Report on the investigation of

Nottingham Princess

striking Trent Bridge Nottingham

on 15 November 2002

Marine Accident Investigation Branch
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Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1999

The fundamental purpose of investigating an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 1999 is to determine its circumstances and the causes with the aim of improving the safety of life at sea and the avoidance of accidents in the future. It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

Note

This report is not written with liability in mind and is not intended to be used in court for the purpose of litigation. It endeavours to identify and analyse the relevant safety issues pertaining to the specific accident, and to make recommendations aimed at preventing similar accidents in the future.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

BW	-	British Waterways
°C	-	Degrees Celsius
Category B waters	-	Wider rivers and canals where the depth of water is generally more than 1.5 metres and where the significant wave height could not be expected to exceed 0.6 metres at any time
CCTV	-	Closed circuit television
Class V	-	Passenger ships engaged only on voyages in category A, B or C waters.
DJ	-	Disc-Jockey
EA	-	Environment Agency
hrs	-	hours
Inland waterways	-	The definition of inland water, adopted for this report, embraces navigable rivers, canals and lakes
LSA	-	Lifesaving appliances
m	-	metre
m^3/s	-	cubic metres per second
MCA	-	Maritime and Coastguard Agency
MGN 20(M+F)	-	Marine Guidance Note 20: Implementation of EC directive 89/391 Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997
N	-	Newton: SI unit of force
NSWL	-	Normal summer water level
rpm	-	revolutions per minute
UTC	-	Universal Co-ordinated time

SYNOPSIS

On 15 November 2002, during an evening river cruise, the river cruiser *Nottingham Princess* collided with repair scaffolding around the centre arch of Trent Bridge, Nottingham.

The river was high and flowing at about 5 to 7 knots. One serious injury and 34 minor injuries were reported among the 130 passengers and 9 crew on board. The vessel suffered mainly superficial damage.

The accident happened when the vessel was cruising upriver in darkness, through the centre arch of Trent Bridge. Her starboard quarter struck scaffolding under the arch, and the strong river current came on to the port bow, pushing her bodily to starboard. She was pinned on the upriver side of the bridge's north buttress, where she received further damage as a result of a scaffolding pole going through one of the windows and side plating on the lower deck.

With the assistance of the emergency services, the passengers evacuated the vessel, initially by climbing the scaffolding and, later, using a hydraulic platform. She was unable to be freed from the bridge until the afternoon of Monday 18 November, after which she underwent repairs and resumed service.

The cause of the accident was loss of control of *Nottingham Princess* while transiting under the Trent Bridge because of the high level of the river, which caused a fast, confused flow through the centre arch, and scaffolding, which reduced the safe navigable width of the arch.

Recommendations have been made to all inland waterways navigation authorities, that all river works should be designed and built to minimise risk to river users, and to promulgate information which may affect the safe navigation of their rivers. Further recommendations have been made to the MCA with respect to the identification, by risk assessment, of the level and type of lifesaving apparatus to be carried on vessels, and the completion of a formal risk assessment on the hazards which may imperil a vessel.

Figure 1

Nottingham Princess

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *NOTTINGHAM PRINCESS* AND ACCIDENT

Vessel details

Registered owner	:	Endeavour Northern Limited
Port of registry	:	Hull
Flag	:	UK
Type	:	River cruiser (Class V category B)
Built	:	Newark 1997
Construction	:	Steel
Length overall	:	24.5m
Gross tonnage	:	About 80
Engine power and/or type	:	Twin Ford Genesis 4 cylinder diesel engines 81 BHP at 2200 rpm continuous rating with fixed pitch, outward turning propellers
Maximum speed	:	About 10 to 11 knots
Service speed	:	About 6 knots
Other relevant info	:	230 N bow thruster hydraulically-driven from main engine

Accident details

Time and date	:	2035 UTC, on 15 November 2002
Location of accident	:	Trent Bridge, River Trent, Nottingham
Persons on board	:	130 passengers + 9 crew (including DJ)
Injuries/fatalities	:	1 person had 3 days or more off work, 34 reported bruising, cuts and aches
Damage	:	Mainly superficial damage to vessel; indentations, broken window, fittings damaged
Wind	:	10 knots from a southerly direction
River flow	:	5 to 7 knots at Trent Bridge

1.2 BACKGROUND

1.2.1 *Nottingham Princess*

Nottingham Princess **(Figure 1)** was a purpose designed, twin decked steel hulled river cruiser, built and operated solely on the river Trent. She was certificated by the Maritime and Coastguard Agency (MCA) as a Class V passenger vessel for use only on category B waters, with a restriction, limiting her to the river Trent between Wilford, Nottingham and Newark. She was certificated to carry 172 passengers with a minimum crew of 3. One crew member was required to have a boatmaster's grade 2 certificate. She was limited to 90 persons on the upper deck.

Nottingham Princess had a British Waterways licence allowing her to operate on the river. She also had a domestic passenger vessel safety management certificate and a search and rescue co-operation plan. She carried 32 lifebuoys, 5 x 10-person buoyant apparatus and 3 lifejackets. She had a draught of about 1.3m and an air draught of about 4.8m. Her maximum engine speed of about 2200 rpm gave a speed of about 10 to 11 knots in still water. She normally operated at about 800 to 1000 rpm to keep to schedules.

Because of the vessel's air draught, the maximum river level datum the vessel would attempt to pass under the bridge was 21.4m. This is 0.65m above the normal summer water level of 20.75m and normally gave a clearance of just over a metre in the centre of the arch. She could pass under about 77% of the arch, until the curvature of the arch was such that the clearance was insufficient **(Figure 2)**.

The wheelhouse was situated forward. The only view astern from the wheelhouse was through the upper deck bar. The vessel had CCTV cameras on the stern, by the gangway, on the lower deck and on each external side looking aft.

She operated all year round, in both directions from her moorings in Colwick, Nottingham and, quite often, had cruises twice a day at lunch time and in the evening. When operating upriver, she would go under four bridges to Wilford, before turning and heading back to her moorings. An evening cruise normally took about 3 hours.

In 1997, while on an evening cruise, *Nottingham Princess* struck a submerged car, through no fault of the vessel, and badly damaged her propellers.

Sailings have been cancelled in the past because of excessive winds, fog, mechanical reasons and, on one occasion, when the river burst its banks.

Another vessel, *Trent Lady*, also operated all year round. She was owned by Trent River cruises and was also based at Colwick.

