

PART II CONSIDERATION OF POSSIBLE FACTORS IN THE ACCIDENT

4. INTRODUCTION

- 4.1 The investigation by inspectors from the Marine Accident Investigation Branch (MAIB) began almost at once. In its course, in addition to obtaining evidence from witnesses, both vessels were inspected and various trials carried out including, so far as was practicable, a re-enactment in similar conditions. Two Research Projects were commissioned, one into tides and the other into environmental factors. Close liaison has been maintained with the Metropolitan Police and the Port of London Authority (PLA), and valuable help has been received from both those bodies and from other organisations and individuals; and the inspectors had full co-operation from the owners of both vessels and their staff, including the crew of BOWBELLE and surviving crew of MARCHIONESS.
- 4.2 Because the inspectors had the benefit of receiving copies of their statements made to the Police, it was not felt necessary or indeed desirable to interview personally many of the surviving passengers from MARCHIONESS; it was clear from those statements that most of the passengers, as was to be expected, were quite unaware of the circumstances leading to the accident. Requiring them to rehearse yet again the events of the night would in many cases simply have added to their distress without any gain to the Inquiry. Nonetheless, some useful evidence was obtained from their accounts, and also from statements made by passengers on board the HURLINGHAM.

5. THE SHIPS, THEIR DESIGN AND THEIR OPERATION

- 5.1 BOWBELLE was built in 1964 by Ailsa Shipbuilding Co Ltd of Troon for British Dredging Group, of Cardiff and London. From the beginning, she was intended to discharge in the Thames and therefore she was designed to have a low air draught so as to be able to pass beneath the bridges over the river. In particular the superstructure was kept to the minimum height and the masts were hinged so that they could be lowered to the horizontal for the river passage; and because of the nature of her employment, requiring a large hold and a long deck area for the dredging gear, all the superstructure, including the wheelhouse, was placed aft. There is thus a poor view ahead from the wheelhouse, particularly when the ship is in ballast and trimmed by the stern; and to starboard the view is further obstructed by the dredging gear. (These features can be seen from the photographs in Annexes 4 and 5). Some improvement would have been achieved if the wheelhouse had been provided with wings extending to the ship's side, but this was not done, apparently because the deck alongside the wheelhouse was required for winches associated with the dredging gear. To get to the ship's side means not only leaving the wheelhouse but leaving the bridge altogether.

The London based operation of British Dredging was acquired some years ago by RMC Group who established a separate company to run the ships, known as East Coast Aggregates. South Coast Shipping, another company operating dredgers, are also a member of RMC Group. In June 1988, the fleets of the two companies were merged for management purposes under the control of the latter: thus at the time of the accident BOWBELLE was owned by East Coast Aggregates, but managed by South Coast Shipping. A total of 14 ships are now under that Company's management. Most of these ships maintain a continuous service and, to facilitate this, each has two complete crews. Management ashore rests with a team of senior personnel, of whom two are Master Mariners and two hold combined First Class Marine Engineer Certificates. There is no specific "designated person", as is recommended in Merchant Shipping Notice M. 1188, but the team does include well qualified marine personnel, two of whom - the Marine Manager, who is a Master Mariner, and the Senior Superintendent, who is a former Chief Engineer Officer - effectively share this responsibility.

Both East Coast Aggregates and South Coast Shipping issued standing orders and instructions; new combined orders have been drafted to replace these now that the ships are under common management, but these had not yet been issued at the time of the accident and BOWBELLE carried both the old sets of orders. There does not appear to be any conflict between the two sets which might lead to confusion, at least in navigational matters. Both sets draw attention to the International Collision Regulations and the need for look-out; they do not go into detail nor, in general, should there be need to do so, for a comprehensive understanding of what is required is legitimately to be expected of Certificated Officers. However, navigation in very restricted waters is a special case for these vessels with their limited visibility from the bridge, and following a series of incidents in the Thames in the early 1980's (see Section 15) an amendment to the (then British Dredging) Standing Orders is reported to have been made with specific instructions on the special need for look-out in the River; but when the Orders were revised in 1987 this amendment was not included.

An inspection of the vessel after the accident indicated no mechanical deficiencies which might have contributed to the collision. The rudder position indicator did not correspond to the actual rudder position, but this fault was known and the instrument was not used. There was slight mal-adjustment of the telemotor but this was not serious enough to affect the vessel's fitness for sea and it had no bearing on the collision.

- 5.2 MARCHIONESS was built in 1923 by Salter Bros Ltd of Oxford as a pleasure cruiser. During the war she took part in the evacuation from Dunkirk, but so far as is recorded she spent most of her life on the River Thames (see Annex 6). In about 1978 she was acquired by Tidal Cruises Ltd who substantially augmented her covered accommodation by providing an upper and lower saloon; the former rose to a rather greater height than the wheelhouse, and thus inhibited vision aft, (this is clearly shown in the photograph in Annex 7). It was, however, possible to see aft by either climbing steps on the aft bulkhead of the wheelhouse and looking through a hatch in the deckhead, or going to the side of the boat. It is reported that MARCHIONESS steered well and that there was no problem in leaving the wheel for a few seconds to do this (though the desirability of having to do so is another matter).

