application of licensing laws to ships. On 13<sup>th</sup> November 2000 the Department told us that they had put forward legislative proposals and that Parliamentary Under-Secretary of State had written to Ministerial colleagues within government seeking agreement to these proposals. The intention is to include the proposal in a Bill which should be submitted to parliament in the near future. The proposals put forward by the Department are in summary:

1. that the proposed legislation to prevent alcohol abuse aboard waterborne transport should be generally in line with the legislation governing rail and road transport;
2. that the legislation should apply:
  - a) to commercial vessels including fishing vessels **and to recreational water craft**<sup>1</sup> of all description in UK waters, and, in principle, to UK vessels outside UK waters
  - b) in UK inland waters where there is a right of navigation or where the public may have access
  - c) to all those having a safety critical function working on board on account of a commercial vessel including fishing vessels; and
  - d) when underway, to those on board recreational craft having an essential role in its navigation or propulsion;
3. that the legalisation should permit tests for alcohol to be conducted after an accident or when there are reasonable grounds to suspect that an offence has been committed and alcohol has been consumed by those whom legislation applies;
4. that any person found guilty of an offence under the new Act would be liable on summary conviction to a fine and on indictment to imprisonment for a term of not more than two years or a fine or both; any person guilty of an offence who holds a certificate of competency relating to ships or their operation may be liable to that certificate of competency being withdrawn or suspended;

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<sup>1</sup> MAIB emphasis

5. that the legislation should include permissive powers to introduce drug testing of mariners by the police, subject to affirmative secondary legislation, if the need is subsequently shown.

37.4 We expressed our views in section 13 above, with particular reference to the amount which Captain Henderson and Mr Blayney had had to drink on 19<sup>th</sup> August 1989. In short it is our view that both Captain Henderson and Mr Blayney had drunk far more than they ought to have done. Although we formed the view that it was not shown that either was unfit for duty by the time the vessel sailed or that the amount that they had to drink was causative of the collision, we nevertheless strongly deprecate what seems to us to be the irresponsible consumption of alcohol on that day. Those facts seem to us to underline the importance both of the changes in the law recommended by the TSI<sup>2</sup> and now proposed by the Government and the importance of shipowners and managers having a firm policy on alcohol, drugs and fatigue.

37.5 Since the conclusion of the hearing of the FI<sup>3</sup> we have received a copy of the final report by Lionel Persey QC dated 8<sup>th</sup> January 2001 following the recent section 61 inquiry into an incident on board the MATCO CLYDE. We note that the report was signed not only by Mr Persey but also by his assessors, Captain Beetham and Eur Ing WTO Ballantine. The report reached substantially the same conclusions as the TSI and includes the following paragraphs:

9.3 In my oral judgement I said that “it goes without saying that the officers and crews of vessels should never carry out their duties, or be in a position where they may be called upon to carry out their duties, when under the influence of alcohol”, and that this went for vessels of all types and sizes from the largest of tankers to the smallest of workboats or **pleasure craft**.<sup>4</sup> That seemed to me to be nothing more than a statement of the obvious.

....

9.7 The impetus provided by the Thames Interim Report and the DETR Consultation paper has borne fruit. A new Safety Bill was announced in the Queen’s Speech in December 200. I understand that instructions have already been sent to Parliamentary Counsel to prepare the Bill, that it will cover all of those matters that were recommended by Lord Justice Clarke in the Thames Interim Report, and that it will reflect Government policy as set out in the DETR Consultation Paper. In summary, it is intended to make it an offence for any crew member who might be called upon to assist in the event of an emergency to have more than the prescribed amount of alcohol in his breath, blood or urine; for the legislation to cover those in charge of all classes of leisure craft when underway; that the prescribed amount will reflect permissible levels that apply from time to time on the roads; and that

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<sup>2</sup> TSI – Thames Safety Inquiry

<sup>3</sup> FI- Formal Investigation

<sup>4</sup> MAIB emphasis

the police will have the powers to test for alcohol. It is intended that the Bill will be placed before Parliament in the forthcoming session.

9.8 It seems to me that this proposed legislation covers everything that can realistically be hoped for in the criminal field. It is not for me to make any formal recommendations to deal with matters that are already covered by the Bill. I instead simply express my wholehearted support for it. I hope and trust that it will soon become law.

9.9 I would also like to endorse what was said by Lord Justice Clarke at paragraphs 13.1 and 13.12 of his Thames Interim Report. He there deals with alcohol policies. He stresses how important it is for owners and operators to introduce, and thereafter actively to monitor, such policies. The present case was a rare exception. In my view, every shipowners and ship operator should have an active alcohol policy.

37.6 It is perhaps somewhat self-congratulatory for me to support Mr Persey's approach in light of his generous words about the TSI. However I make no apology for doing so because these seem to us to be important matters. Thus we entirely agree with his conclusions in paragraph 9.3 of his report. We also agree with the view expressed in paragraph 9.7 that the proposed legislation covers everything that we can realistically hope for in the criminal field. We turn, therefore to the roles of owners and managers in preventing excess consumption of alcohol or drugs and excessive fatigue.



Extracts from the 'Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations'

## Rule 5

### Look-out

Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

## Rule 6

### Safe speed

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

In determining a safe speed the following factors shall be among those taken into account:

- (a) By all vessels:
  - (i) the state of visibility;
  - (ii) the traffic density including concentrations of fishing vessels or any other vessels;
  - (iii) the manoeuvrability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions;
  - (iv) at night the presence of background light such as from shore lights or from back scatter of her own lights;
  - (v) the state of wind, sea and current, and the proximity of navigational hazards;
  - (vi) the draught in relation to the available depth of water.
- (b) Additionally, by vessels with operational radar:
  - (i) the characteristics, efficiency and limitations of the radar equipment;
  - (ii) any constraints imposed by the radar range scale in use;
  - (iii) the effect on radar detection of the sea state, weather and other sources of interference;
  - (iv) the possibility that small vessels, ice and other floating objects may not be detected by radar at an adequate range;
  - (v) the number, location and movement of vessels detected by radar;
  - (vi) the more exact assessment of the visibility that may be possible when radar is used to determine the range of vessels or other objects in the vicinity.