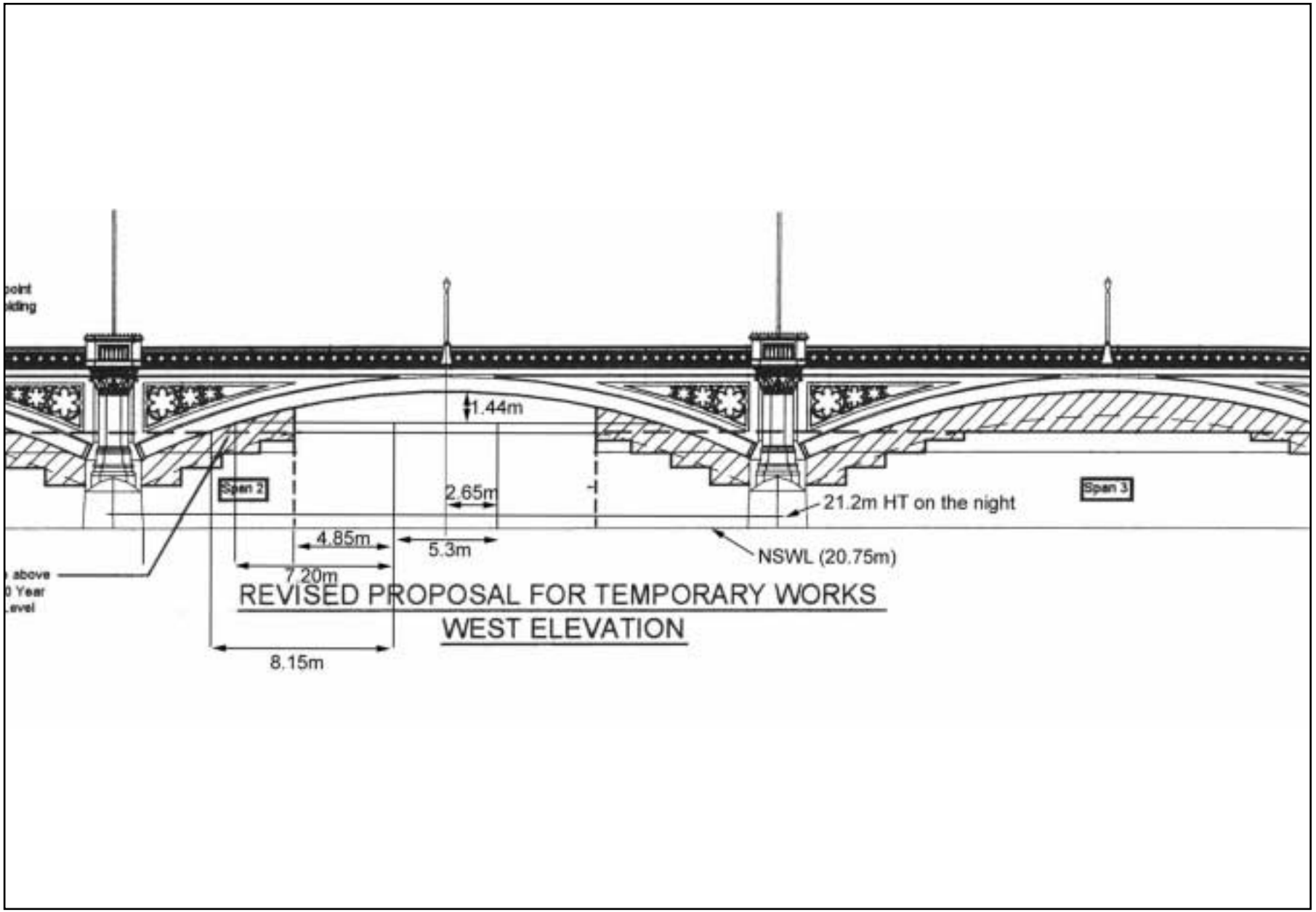


Figure 2

Centre span from the west

1.2.2 River Trent

The Trent is tidal up to Cromwell lock near Newark, some 20 miles downriver from Trent Bridge **(Figures 3a and 3b)**. The level upriver of Colwick is controlled by the use of sluices, operated by the Environment Agency (EA). The sluices operate automatically to maintain a minimum level, they are rarely closed, being either full or partially open the majority of the time. The EA is responsible for reducing the likelihood of flooding from the river and for protecting the river from pollution. British Waterways (BW) is the navigation authority responsible for the safety of navigation on the river. The EA does not have direct contact with the river users. The EA website contains various information and news, but does not include specific information regarding the river height or flow, closures, or works on rivers. The minimum level to maintain in the river is agreed with BW.

BW issued restriction notices regarding any safety-related navigation matter. At the time of the accident neither of the owners of *Nottingham Princess* or *Trent Lady* were on the circulation list for these notices.

BW also holds river user group meetings at approximately 6 monthly intervals. Before the accident they were held in April 2002 and October 2002. At the time of the accident, *Nottingham Princess*'s owners were not on the user list for these meetings, however, *Trent Lady*'s owners were.

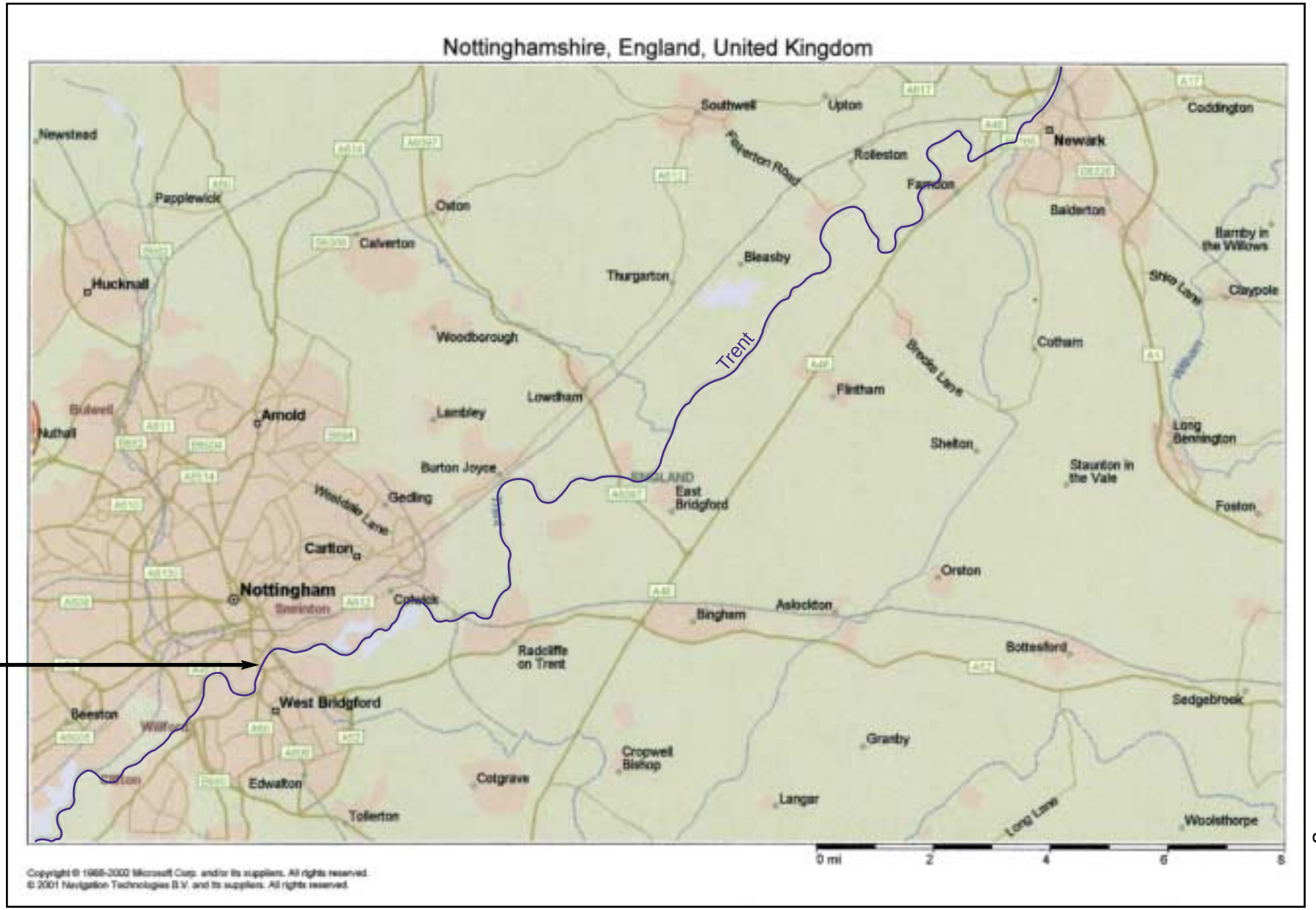
BW also requires boat owners to be licensed to use the river. For commercial vessels, the MCA certification and third party insurance is required to be sighted before the licence is issued.