Tidal Cruises Ltd have been managed for the last 12 years, by two licensed Watermen who have long experience of the river. At the time of the accident the Company operated 6 vessels: on day trips, circular cruises and for private hire. The vessels are frequently not manned by direct employees of the Company; in particular, in MARCHIONESS the Skipper and the Mate were an independent company contracted to crew the vessel. However, they had been crewing MARCHIONESS for a considerable period, the Skipper for about 4 years, and the Mate for about 15 months. Any catering staff carried are not, under present arrangements, strictly considered as part of the crew. On private hire cruises a client can, if he wishes, make his own catering arrangements, but when, as on the night of 20 August, he does not, the arrangements are sub-contracted to the crew who employ the bar staff.

No formal standing orders are provided to skippers by Tidal Cruises Ltd, but they are all licensed Watermen with extensive experience of the River. (This, however, does not apply to all Thames passenger craft: see Section 9.4).

Inspection of MARCHIONESS after she was raised was restricted in its value as an indication of her condition before the collision because of the extensive damage, but there was no evidence of any mechanical deficiency which could have contributed to the accident.

6. TIDE: INTERACTION

- 6.1 High Water (HW) London Bridge was predicted at 0448 hrs and HW Southwark occurs some 4 minutes later; the tide in fact made some 8 minutes late, so actual HW at Southwark was about 0500 hrs. Low water (LW) had occurred at 2350 hrs on 19 August, so the collision took place shortly before half-tide. The range of tide was 7.29 metres, which is 0.18 metre less than predicted. The differences between actual and predicted tide are not significant to the accident. It was a spring tide; not the highest of the year, but one of the highest.
- 6.2 Detailed information about tides in the region of the collision has been provided by PLA and a firm of consultants, the latter being commissioned by MAIB to make a full assessment under corresponding conditions one month later. Their findings are that the current runs fairly along the reach with little or no deflection. The rate in mid-stream at half-tide, with a rather smaller range than that of 19/20 August, was about 3 knots, reducing as would be expected nearer the bank. This does not however preclude the possibility of eddies near the bridge piers; PLA suggest that "there would be some disturbance to the flow pattern close to the piers", and indeed it would be surprising if this were not so. This has been discussed with a number of Watermen and others regularly using the river, and the understanding is that eddies do exist but are not generally considered to cause a problem to navigation.
- 6.3 The effect of eddies is unpredictable. It is thought that the most likely effect on MARCHIONESS, if she had the southern pier of the centre arch of Southwark Bridge close to starboard, would be to cause a sheer to port; it is possible that this occurred and the Skipper applied starboard rudder to correct it. As the bow cleared the eddy, but the stern was still affected, momentarily a couple would exist with the tide on the port bow and the eddy on the starboard quarter, so that when the vessel steadied she was heading to the south and to starboard of the intended track. There is some evidence for the vessel coming to starboard. This would lead to an alteration to port to resume the track, and help to explain the fact that the vessels were on converging rather than parallel courses.
- 6.4 The tide is also relevant to MARCHIONESS getting across BOWBELLE's bow, especially if interaction between the two ships was a factor. With a three knot tide, their speed through the water was substantially more than that over the ground, and the effect of interaction is very dependent upon speed through the water. Further, as the boat swung further to port and thus across the tide, it would have a progressively greater effect in setting her on to the other ship's bow.
- 6.5 The phenomenon of hydrodynamic interaction, as it affects ships, is outlined in Annex 8, a cautionary notice issued by the then Department of Trade, Marine Division, (which is now the Department of Transport, Marine Directorate) in 1980. The essential point, so far as the present accident is concerned, is that a positive pressure field exists near both the bow and the stern, and therefore when, as here, a relatively large ship is overtaking a smaller one the latter will tend to sheer across the bow of the former. Where the two vessels are very close the effect can be so great that the small vessel loses all control. It is highly likely that this effect was a cause, probably the major cause, of MARCHIONESS sheering across the bow of BOWBELLE.

- 6.6 Interaction may also have been partly responsible for the initial, relatively slight, convergence of the vessels' tracks rather than (or as well as) tidal eddy as suggested in section 6.3; for well before two vessels are close enough for control to be lost some effect will be felt. Advice from a leading authority on the subject is that with vessels of the size of BOWBELLE and MARCHIONESS, at their speeds through the water at the time of the accident, there would be some effect on the smaller vessel when they were 40 to 50 metres apart. At this range, of course, the effect would be slight and appreciated only as an easily controllable yaw; but the tendency would be for the small vessel to fall off to port. With the slight bend in the river ahead between Cannon Street and London Bridges, an alteration to port would in any event soon be required, and the Skipper of MARCHIONESS thinking the river clear may have accepted this slight falling off and steadied on the course for London Bridge rather earlier than he would usually have done.