BW legislative powers come from the British Waterways' General Canal Bye-Laws 1965. BW has allocated specific telephone numbers for reporting emergencies, and for obtaining the latest news, restrictions and unscheduled stoppages. BW's website includes various information concerning its areas of responsibilities and latest news items. The Trent Bridge works was not mentioned on the website.

BW also has a code of practice for works affecting British Waterways.

Although there were gauges, in various locations, where the height and/or flow of the river could be observed, there were no remotely accessed gauges on the river. The position of the sluices was not promulgated to river users.

Until 2001, when it was withdrawn, the local police operated a launch on the river.



Site of accident

Figure 3a

Map showing River Trent

Figure 3b

Map of the river Trent in Nottingham

1.3 TRENT BRIDGE

1.3.1 Background

Trent Bridge **(Figure 4)** is a three span arch structure of 25 metres width, with each span being approximately 30 metres in length. The bridge was built in 1871, widened in 1922 when the steel arches were installed, and carries the A60, also known as London Road. It is located about 3 miles to the south of the city centre, and is a primary route into and out of the city, with an annual average daily traffic flow of 47,500 vehicles.

Figure 4

Trent Bridge

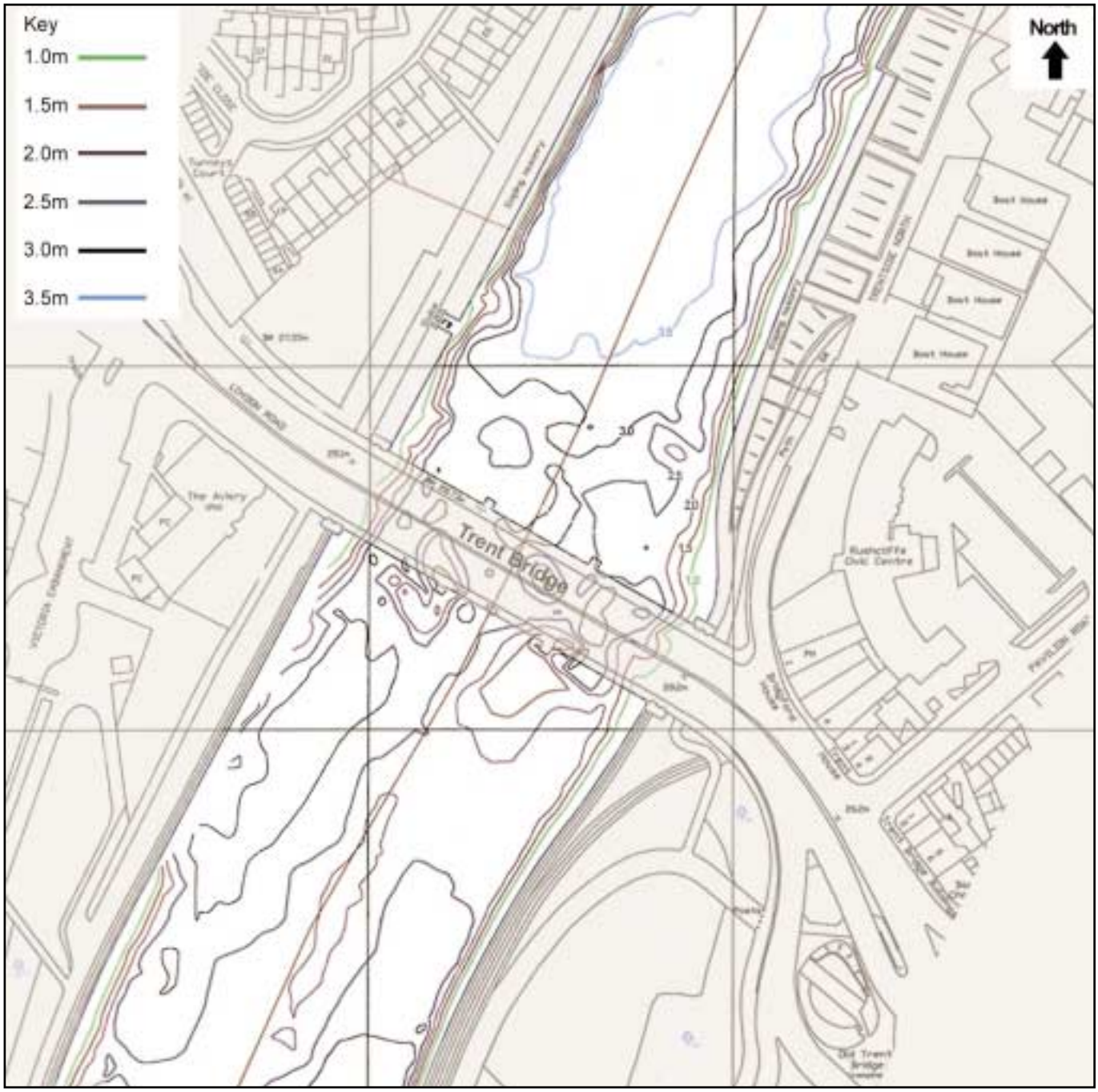
The bridge has stone and brick abutments and piers, while the arches, deck and parapets are a mixture of cast iron and steel. The bridge is a listed structure.

This part of the Trent is effectively a “cul-de-sac” for water traffic because of the low bridge restriction at Wilford. Most through-traffic heading upriver leaves the Trent at the Nottingham-Beeston canal, close downriver of Trent Bridge.

The river boats normally use the centre arch for navigation. There is insufficient water depth to use the south arch, while the north arch, although occasionally used in the past, brings the boats close to the riverbank where they can be affected by interaction with the bank.

The flow under the bridge during high water levels is often confused, consisting of eddies and whirlpools, as the water is funnelled between the two arches. There is also a patch 1.5m deep immediately upriver of the southern buttress. For the river depths in the vicinity of the bridge **(Figure 5)**.

Figure 5



River Trent depths

1.3.2 Repainting

The bridge was last painted in 1987. Nottingham City Council intended to repaint it during the summer of 2002.

The contract for painting the bridge was put out to tender in early 2002, and the contract was subsequently awarded to TI Protective coatings. British Waterways and the Environment Agency were informed. An application for flood defence consent was made by the council to the Environment Agency. This application was initially refused because of a lack of details, but was granted on the second attempt, on 3 April 2002.

The pre-tender method statement, which the council issued in early 2002, mentioned *Nottingham Princess* as being one of the principal river users. It also identified collision between water users and the temporary works on the bridge as one of the possible hazards from carrying out the works. Signage, lights and ensuring the scaffolding was securely fastened, were identified as potential control measures. The contractors made a risk assessment with regard to the hazards faced by their workstaff.