7. LIGHTING AND VISIBILITY

- 7.1 Early in the Inquiry it became clear that the essential cause was the failure of either vessel to see the other despite the fact that the atmosphere was clear, it was a bright moonlit night, and in both vessels the wheelhouse was properly manned with, in addition, in BOWBELLE a look-out posted forward. The reasons for the failure must have been partially human, but they were much exacerbated by the physical difficulty imposed by the construction of each vessel and, very probably, by the lights shown by each vessel being inconspicuous against the background of shore lights and perhaps other craft. There was another problem with BOWBELLE in that her masts were down so as to allow passage through the bridges, and the lights carried in lieu of the mast-head lights are low down and can be obscured at close range by the ship's structure.
- 7.2 On the night of 16/17 September, with the moon much as it was at the time of the accident, a down-river passage in BOWBELLE was arranged with the co-operation of her owners to simulate, so far as was safe and practicable, the events of a month earlier. A PLA launch followed the track of the MARCHIONESS and Thames Division of the Metropolitan Police provided a supporting craft. One inspector was on board BOWBELLE and one on board the PLA launch; also on board the PLA launch was an independent consultant specialising in the human element in industry, who had been commissioned to carry out research into relevant human factors, particularly in relation to visual perception.
- 7.3 In fact, conditions were not exactly the same as those of 20 August, as that night was clear and on 16 September there was a good deal of cloud, though this did clear as the exercise progressed. However, conditions were similar enough for the trial to be most useful.
- 7.4 At the time of the exercise, the recommendation in the Interim Report for a light over the bow had already been implemented; good reports had been received of its effect and these were confirmed by observations during this exercise. It rendered BOWBELLE (and another ship showing it which was passed in the River) very conspicuous. However, for the purpose of simulation the light was extinguished for much of the passage, and the contrast was marked. BOWBELLE could still be seen but as the consultant says in his report, her substitute masthead lights did not show up well, and although the inspector found her starboard sidelight more visible than the consultant's report suggests, it is difficult to allow fully for the fact that he knew where to look. It is probably fair to say that with a fairly long and careful look the ship would have been seen; but with a quick glance she could easily have been missed. (The photographs in Annex 9 illustrate this very well). Clearly, the construction of MARCHIONESS with no direct view aft from the wheelhouse encourages the quick glance rather than the long and thorough look.
- 7.5 Equally, the trial confirmed the inadequacy of the view from the bridge of BOWBELLE. The launch could not be seen in any position reasonably close ahead or on the starboard bow. In short, the trial essentially confirms the initial view of the inspectors.
- 7.6 The report prepared by the consultant following the trial and an independent exercise which he carried out on the River Clyde, makes seven recommendations. The first two relate particularly to vessels like BOWBELLE in the Thames, and given the new requirement for a light over the bow, the sense of them is covered. The next three propose the introduction of flashing navigation lights to increase both their conspicuity and, by coding the flashes, their significance to the observer. The sixth recommendation relates

to the link between fatigue and perception and proposes limits on hours of work; while the seventh and last recommendation, returns to conspicuity and proposes that hulls should be painted with alternate light and dark bands. These recommendations, if fully implemented, are far reaching and would affect ships generally, not just those trading in the Thames and other UK waters. There would be need for very extensive discussion internationally as well as domestically, and it is recognised that action in respect of them can only be considered as a long-term project. It is also recognised that some of the proposals are contentious, and in particular reservations will be felt about the proposal for flashing navigation lights: there is no doubt that this would lead to a considerable improvement in their attention-gaining capability, but there are real objections to a proliferation of such lights, particularly bearing in mind the possibility of confusion with the flashing lights on buoys and other navigational marks. Nonetheless, it is considered that the consultant's report merits careful consideration, and it is recommended that it should be submitted to the Department with a request that it be fully examined. The lights required by the Collision Regulations are essentially based (as indeed the Regulations used to say) on "a dark night with a clear atmosphere". With the possible exception of the stern light they are very suitable for the open sea, sufficiently conspicuous but not causing distraction to watch-keepers; but they are much less satisfactory close to a brightly-lit shore. If a means could be developed of improving them in such areas without causing confusion, it would be very valuable to mariners generally.

- 7.7 In one respect more urgent action to improve lighting is needed. It will be appreciated from the chart that as MARCHIONESS made her way down river, she must have been in full view from BOWBELLE's fo'c'sle long before either of the men there observed her. Commonsense says that they must have seen her, but they did not notice her. One reason may have been that she was close to HURLINGHAM, where there was also a disco party with very bright lights which were commented on by several observers; or that she was lost against the background of shore lights. Other river users say that passenger launches are often not readily identified from an overtaking vessel, despite their bright accommodation lights. Therefore, in the short term it is considered that action should be taken with the aim of making such vessels more conspicuous when seen from aft. The stern light has always been something of a poor relation, and difficulty in recognising it is by no means confined to the Thames or to small passenger craft, but a series of trials with such craft on the Thames would be a sensible first step. The detail of the trials should be agreed between the Department and PLA, but it is suggested that there are at least three possibilities for replacing the single fixed stern light which merit test:-

A distinctive arrangement of two or three lights is one;
another is a pair of dual flashing lights in Phi movement;
and the third (tying in to some extent with recommendation
7 of the consultant's report), is the provision of distinctive
marking on the stern illuminated by a fixed light.