BW and the council had a period of consultation in early 2002 regarding navigation issues and river users. On 1 February 2002, the council informed *Nottingham Princess*'s owners of the intention to paint the bridge during the summer of 2002, and estimated the work would last for about 16 weeks. The centre span would be reduced from 30m to 15m in navigable width, but not fully scaffolded like the other two spans. The buttresses were scaffolded to the riverbed on the upriver side **(Figure 6)**.

On 17 May, the council informed *Nottingham Princess*'s owners that work would start on June 6. In early August, the project was behind schedule. It was also becoming apparent that the existing paint system was in a poor condition. The new paint manufacturers could not guarantee that their paint would adhere to it, therefore, the decision was made to grit-blast the bridge before painting. The project completion date was put back until the end of November.

At the end of July, BW told the council to ensure that the contractor maintained contact with the river users. The site foreman spoke, on an informal basis, to *Nottingham Princess'*s skipper whenever they saw each other. BW was making regular site inspections throughout the work.

On 16 September 2002, the council informed BW that they did not believe that *Nottingham Princess* operated between October and February; BW were under the same impression. At the end of October, consideration was being given to using the North span for navigation and closing off, through scaffolding, the centre span for blasting.

Figure 6

Scaffolding around southern buttress

1.4 THE CREW

Nottingham Princess's skipper was 59 years old, and held a boatmaster grade 2 licence. He was the only licensed crew member on board. He had been with the company for 5 years and was one of two skippers on *Nottingham Princess*. He had also been on fire-fighting and first-aid courses. Before the accident, he had had 8 hours sleep in the previous 24 hours, and had consumed no alcohol during that period.

The remaining eight crew consisted of three bar staff, two barstaff/chefs, one waitress, one mate and the disc jockey (DJ). All had attended at least one internal crew training day, run by the owners. This consisted of familiarisation and safety training relevant to working on *Nottingham Princess*, some of which was in excess of the regulatory requirement. One of the barstaff/chefs had also been on a fire safety course, and the mate had been on first-aid training and a food and hygiene course.

At the time of the accident, the crew were located in the following areas of the vessel:

Rank	**Position on vessel**
Skipper	Wheelhouse
Mate	Going up aft stairs
Bar staff 1	Upper deck bar
Bar staff 2	Upper deck bar
Bar staff 3	Bottom deck bar
Barstaff/chef	Bottom deck bar
Barstaff/chef	Serving food upper deck
Waitress	Serving food upper deck
Disc Jockey	Starboard bridge wing

1.5 ENVIRONMENTAL CONDITIONS

Normal summer water level is at a datum height, not river depth, of 20.75m. This level is shown in **Figure 2**. At the time of the accident, the level at the bridge was known to be around 0.45m above this level, at about 21.2m.

Heavy rain had been experienced in both the Nottingham area and the areas upriver on the day preceding the accident. The river levels and flow rates, as recorded by the EA, are shown below:

River levels (datum heights in metres):

Location	Annual mean	Nov mean	10/11	11/11	12/11	13/11	14/11
Clifton Bridge	21.25	21.83	22.59	22.47	22.07	22.07	22.45
Colwick	17.60	18.40	19.29	19.18	18.73	18.69	19.12

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Location	Mean	High	Low	2000hrs	2100hrs
Clifton Bridge	22.60	22.67 (10:30)	22.56 (08:45)	22.59	22.59
Colwick	19.30	19.39 (10:45)	19.24 (06:30)	19.31	19.30

Flow rates at Colwick sluices(m^3/s):

Annual daily mean	Nov daily mean	10^{th} mean	11^{th} mean	12^{th} mean	13^{th} mean	14^{th} mean
101.62	205.14	338.45	319.90	250.01	244.47	310.90

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15^{th} mean	15^{th} Max	15^{th} Min	15/2000	15/2100
340.70	354.92 (10:45)	330.88 (06:30)	342.18	339.55

At the time of the accident it was overcast, fine and clear. Wind speed was about 10 knots from a southerly direction. The air temperature was about 6°C. The river water temperature was about 7°C. The flow speed at Trent Bridge was estimated, by various parties, to be between 5 and 7 knots.

1.6 NARRATIVE

On the evening cruise of Sunday 10 November 2002, *Nottingham Princess* was under the command of the second skipper, who was not on board at the time of the accident. On that night the vessel had been set over close to the scaffolding while passing upriver under the bridge. On the night of Monday 11 November, under the command of the skipper on board at the time of the accident, the vessel was again set over close to the scaffolding.

The two skippers consulted each other regarding these incidents and agreed that, although the river was high on the nights in question, a possible cause was the flotsam, which had gathered around the upriver southern buttress scaffolding. This diverted the flow through the centre arch and was considered to have set the vessel towards the northern buttress.

The skipper, who was on duty on the Sunday, reported this to the vessel's manager. The manager called the local British Waterways patrol officer, who referred him to the city council. The council project engineer then contacted the site foreman, who arranged the clearance of the flotsam, on Wednesday 13 November, from the scaffolding around the upriver southern buttress, using a boat. *Nottingham Princess* had sailings on the afternoon of 12 November and the evenings of 12, 13 and 14 November. On the morning of Friday 15 November, both the council and BW representatives visited the site and reported that the scaffolding was clear of flotsam.

Passengers started boarding *Nottingham Princess* at 1945 for the evening cruise of Friday 15 November. The skipper observed a river level of 21.2m datum height from the gauge by the berth. He estimated, by eye, the river to be flowing at 3 to 4 knots by the berth. At around 2005, the vessel left her moorings with 130 passengers and 9 crew on board. The cruise included complimentary bar and food. The passengers were in six different parties.

On leaving the berth, the normal safety announcement was made and the vessel proceeded upriver. The skipper adjusted the main engine revolutions to about 1200 rpm which was slightly above normal because of the flow.

The crew began serving food almost immediately, on the upper deck port side. The DJ was not working while the food was being served, and was in the wheelhouse talking to the skipper.

Trent Lady was also on the river that evening, and was some distance astern of *Nottingham Princess,* also proceeding upriver.

As the vessel passed the Nottingham/Beeston canal entrance, the skipper increased the revolutions to about 1400 and, using two small white lights situated above the centre arch, lined up to pass under the centre arch of Trent Bridge. As the vessel approached the bridge, he increased the revolutions to about 1600. The skipper was aware of the two incidents earlier that week, and had not worked since the Monday night. He was, therefore, concerned about being set over towards the scaffolding. He asked the DJ to look over the starboard bridge wing and check the clearance from the scaffolding. His visibility aft was obstructed by the passengers and crew on the top deck, and the view from the CCTV was of limited use because it was night time.

As the vessel began passing under the bridge, at 2035, she became set over to starboard without any discernible change in her heading. The vessel struck scaffolding about two-thirds of the distance through the arch. The DJ told the skipper that the vessel had just struck the scaffolding. There was a loud “metal to metal” scraping noise, and the vessel heeled over to port and came to a stop. Food, drink, chairs, tables and other fixtures were thrown on to the decks. Plates and glasses were smashed. Some passengers were also thrown to the deck, either from their seats or from a standing position.

The vessel had become partially fast on horizontal scaffolding poles, which had scraped a short distance along the starboard quarter close to the funnel. Her head was then turning to starboard as the river current came on to the port bow. The skipper put the engines out of gear, to use full power on the bow thruster to port. He also put the rudder hard over to starboard in an attempt to crab the vessel off the scaffolding to port.

The vessel was then under the control of the river current, despite the skipper’s attempt to bring the head to port, by using the bow thruster. She came free of the scaffolding under the bridge and pivoted, to starboard, around the corner of the scaffolding on the upriver city side buttress, and out from under the bridge. She came to rest in a position where she was effectively “pinned” against the buttress at 90° to the river flow. On striking the scaffolding on the upriver side of the buttress, further damage was done; a pole came through a window on the lower deck, missing passengers who had just left their seats under the window. A hole was also made in the side plating in this location. The vessel heeled as she struck the scaffolding, before coming to rest heeled to port.

The skipper checked the bilge alarms and confirmed *Nottingham Princess* was not taking on water. The mate went to the wheelhouse and the skipper told him to check for injuries. The skipper contacted the emergency services on his mobile telephone. He then made a short announcement to the passengers, stating the vessel was not taking on water and asking them to sit down and to remain calm.

The emergency services arrived on the Trent Bridge shortly after the skipper had contacted them. The vessel was secured with lines at each end. Some crew members went among the passengers, seeing if they were all right and trying to reassure them. Many passengers were in a state of shock. A heater, left running on the aft end of the upper deck, was switched off.

The bars did not stop serving, and several passengers appeared to be content to stay by them and continue drinking. Some passengers picked up lifebuoys, and stood with them around their waists, on the upper deck.

Passengers started to evacuate the vessel, using a chair on the starboard upper deck to climb over the handrails and then on to scaffolding. Once on the scaffolding platform, a series of ladders took the passengers on to higher platforms and then eventually on to the bridge. Crew members were assisting the passengers off the vessel, and also keeping a headcount. Once the passengers were clear of the vessel, they were assisted by firefighters up the ladders and on to the bridge. Some passengers had difficulty leaving the vessel that way because they were hindered by their dress and footwear.

A local public house opened up one of its function rooms and gave blankets and hot drinks to the passengers, once they had disembarked. A hydraulic platform arrived after a further period and began disembarking passengers in groups of four directly from the aft end on to the bridge.

As a result of the accident, one person suffered bruising which required her spending three days or more off work, and 34 passengers reported to the MAIB that they had suffered bruising, cuts and aches.

All of the passengers had disembarked by about 2145. Some crew stayed to clean up and disembarked later, while other crew members stayed on board overnight. The vessel was secure in her position and had lines fast each end.

Nottingham Princess remained in position over the weekend **(Figures 7, 8 and 9)** because of the continued high river levels and subsequent flow. On the afternoon of Monday 18 November, the sluices downriver were adjusted to minimise the flow, and two tug boats operated by BW assisted in successfully removing the vessel off the bridge and on to a nearby mooring **(Figure 10)**.

The vessel suffered mostly superficial damage as a result of the accident, including a broken window, a hole in the side shell, dented, twisted and scratched steelwork, damage to electrical fittings, damaged handrails and panelling **(Figures 11 & 12)**. She underwent repairs and, after inspection by the Maritime and Coastguard Agency, resumed service 7 days after the accident, but did not sail under Trent Bridge while the scaffolding was in place.

Figure 7

Vessel fast to bridge on Saturday 16th, pm (note flow by bow)

Figure 8

Vessel fast to bridge on Saturday pm

Figure 9

Vessel fast to bridge on Saturday 16th, pm

Figure 10

Vessel being removed from bridge

Figure 11

Damage to starboard side of vessel

Figure 12

Damage to window on lower deck

1.7 PASSENGER FEEDBACK

A questionnaire was circulated to each passenger, through their respective group leaders. A copy of it is in **Annex 1**.

Eighty-seven questionnaires from a total of 130 passengers were completed and returned to the MAIB, giving a response rate of 66.9%. The MAIB has used passenger questionnaires on many occasions, and this response rate is the best since the Branch was formed in 1989.

The passengers who returned questionnaires were located at the time of the accident as follows:

Lower Centre	Lower Port	Lower Stbd	Upper Centre	Upper Port	Upper Stbd	Stairs
7	9	15	16	21	15	4

Of the passengers who returned questionnaires, 12 were male and 75 were female. 16 vacated the vessel using the firefighters' platform, while 71 went on to the scaffolding and then on to the bridge via ladders. 34 said they heard the skipper's announcement clearly immediately after the accident, 21 said it was not clear, and 32 did not hear it at all.

Passenger comments included the following:

"Should the vessel have sailed when the river was so high and flowing so fast?"

"Where were the lifejackets?"

"*A heater was left running and unattended*"

"*We were given little information or instructions by the crew*"

"*I now have a fear of water and boats"*

"*Terrified, a frightening experience"*

"*Unable to sleep properly since"*

"*The crew did well under the circumstances"*

"*I hope lessons are learnt from this"*

"*The crew helped us by staying calm"*.

1.8 RIVER BOAT SAFETY

River boat safety in the UK was reviewed following the *Marchioness* accident on the River Thames in 1989, when 51 people lost their lives. Among the initiatives to emerge from that accident were the domestic passenger vessel safety management code, and the requirement for a boatmaster's licence for those in charge of local passenger vessels.

The domestic passenger vessel safety management code requires companies to develop and implement safe practices which include, but are not limited to, the following:

- A health and safety protection policy
- Procedures to ensure the safe operation of the ship in compliance with relevant rules
- Procedures for reporting accidents
- Procedures for responding to emergency situations

Under the health and safety policy, all personnel, both ashore and afloat, have a duty to take care of themselves and other persons who may be affected by their acts or omissions.

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 WORK ON TRENT BRIDGE

2.2.1 Effect of the work on the navigation channel

The repainting of Trent Bridge was originally intended to be completed during the summer months. The city council's consultations with various bodies were made using this assumption. The navigation channel, available to *Nottingham Princess*, without any scaffolding, was about 21.6m wide at the Normal Summer Water Level (NSWL) of 20.75m, and about 19.7m at the water level on the night of the accident, which was about 21.2m. The 15m navigation channel allowed by the scaffolding, reduced the safety margin from being set off the centre line of the arch, as shown in the table below **(see also Figure 2)**.

	NSWL (no scaffolding)	21.2 m (no scaffolding)	With scaffolding
Distance from centre line of arch to obstruction (Nav channel/2)	10.8m	9.85	7.5
Vessels beam/2 (5.3/2)	2.65	2.65	2.65
Safety margin	**8.15**	**7.2**	**4.85**

The vessel had a considerably reduced safety margin with the scaffolding in place, which was less than the beam of the vessel on each side of the centre line of the arch. This was proved to be sufficient for the summer months, when the river levels and flow are low and the amount of set from the intended course under the bridge is minimal, if any at all.

Outside the summer months, when rain has been falling in areas upriver, the amount of set from the intended course is likely to increase as the rate of the river flow increases. The safety margin, without scaffolding, also decreases, as the vessel has less headroom in which to manoeuvre when transiting under the bridge.

The flow under the bridge during high water levels is often confused, consisting of eddies and whirlpools, as the water is funnelled between the two buttresses **(Figure 12)**. The passage through the arch is, therefore, more complex and demanding in periods of high river levels and flows.