If the trials prove successful, it is suggested that they should be extended to other vessels in UK rivers which are particularly at risk to overtaking collisions, especially to barges under tow which, by their nature, obscure the view aft from the tug. The results of the trials should be reported to the International Maritime Organisation (IMO).

- 7.8 Just as important as conspicuity is the ability to see. The recommendation of the Interim Report that the Department should seek to set standards for the construction of ship's bridges is endorsed. Indeed, there already exist standards, agreed by the Maritime Safety Committee of IMO at its 51st Session, and promulgated in the UK by Merchant Shipping Notice M.1264 (see Annex 10), but these are only guide-lines. It is recommended that the

Directorate should actively pursue methods of enforcing them, if necessary with Regulations. For example, bridge wings extending to the ship's side should be a requirement in all but the most exceptional cases.

- 7.9 The Department should pursue this vital aspect of safety in advance of further international agreement, which will inevitably take time: provided that the requirements are clearly set out so that they can be fully taken into account at the design stage, it is difficult to see how they could penalise domestic owners. To this end, plans of proposed new buildings should be submitted for scrutiny. It is also recommended that the Department should take such steps as are reasonable and practicable to improve visibility from the bridges of existing ships which are under their jurisdiction.
- 7.10 On the specific problem of visibility astern from the wheelhouses of Thames passenger launches, investigations by the inspectors lead to the belief that, in spite of the considerable improvements carried out in 1983/84 following the series of minor collisions noted in Annex 11, the situation on many boats is still unsatisfactory and should be looked at again. The type of wheelhouse where the skipper has to leave the wheel and either go out to the ship's side, or climb a ladder and/or raise a hatch in order to see astern positively inhibits the keeping of a proper look-out, and is unacceptable. It is strongly recommended that regulations be introduced governing this aspect of passenger launch construction for new vessels, and that the regulations should also be applicable to existing vessels where the visibility astern does not reach a minimum safe standard. The requirement that a vessel has a low air draught in order to navigate under bridges, thus restricting the height of the steering position, should not take precedence over the fundamental requirement to keep a proper look-out. A satisfactory standard would be achieved if the skipper could see comfortably round a 360 degree arc by moving from say 1 metre to port of the steering position to 1 metre to starboard. If, after exploring all possibilities (including optical devices, on which there have been significant developments in the last few years), it is found impossible to achieve this, then the vessel should carry an additional crew member with the sole duty of look-out.

8. NOISE: COMMUNICATIONS

- 8.1 Broadcasts about BOWBELLE's movements were made at 0103 hrs, when she reported that she was making ready to sail; at 0115 hrs when Woolwich Radio included her as "outbound through bridges" in their regular half-hourly navigation broadcast; at 0120 hrs and at 0135 hrs when she reported herself at Vauxhall and Waterloo Bridges; and at 0145 hrs when Woolwich Radio again reported her in their routine broadcast. If any of these transmissions were received, they ought to have been recognised as providing a warning. The first three were made before MARCHIONESS left the pier, but when the last two were made she was on passage; even that at 0145 hrs (actually timed at 01.44.39) would not have been too late to avert the collision if it had led to the Skipper of MARCHIONESS looking astern as soon as he heard it. The routine broadcast at 0115 hrs, if it had been monitored as would have been wise with the vessel about to leave, would have given good advance warning. The broadcasts were all made on Channel 14, to which MARCHIONESS's set was tuned; the set was almost new and on examination after the recovery of the wreck it appeared to have been in good condition. The volume control was full on, which might indicate a high level of noise in the wheelhouse, presumably from the disco. The Interim Report referred to the possibility that noise had drowned reception, and recommended investigation of sound levels in passenger launches.
- 8.2 Following this, the Department carried out a noise survey in a sample of Thames passenger launches, both with and without a disco in operation. In addition, the inspectors underwent a part of a disco cruise in a passenger launch in order to make a subjective assessment of conditions in the wheelhouse with a party in progress. Unfortunately, there is no vessel exactly like MARCHIONESS, so the results cannot be regarded as demonstrating just what conditions were like on the night of the accident, but they are nevertheless useful.
- 8.3 All "disco boats" are provided with a sound limiting device, restricting noise from the disco to a maximum of 90 dBA, for environmental reasons. With this limiter in operation, the loudest noise within the wheelhouse, in any vessel surveyed, was 83 dBA. This was in the passenger launch during the cruise the inspectors took part in. Engine noise made a large contribution, and this should not have been so marked in MARCHIONESS because of her design, so the wheelhouse in MARCHIONESS is likely to have been quieter, though not much quieter since it is known that the wheelhouse door and the closely adjacent door to the dance-deck were both open.
- 8.4 At that level the noise, though considerable, did not prevent the recognition of VHF signals. However, although the VHF could be heard and understood, the noise might well inhibit reception of broadcasts which were not being specifically listened for, and similarly of whistle signals from other ships. The report of the Directorate's noise survey recommends that the noise level in the wheelhouse should be kept down to 75 dBA, and this proposal is supported. It is worth noting that work reported by W I Acton and A H Middleton of the University of Southampton, Wolfson Unit, some years ago suggests such a figure for R/T reception in small vessels*. For some vessels achieving this figure will require no action; for some it may mean reducing the cut-off level at which the disco limiting device operates, and for others, where the disco is not the main problem, it will require steps to reduce the transmission of engine noise to the wheelhouse. The requirement should, of course, apply to all small passenger vessels and not just those in the Thames.