In the past, before the scaffolding was erected, the vessel would have been likely to have been set over. However, the available safety margin would have allowed sufficient room for the set, and the vessel would have proceeded under the bridge without incident. As it was, the vessel's starboard quarter impacted the scaffolding about two-thirds of the way under the bridge. It is clear that without the scaffolding the vessel could have been set over and would, almost certainly, have passed safely under the bridge.

Even if the vessel's upper structures had touched the underside of the arch, while being far from desirable, the consequences would have been likely to be less severe than this accident. On the night of the accident, the flow off the flotsam gathered on the scaffolding upriver of the southern buttress would have contributed to the confused flow under the centre arch **(Figures 13 and 14)**. There is also an additional flow into the centre arch, from around the patch of shallower water immediately upriver of the southern buttress.

The delay in the bridge works meant that the work continued into the winter, with the same navigation channel designed for the summer months. This accident would, most likely, not have occurred if the scaffolding had not been present, for the reasons discussed above.

2.2.2 Risk assessment

A comprehensive risk assessment, made by any of the parties involved in the bridge works with respect to a river user colliding with the scaffolding at times of high river levels and flows, could have identified control measures. The control measures may have included closing the bridge to navigation completely, or to vessels above a certain size, and protection to the river user in the event of collision.

However, the only risk assessments made were by the contractor, for the health and safety of its own workers. The pre-tender contract, made by the council, identified hazards, and potential control measures were suggested, however the risk level was not assessed and the hazards were only considered for the summer months when the work was expected to be completed.

Figure 13

Water flow under centre arch looking downriver

Figure 14

‘Flotsam’ on southern buttress

2.2.3 Communication issues

The communication between the various parties involved in the Trent Bridge work and the owners of *Nottingham Princess* was limited to just two letters from the council and the telephone conversation on the Tuesday before the accident. The skippers and the work's foreman did meet informally at sporadic intervals; however, there was no contact at a higher level. The delay in the works leading to the scaffolding being in place beyond the summer, was not officially promulgated to the owners, although there is no suggestion that they were not aware of the delay.

The owners did not receive the restriction notices issued by British Waterways as they were not on the mailing list, despite *Nottingham Princess* being one of the two principal river users. In addition, the owners were not on the user list for the river group meetings. British Waterways has since addressed both of these issues.

In addition to the above, there was confusion regarding the operation of *Nottingham Princess* during the winter months. Both the city council and British Waterways were under the impression she did not sail during the winter. A phone call, a look at the *Nottingham Princess* website, or even a word with the work's foreman, who saw her on the river every day, would have confirmed that *Nottingham Princess* sailed all year round.

The river level and flow information, as recorded by the Environment Agency and shown in section 1.5, would be of benefit to river users, especially commercial users such as *Nottingham Princess*. The 15 November flow rates were well above the average for November, and were about 3.5 times the annual daily mean. Had the hourly readouts of the river levels been available to the owner or skipper, they would have been in a position to evaluate the level of risk involved.

Since the accident, both the Environment Agency and British Waterways are seeking to improve communication of information on river levels and flows, by utilising technology, so as to be able to provide river users with an instant updated river condition report.

It is essential that any information affecting the safe navigation of rivers is brought to the attention of all river users.

2.2.4 Flotsam

The contractors, at the request of *Nottingham Princess*'s owners, removed the flotsam which gathered around the scaffolding on the upriver side of the southern buttress. However, it quickly built up again. Both the council and British Waterways reported the flotsam to have been cleared during their site visit made on the morning of the accident.

The large amount of debris coming down the river during high levels is well known locally and, regardless of the frequency it is cleared, it can be expected to quickly build up again. The work on the bridge was not a 24-hour operation, and the flotsam was not cleared outside working hours.

Commercial river users should be aware of this issue and, where flotsam is likely to affect safe navigation, include it in their risk assessments.

2.2.5 Fendering

The scaffolding was not fendered. Fendering would have protected both the vessel and the scaffolding from light impacts, but not from a heavy impact such as experienced in the accident. It might also have given false security to smaller leisure boat owners who have been known to make fast their boats, on a temporary basis, to any fendered structure. In this accident, fendering might have lessened the impact damage from the horizontal poles which caused the damage to the lower deck window and side plating.

It is essential that, when inspecting works which may affect the safe navigation of the river, navigation authorities (British Waterways in this instance) must ensure that they offer no risk to river users above or below the waterline. The fact that the vessel may approach the hazard abnormally must also be taken into account.

2.3 *NOTTINGHAM PRINCESS*

2.3.1 Risk assessment

When the skipper boarded *Nottingham Princess*, in preparation for the evening cruise, he was aware that the river was high, and he obtained a level of 21.2m from the gauge near the moorings. He estimated the flow to be 3 to 4 knots by the moorings. He had sailed on the river in similar conditions on many occasions and, on some occasions, in even slightly worse conditions.

He was aware of the two incidents earlier in the week, on the Sunday and Monday. He had been on duty on the Monday, when the vessel had come close to the scaffolding during periods of similarly high water levels and flows. He was also aware of the flotsam gathering on the scaffolding and diverting the flow through the centre arch. He knew it had been reported as being cleared, and made the assumption that it would be kept clear and no longer posed a problem.

Nottingham Princess's owners were also aware of the river conditions and the gathering of the flotsam. They were concerned enough to contact the council and ask for it to be removed. They also made the assumption that it would be kept clear and would no longer be a problem.

The owners can tell the skipper not to sail at any time. The final decision on whether or not to sail, the conduct of the vessel, the route she takes, and the way she is navigated, lies with the skipper. The skipper is responsible for the passengers and crew, and they all place their implicit trust and their safety in his hands.

Because the vessel had sailed in these conditions in the past, the skipper was not deterred from sailing or from making the transit under Trent Bridge. That week had been the first time since the works on the bridge began, that the river had been so high. He assumed the conditions when passing under the bridge would be safe, and that he would remain in control of the vessel.

The requirement to undertake risk assessments was publicised in Marine Guidance Note MGN 20(M&F) issued in 1998 to describe the implementation of EC Directive 89/391, Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997. It introduced the legislation, and covered the implications for employers and employees. It also contained guidance on risk assessment. However, perils to the ship, resulting from the particular work activity, and hazards which imperil a vessel, are excluded from the requirements of the regulations and do not have to be formally assessed. This fact has been discussed in other MAIB reports, and recommendations have been made in them to the MCA, to review and modify the guidance given in MGN 20(M&F) with regard to this issue.

Under the health and safety policy, required by the domestic passenger vessel safety management code, all personnel, both ashore and afloat, have a duty to take care of themselves and other persons who may be affected by their acts or omissions. This code also requires procedures to ensure the safe operation of the ship in compliance with relevant rules.

In order to ensure that this duty of care is met, and in line with the requirement for procedures to ensure the safe operation of the ship, a risk assessment of the vessel, and the operations undertaken by it, should be carried out by the owners.

The owner/skipper, although complying with all statutory requirements, had made no risk assessment on their operation. Had such a risk assessment been made, it could have been reviewed and the risks re-evaluated as a result of:

- the two incidents earlier that week
- the bridge being scaffolded, and the consequent reduction in safety margin (see 2.2.1)
- the high river levels and fast flow.