* Report no 1618 to the Department of Trade & Industry (1974)

- 8.5 Provided noise is kept to the proposed level, there should be no difficulty in hearing the VHF. However, it is a common experience that when any appreciable background noise is present, messages are apt not to be picked up unless the listener is expecting them or is alerted. Advice has been received that at one time navigational broadcasts from Woolwich were preceded by a distinguishing tone to alert listeners; this is an excellent idea, and it is recommended that the practice be resumed and adopted by other Port Authority radio stations broadcasting navigation information. In considering the most suitable alerting tone to be used, consideration might be given to a Report by Dr Roy Patterson of Cambridge University, to the Civil Aviation Authority*, which discusses the most effective tones for such purposes.
- 8.6 It is also, of course, necessary that VHF signals are picked up by the vessel's receiver. This is not always the case in the Thames; in at least some vessels (though there is no evidence that MARCHIONESS was one of them) difficulties have been reported especially in some areas in the vicinity of the bridges. It is suspected, following tests, that the reason lies with the type of aerial system fitted in these vessels; it is recommended that this be further investigated.
- 8.7 A number of letters from members of the public have been received complaining of the noise from disco boats. Clearly the environmental problem is not a subject for the Inquiry, but equally clearly if a disco is so noisy that it is unpleasantly loud ashore, then it is difficult to believe that it has no effect on those in the vessel's wheelhouse; and the effect is not necessarily limited to communication. The Acton and Middleton Report referred to above refers to the effect of noise on work performance generally, and says that "the major area where performance effects are likely to occur is in prolonged or vigilance tasks". Manifestly, conning a launch on a fairly long river cruise is such a task. After quoting various research, Acton and Middleton conclude that significant effects on performance occur only when noise levels are above about 90 dBA. With the disco output restricted at source to that figure by the limiting device, noise in the wheelhouse will be well below that level; but there is some reason to believe that on occasion, in some boats, the limiter is deliberately cut out.

In the trial mentioned in Section 8.2, this was done on request and the disco operator was allowed to increase volume to that which he would use in a party ashore. The volume reached 110 dBA before he was satisfied; when comparing this with the specified 90dBA cut-out it should be remembered that the decibel scale is logarithmic. Therefore the need for the limiter to be operated at all times when the vessel is under-way should be most strongly impressed upon all skippers, and it is agreed that the device should be a surveyable item as recommended in the Directorate's Report.

- 8.8 Though not relevant to the accident, it is also agreed that an over-ride switch to the disco circuit should be provided in the wheelhouse to cut out all disco sound when safety announcements are made over the vessel's public address system, as recommended in that report.
- 8.9 With regard to communications in BOWBELLE, it will have been seen that when at a very late stage the men forward did recognise danger they could only shout a warning. Probably if it had not been for the noise of the disco they would have been heard; but it is clearly not satisfactory that this was the only means of internal communication between them and their ship's wheelhouse. The vessel carried sufficient hand-held VHF sets in working

* Report no 82017 published by the CAA in 1982

order to be used for communication between fo'c'sle and wheelhouse although the Master was under the impression that only one set was working. There was no telephone link, though the managers intended to provide one and this has now been done. External communications by VHF between BOWBELLE and the shore were satisfactory.

9. MANNING AND QUALIFICATIONS INCLUDING PILOTAGE

- 9.1 The manning of both BOWBELLE and MARCHIONESS was fully in accord with the requirements, and all personnel concerned were properly qualified. However, a number of comments have been received, mainly relating to the manning of passenger launches, saying that the requirements are themselves inadequate. Most of these suggest that two men are insufficient for such craft taking into account the need to deal with large numbers of passengers in an emergency, while others question the adequacy of the qualifications required for the launches.
- 9.2 Several submissions have also been received relating to the perceived need for pilots to be carried by vessels like the BOWBELLE.
- 9.3 Dealing with the manning of launches, it should first be made clear that from the evidence, the Skipper of MARCHIONESS was an experienced and competent Waterman, and that the Mate, though obviously less experienced, has good familiarity with the River, is fully capable and was entirely suitable to act in that capacity. For ordinary purposes two men are fully adequate for a vessel the size of the MARCHIONESS. However, in an emergency this may no longer be so. The matter is not strictly relevant to the subject accident since it was so sudden and catastrophic that it is most unlikely that extra crew would have made any difference to the outcome; but it is easy to imagine circumstances, with a vessel damaged and in grave hazard, when the two man crew would be fully occupied in trying to save their boat and no one would be left to assist, reassure and control the passengers. The answer is to make use of the bar staff. It is considered that bar staff should be recognised as crew members and should have elementary training in emergency procedures, especially in assisting passengers.