Additionally, potential control measures might have been identified and taken. These could have included: *it is safe to sail but the vessel will not go under the bridge. Instead it will turn around just before, and sail along a shortened route at slower speed.*

After the accident, the owners made a risk assessment, which determined the vessel would not sail under Trent Bridge while the works were in progress.

The lack of the risk assessment on the night of the accident, resulted in *Nottingham Princess* leaving her moorings for the evening cruise with the assumption that flotsam had been cleared, that the reduced safety margin would be sufficient, and that the condition of the river would allow safe transit under the bridge.

A recommendation has been made to the MCA, to ensure, by the most expeditious means, that a specific requirement is made to operators to carry out a formal risk assessment on the hazards which may imperil vessels during their planned operations.

2.3.2 The river conditions and the collision

The reason for *Nottingham Princess* colliding with the scaffolding was a loss of control while transiting under the centre arch. The vessel was pushed bodily to starboard without any discernible change in the heading. The forces pushing her to starboard were, almost certainly, water-based, as the wind strength that night was not great. Under the centre arch, when the water levels are high, the flow is often confused with eddies and whirlpools. In addition, as mentioned in section 2.2.4, the flow off the flotsam gathered on the scaffolding upriver of the southern buttress, and the additional flow into the centre arch from around the patch of shallower water immediately upriver of the southern buttress, also contributed to the confused flow.

The effect was clearly to push the vessel to starboard, away from the southern buttress and towards the scaffolding. Once she had the initial impact, and the current came on to the port bow, she was at the mercy of the effect of the water flow, and the second impact followed with her becoming “pinned” in position.

The skipper put the engines to neutral after the first impact so as to have full power on the bow thruster. This attempt to “crab” the vessel off the scaffolding, by also using the rudder hard-to-starboard, was unsuccessful.

The conditions, clearly, had a greater effect on the vessel than was anticipated by the skipper, and control was lost.

2.3.3 Visibility

Several factors might have hampered the skipper's situational awareness as *Nottingham Princess* passed under the bridge.

Because it was night time, it was very dark under the bridge, with the vessel's lights providing most of the illumination. The view ahead from the wheelhouse was of a dark shadow passing over the wheelhouse top. By day the skipper can see from the alignment of the bridge girders how quickly the vessel is being set over. However, this is difficult at night.

The CCTV cameras mounted on the sides and astern were of limited value under the bridge at night, because of the black and white images picking up only lighter, illuminated, objects.

With a bodily set, where the vessel's head is not changing very much, it is not easy to determine quickly the extent of the set. Looking ahead and/or astern with reference to lights or transit marks ashore will help.

The skipper's view astern was virtually non-existent because of the passengers and crew on the upper deck. He could not, therefore, reference the set by looking astern. Furthermore, he was unable to see just how close he was to the scaffolding, which is why he sent the DJ out to look.

The scaffolding was mainly dark, with occasional illumination, and was not easy to pick out from under the bridge. The searchlight, carried onboard, could have been used, possibly by another crew member in communication with the skipper.

These factors contributed towards the skipper not being aware how quickly he was becoming set towards the scaffolding.

2.3.4 Evacuation of the vessel

Once *Nottingham Princess* was "pinned" in position on the upriver side of the northern buttress, it was clear to the skipper that she had to be evacuated as soon as possible. He contacted the emergency services, who arrived quickly and organised the evacuation from the shore. He ascertained from the bilge alarms that the vessel was not taking on water, and then made a short announcement to the passengers and crew.

For many of the passengers and crew, this was a traumatic and distressing experience, something they were not expecting on an evening river cruise. There was, naturally, shock and concern among them.

The mate checked for injuries but no-one reported any serious injury. He then liaised with the firefighters; the skipper remained in the wheelhouse. This left seven other crew; one crew member was in a state of shock so another crew

member stayed with her to comfort and assist her. One crew member counted the passengers as they disembarked. The remaining four crew members went around the passengers, reassuring them as best they could.

In the minutes following an emergency, passengers are disorientated and often in varying levels of shock. Reassurance and communication can assist them during the period between an accident occurring and their evacuation from the vessel. Although there was an announcement, most passengers who completed the MAIB questionnaire either did not hear it, or found it unclear (see section 1.7). The skipper might not have been aware of this. However, further frequent announcements, even if the same message was repeated, would have been likely to reassure and calm the passengers.

Continuing to keep the bars open, and serving alcohol to the passengers, was ill advised. The owners have since addressed this and have amended their procedures.

Some passengers voiced concern about a gas heater, which was left running after the accident and could have fallen over, and created a potential source of ignition. However, after a short period of time, the heater was switched off.

Many passengers voiced concern over the lack of lifejackets. This is discussed in section 2.4.

The owner's crew training days are in compliance with their safety management system, and the standard of training is reasonable, quite possibly in excess of training found on other UK Class V category B vessels.

Overall, the crew members generally performed to the best of their abilities, given their experience and training to deal with such a situation.

2.4 RIVER BOAT REGULATIONS

2.4.1 Lifejackets

As a Class V category B vessel, *Nottingham Princess* is not required to carry lifejackets for use by passengers. There were three lifejackets on board, but these were for crew use. This may come as a surprise to some observers. However, the regulations only require buoyant apparatus, in the form of rigid rafts and lifebuoys, to keep people entering the water afloat. This is because of the operating areas of this type of vessel, which are never more than a few metres from a riverbank. The vessel complied with the lifesaving regulations at the time of the accident.

Lifejackets might have been of use in this accident, to those passengers who had to leave the vessel by climbing over the vessel's handrails, and using the series of handrails and ladders to reach the Trent bridge. While waiting to

disembark the vessel, some passengers put lifebuoys around their waists as a reassurance, rather than for any practical use. This concern was evident from many of the passenger questionnaires, which expressed surprise that no lifejackets were available.

The operators of Class V passenger vessels should carry out risk assessments on the level and type of lifesaving apparatus carried. Specifically, they should take into account the suitability of their flotation aids for the prevailing conditions. The use of rigid rafts, to evacuate a vessel in the fast flowing conditions of the night of the accident, would have been extremely dangerous.

The regulations regarding lifesaving apparatus state the minimum requirement. This should not necessarily be seen as being sufficient for the specific operation.

2.4.2 Visibility

The view aft from the wheelhouse was virtually non-existent, as the skipper had to look through the upper deck, which contained many passengers and crew. The CCTV, as mentioned in section 2.3.3, was of limited use at night. One of the issues arising from the *Marchioness* disaster in 1989 was the visibility aft from the wheelhouse. In that particular accident, it was the inability to see overtaking vessels from the wheelhouse. In this accident, it is the necessity of the skipper to reference the set of the vessel and to see how close his vessel is to an obstruction.

This accident, fortunately, resulted only in minor injuries and, mainly, superficial damage. It did, however, have the potential to be far more serious. The vessel could have started taking on water, and/or people could have entered the water.

Marchioness was of the same class and a similar size. Fifty one people were lost when she was in collision with the larger and faster dredger *Bowbelle*. River boat safety in the UK, with the large numbers of passengers carried, is a responsibility for all parties involved in the industry, and should be continually reviewed and improved where appropriate.

SECTION 3 - CONCLUSIONS

The following are the safety issues which were identified as a result of the investigation. They are not listed in any order of priority, but are listed in the order in which they appear in the analysis.