It is appreciated that the method under which such staff are employed - described in Section 5.2 above - could lead to problems, but it should be possible to overcome these, perhaps by having a register of trained staff. The training, though basic, should be recognised and approved, either by the Department or by the PLA. The Passenger Certificate should stipulate a requirement, linked to the number of passengers actually carried at any given time, that in addition to the minimum operational crew a specific number of persons who have undergone this training should be carried.

- 9.4 With regard to Watermen's qualifications, this accident does not lead to criticism of their adequacy; but it was found in another recent accident on the Thames, fortunately minor, that the passenger boat involved was under the command of an 18-year old Apprentice Waterman; and this is permitted under the present rules. This ought not to be. (The vessel in question was not owned by Tidal Cruises Limited). The subject of Watermen's qualifications has been under discussion between PLA and the Watermen's Company for some time, indeed since before the accident occurred; it is the Company who administer the scheme under the supervision of PLA. There is no objection to this arrangement, for it is considered that the Company have the appropriate experience to administer it and that they take their responsibility seriously, but it is recommended that irrespective of other matters resolved in the discussions there should be an absolute requirement that launches carrying passengers should be commanded by a man who is fully qualified and with recent experience.
- 9.5 The application of medical standards to Watermen has also been under discussion for some time. It has been suggested that the standards for Merchant Navy personnel (set out

in Merchant Shipping Notice No M. 1331) might be appropriate. A detailed consideration of this topic is not within the scope of the Inquiry: it is doubtful if the full MN standard is necessarily called for, but it is recommended that some minimum standards - perhaps an abbreviated form of those laid down in M. 1331 - should be developed, especially with respect to sight and hearing.

9.6 The review of qualifications of Thames Watermen noted above will ensure that those in charge of passenger carrying vessels within PLA jurisdiction will be fully competent. Outside this area, the Boatman's Licence (BML) scheme as set out in Merchant Shipping Notice M. 1036 is available to ensure that those in charge of small passenger vessels have a minimum qualification. While the BML scheme is basically sound, it has a number of weaknesses, and it is recommended that the Department should review it, giving consideration to the following points:-

.1 That the BML be made a statutory requirement for anyone in charge of any small passenger carrying vessel (including those carrying 12 passengers or less) who is not qualified under the Merchant Shipping (Certification of Deck Officers) Regulations.

.2 That the syllabus be reviewed with a view to issuing different grades of licence. The present syllabus covers all types of operation, from a canal barge to vessels carrying up to 250 passengers short distances to sea. It is suggested that three levels of expertise are logical:-

(a) Smooth Waters - non tidal

(b) Smooth Waters - tidal

(c) Partially Smooth Waters/Sea Going

.3 That for categories 2(b) and 2(c), a minimum period of service (say 12 months) be required before examination, and a practical test in a boat becomes part of the examination.

.4 That the syllabus for category 2(c) contains a requirement for basic navigational knowledge, eg chartwork, bearing in mind that at present the holder of a BML can be in charge of a sea-angling boat operating 30 - 40 miles from land.

9.7 As to Pilotage, the present situation is rather curious in that there is no requirement for a Pilot to be carried in any vessel above London Bridge; though in fact, as mentioned in Section 3.5 above, in BOWBELLE both the Master and the Second Mate did have Pilotage Exemption Certificates. However, unofficial "Bridge Pilots" are available and at one time used to be employed by vessels trading up-river, including the BOW dredgers. It is not felt that on the strength of the Inquiry there is evidence that the lack of a Bridge Pilot was a causative factor; it is suggested however that serious consideration should be given to extending the pilotage limits to cover all reaches of the River used by sea-going ships; and it is recommended that Exemption Certificates should only be granted to officers under strictly controlled and clearly set out conditions.

9.8 Several submissions on hours of work have been received. There is no doubt that those navigating vessels, whether on the River Thames or elsewhere, often carry out very long periods of duty, but so far as the subject accident is concerned, as has already been mentioned, the Master of BOWBELLE was well rested. As to the Skipper of MARCHIONESS, the evidence is that on 18 August he spent most of the day on cleaning

and maintenance work and undertook one evening cruise. On 19 August he was off duty until late afternoon and told his wife by telephone (she was away that weekend) that he was having a quiet day. Whether he slept during the day is not known. He said he was going to Westminster Pier at 1600 hrs to prepare for the night's two cruises. The first of these took place between about 1900 hrs and 2245 hrs. Thus, at the time of the accident the Skipper had been on duty for some 9.5 hours overall, but only on the River for less than half that time, and even by the end of the cruise he would have only had some 8 hours on the River, during which his duties were shared with the Mate. It is not thought his period of duty can really be considered excessive bearing in mind the relatively lightly-worked time preceding it. On the other hand, perception falls off and re-action slows before a person is really exhausted. It is unwise for launch skippers to undertake two successive cruises without a break at night, and it is considered that some degree of tiredness cannot be ruled out as a factor in the Skipper's failure to see BOWBELLE, although there is no firm evidence to support it - indeed, rather to the contrary, the evidence tending to suggest that he was alert and lively. The Department have the regulation of hours of work under consideration; it is recognised that there are serious difficulties with this subject, and that it is not possible to legislate absolutely against tiredness, but it is recommended that the subject be pursued despite these difficulties, and that consideration should include river craft as well as sea-going ships.

10. RIVER THAMES REGULATIONS AND TRAFFIC CONTROL

- 10.1 The navigation of both vessels should have been governed by Part IV of the Port of London Authority Bye-laws, which largely incorporate the International Regulations for the Prevention of Collisions at Sea. Rule 13 of the latter requires an overtaking vessel to keep out of the way of a vessel being overtaken. PLA Bye-law 19 requires a vessel of less than 40 metres in length not to impede the passage of a vessel of more than 40 metres: this Rule applies above Cherry Garden Pier, which is just below Tower Bridge. (Extracts from both the Collision Regulations and PLA Bye-laws are given in Annex 12.) There is no reason to suppose that these requirements would not have been complied with, and the collision averted, if either vessel had recognised the presence of the other in sufficient time.
- 10.2 There is a further requirement in the Collision Regulations (Rule 9) that a vessel proceeding along the course of a fairway shall keep as near to the outer limit on her starboard side as is safe and practicable. PLA Bye-law 16 says that Bye-law 19, mentioned above, is "additional to and shall not derogate from" the Collision Regulations as modified by that Bye-law. This is taken to mean that vessels small enough to be able to do so ought, so far as possible, to keep out of mid-channel and use the starboard side of the river even when the fairway is clear and Bye-law 19 therefore does not apply. However, there is clear evidence that this interpretation has not been generally recognised and that small vessels frequently "take centres" (ie use the centre arches of bridges) even when there is no need to do so. In May 1987 PLA were sufficiently concerned about this to instruct their Harbour Service Patrol launches to look out for infringements of rule 9, board the vessels involved, and issue the Master with a warning letter. In 1988 a Notice to Mariners was issued by the Authority which, though primarily on a different subject, also contained a reminder of the need to comply with Rule 9. Despite these steps, the practice did not cease: over a hundred warning letters were issued between May 1987 and August 1989, an average of nearly one a week. Clearly, Rule 9 was widely ignored on the River. Moreover, so far as the present case is concerned, in the particular circumstances just before the collision, MARCHIONESS was overtaking HURLINGHAM and it was no doubt quite natural not to cut in ahead of her but to continue through the centre arches. The Interim Report recommended that Bye-law 19 be strengthened with the aim of keeping small vessels out of the middle of the fairway and that the possibility of traffic segregation, and of a tighter measure of traffic control generally, should be examined.
- 10.3 PLA have examined these matters. Their conclusion, which is accepted, is that total segregation - which in effect would mean banning the use of the centre arch of bridges to the smaller craft - is not practicable. For many such craft, and for much of the time (depending on the state of the tide) the side arches are not passable so the requirement would have to be qualified by so many exceptions that confusion would arise and in the end more harm than good would be done. However, the Authority are considering introducing a signalling system to control navigation through the bridges. This initiative is welcomed and it is strongly recommended that it be further and urgently pursued.
- 10.4 A fully comprehensive system of traffic control from ashore, covering all vessels, is not practicable nor necessary in the Thames provided that the limited system proposed in section 10.3 is successfully developed. However, even without exercising full control, Thames Navigation Service (TNS) should have as full a picture as possible of traffic movement. To this end, PLA have increased the number of way points at which large vessels should report.

10.5 It will be noted from Annex 12C that some amendments have recently been made to the Collision Regulations, coming into force in November 1989. It will be clear from the foregoing that it is most unlikely that these amendments would have had any effect in preventing the accident, had they been in force when it happened.

11. CONSTRUCTION AND STABILITY

- 11.1 The construction of the two vessels, in as much as it restricted the visibility from their wheelhouses and thus bore heavily upon the accident, has already been discussed. This Report would, however, be incomplete without some consideration of the construction of MARCHIONESS, and her stability, from the point of view of her capability to survive damage.
- 11.2 It was clear, even from a cursory inspection, that fundamentally MARCHIONESS was soundly constructed and, despite her age, had maintained her strength well; and this first impression was confirmed when more detailed examination took place. In spite of the heavy impact which she sustained, her hull was not severely ruptured and the cause of her sinking was ingress of water primarily through deck openings when she was rolled over, not through her damaged hull. This ingress led to rapid flooding virtually overall, so that sinking was inevitable whatever inherent stability she had and irrespective of her sub-division arrangements. Nonetheless, an examination of these items seemed desirable, if only to see whether lessons can be learnt to prevent a further less catastrophic accident in a similar craft leading to disaster. Such an examination has accordingly been carried out by Naval Architects within MAIB.
- 11.3 Their calculations show that, at the time of her loss, for the intact state MARCHIONESS had a positive GZ range of some 55 degrees with a maximum GZ of 0.93 feet (0.28metres) at 28 degrees heel. The GM was 2.4 feet (0.73 metres). However, these figures had little meaning for at an angle of heel of about 19 degrees flooding of the engine compartment would begin through the air inlets, and at 21 degrees the lower saloon would begin to flood through the open windows. As to construction, MARCHIONESS was sub-divided forward, but she would sink with the lower saloon flooded even if all other compartments remained intact.
- 11.4 The stability and sub-division standards required of Class V vessels depend upon whether they are regarded as fully-decked, partially-decked or open. It is only for fully-decked ships that detailed requirements are set out in the Regulations. Historically, this is because it is not practicable with craft which are fully or partly open to achieve the same standards of resistance to flooding and capsize as with a fully-decked vessel; but neither is it so necessary since the passengers should be readily able to escape if the worst should occur. However, the definitions are not as simple as they seem. The tendency for some years now has been both with conversions and new buildings for basically open or part-decked boats to have the passenger accommodation covered in: the covering is relatively insubstantial, there is no comprehensive under-deck sub-division as is required in fully-decked boats, and there are many windows and other openings through which water can flood if the boat takes a heavy list; yet it is sufficient to inhibit escape, as compared with a truly open craft. It has been pointed out in the past that the situation is not satisfactory, and has led to what look to be very similar vessels being made subject to quite different requirements because of a rather arcane distinction as to the nature of the "deck" with which they are provided. MARCHIONESS, after her conversion, exemplified this. Regarded as she was as partially-decked she met the requirements, but had she been considered fully-decked she would not have done so, both because of the loss of water-tight integrity at about 20 degrees of heel and because she would sink with only the lower saloon flooded: fully-decked vessels must withstand the flooding of any one compartment below the deck.
- 11.5 One way which has been proposed to resolve the inconsistency is to require that all Class V vessels carrying a substantial number of passengers (say, more than 50) must be fully-

decked, so that they would have to meet the specifications for such craft which are clearly laid down. There are, however, some reservations about this idea. In such vessels as MARCHIONESS, it would mean that the lower saloon would have no opening windows; but a number of passengers (how many cannot be certainly said) escaped through the windows in the saloon when MARCHIONESS capsized. Although windows ought not to be regarded as a primary means of escape, they are a valuable addition in a catastrophe when the need for evacuation is most urgent. Whilst it is agreed that the present situation is unsatisfactory, it is felt that revision should take particular account of the fact that if a major accident befalls a small vessel she may need to be abandoned very quickly indeed. The suggestions for revision are therefore rather different from that mentioned at the beginning of this paragraph.

- 11.6 Only those Class V vessels which can, in a proper and understandable sense, be regarded as small ships rather than large boats should be treated as fully-decked and subject to the full requirements of the Passenger Ship Regulations. It is recognized that to develop a satisfactory definition will be difficult but it should not be impossible. For other craft, in any vessel with covered accommodation, the first priority should be to ensure means of escape, and especially that there is ample provision of wide doors and stairways. It is important that exits are not obstructed; in MARCHIONESS loose furniture shifted across the saloon and some of it appears to have blocked at least one stairway. It is recommended that furniture should be secured while vessels are on passage.
- 11.7 There should also be a further distinction between those vessels which work solely in very restricted waters - canals and non-tidal rivers where the bank is never more than a few feet away and the depth of water is such that there are few places where it is possible for the boat to submerge fully - and those which operate in more open waters. The latter should be required to incorporate measures against sinking: but again bearing in mind that they are large boats rather than ships, it is suggested that as alternatives to sub-division such possibilities as foam-filled tanks and flotation devices should be explored. Susceptibility to down-flooding should be critically examined, despite what has been said above, and there should be no openings lower than those essential for escape. The stairways and doors for escape from the accommodation should give egress to a platform where passengers can muster, for accidents other than capsize can occur: in boats with very limited deck space (like many pleasure launches) there therefore needs to be emergency access to the cabin roof. It is appreciated that this means that the roof must be capable of supporting the passengers, both structurally and with respect to stability, and this may cause problems, but it is not thought satisfactory that the only alternative to remaining in the accommodation should be to jump in the water.
- 11.8 So far as intact stability is concerned, the existing requirement for a practical test, as set out in Appendix E to Instructions to Surveyors on the Survey of Passenger Ships, Volume II, is appropriate and sufficient, provided that it is carefully carried out and realistically represents the vessel's likely range of operating conditions. It should apply to all non-fully-decked vessels of Class V, and include, where appropriate, a check on the emergency situation with passengers on the cabin roof, as pointed out in the preceding paragraph.
- 11.9 Clearly, consideration of these suggestions implies a fundamental review of the requirements for Class V vessels; such a review is recommended. It is hoped that when it is complete the requirements (whether as suggested above or otherwise) can be clearly set out so that the present degree of confusion can be eliminated.