1. The presence of scaffolding around the bridge effectively reduced the safety margin when passing under the centre arch. [2.2.1]

2. Had the scaffolding not been in place, the vessel would have almost certainly passed safely under the bridge. [2.2.1]

3. The communications between the various parties and the vessel owners, with regard to the work on Trent Bridge was insufficient. [2.2.3]

4. There was no means for river users to obtain the river height and flow information. [2.2.3]

5. The confused flow of the river under the arch at the time of the accident. [2.2.4, 2.3.2]

6. The navigation authority had not ensured that the scaffolding was safe in the event of a vessel being pinned against it. [2.2.5]

7. The owner/skipper of *Nottingham Princess* had carried out no formal risk assessment. [2.3.1]

8. The river's high level and fast flow. [2.3.2]

9. The visibility aft from the wheelhouse being obstructed by the passengers and crew on the upper deck. [2.3.3]

10. The dark conditions under the centre arch at night, prevented the skipper from noticing how quickly the vessel was being set towards the scaffolding. [2.3.3, 2.4.2]

11. The evacuation of the passengers was completed without the safeguard of lifejackets or buoyancy aids, since these were unavailable or unsuitable. [2.4.1]

SECTION 4 - ACTION TAKEN SINCE THE ACCIDENT

4.1 Since the collision, the owners of *Nottingham Princess* have:

- Started the process of undertaking a risk assessment to determine possible hazardous locations along its operating area.
- As a result of a risk assessment, decided not to take the vessel under Trent Bridge until the repainting work is complete and the scaffolding is removed.
- Carried out their own internal investigation and given a copy of the report to the MAIB.
- Amended their procedures, so that in the event of an emergency, all bars will be closed immediately.

4.2 British Waterways has taken the following action:

- The owners of *Nottingham Princess* have been added to the British Waterways user group meetings and circulation list for restriction notices.
- Restriction notices now go to all licence holders.
- British Waterways and the Environment Agency are improving communications to river users about river heights and flows, and sluice operations.
- In January 2003, British Waterways held a meeting of all river users and other interested parties, to discuss this accident.

4.3 MCA

- The MCA is currently undertaking a Formal Safety Assessment (FSA) research project to provide a basis for UK safety regulations on inland waterway passenger vessels. One aspect of this is to consider the level of LSA provision, in response to an EC proposal for 100% LSA on Category B waters. The FSA results will be used to inform decisions/recommendations regarding any departures from EC proposed standards that can be justified for UK vessels on the basis of risk.

4.4 MAIB

- During, and arising from the investigation of the *Nottingham Princess* collision, in December 2002 the MAIB issued Safety Bulletin 05/2002. This is included in **Annex 2**.

SECTION 5 - RECOMMENDATIONS

All inland waterways Navigation Authorities are recommended to:

1. Ensure, as far as is practicable, that all river works which may affect safe navigation, are designed and inspected so as to minimise the risk to river users.

2. Ensure that all information affecting safe navigation, is promulgated to all commercial river users and, as far as is practicable, to all other river users.

The Maritime and Coastguard Agency is recommended to:

3. Ensure, by the most expeditious means, that a specific requirement is made to operators to carry out a formal risk assessment on the hazards which may imperil vessels during their planned operations.

4. Use the FSA they are conducting to consider type/suitability of LSA as well as level of provision.

5. Encourage operators of Class V passenger vessels to carry out risk assessments on the level and type of LSA carried on board their vessels, and ensure its suitability for use in the prevailing conditions.

Marine Accident Investigation Branch
August 2003

ANNEX 1

Passenger Questionnaire

MAIB

MARINE ACCIDENT INVESTIGATION BRANCH

Marine Accident – Passenger Questionnaire

The Marine Accident Investigation Branch (MAIB), based in Southampton, is responsible for investigating accidents aboard UK-registered ships anywhere in the world, and to foreign flagged-ships in UK territorial waters. Its aim is to make travelling by sea safer by thorough investigation, gathering information from crew and passengers. Following the ***Nottingham Princess*** incident on 15 Nov 2002 in which you were involved, we would be very grateful if you could answer as many of the following questions as possible.

Personal Details	
Full name:	
Address:	
Telephone (home):	
Telephone (work/other):	
Occupation:	
Age:	
Gender:	Male / Female
General Details	
Who was the leader of the party you were in?	
Where were you when the accident happened(upper or lower deck, which side? Or elsewhere ie Toilet)	
Description of event	
How and when did you realise something was wrong?	
Please give a brief account of what you saw and heard.	

Were you kept informed about what was happening?	
Leaving the vessel	
Did you hear any announcements made by the crew?	YES / NO
If so, were they clear?	YES / NO
Were you able to follow the instructions?	YES / NO
Were any of the following illuminated:	Cabin lights / Emergency exit lights
How did you leave the vessel?	
Did you encounter any difficulties?	
Injuries	
Please describe any injuries you suffered and how sustained.	
Were you hospitalised or incapacitated for more than 3 days?	YES / NO
General comments	

Thank you for helping us. Please return this questionnaire using the reply-paid envelope supplied or by addressing an envelope to:

MAIB, First Floor, Carlton House, Carlton Place, Southampton SO15 2DZ

If you have any questions, or any issues you wish to discuss, please write to us at the above address, or contact us by:

Telephone: 023 8039 5500
Fax: 023 8023 2459
E-mail: maib@dft.gov.uk
Web site: www.maib.gov.uk

ANNEX 2

MAIB Safety Bulletin

Safety Bulletin

Department for Transport

MAIB

MARINE ACCIDENT INVESTIGATION BRANCH

MAIB

MAIB SAFETY BULLETIN 05/2002

Collision between the river cruiser

Nottingham Princess

and Trent Bridge, Nottingham

15 November 2002

Issued December 2002

MAIB

INVESTOR IN PEOPLE

MAIB SAFETY BULLETIN 05/2002

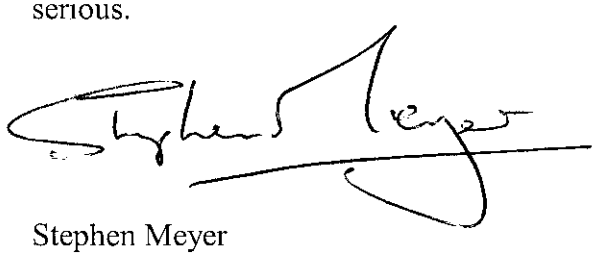
This document, containing Safety Recommendations, has been produced for marine safety purposes only on the basis of information available to date.

The Merchant Shipping (Accident Reporting and Investigation) Regulations 1999 provide for the Chief Inspector of Marine Accidents to make recommendations at any time during the course of an investigation if, in his opinion, it is necessary or desirable to do so.

The Marine Accident Investigation Branch (MAIB) is carrying out an investigation of the collision on 15 November 2002 between the river cruiser *Nottingham Princess* and Trent Bridge, Nottingham . The MAIB will publish a publicly available report on completion of the investigation.

While on an evening river cruise and proceeding upriver into a strong river current, *Nottingham Princess* struck scaffolding around the bridge and became "pinned" beam on to the current on the upriver side of the bridge.

This incident resulted in all her passengers being taken off the vessel with the assistance of the emergency services. Despite a scaffolding pole going through one of the boat's windows there were only minor injuries such as cuts and bruises suffered by a small number of passengers; however the potential consequences were far more serious.



Stephen Meyer
Chief Inspector of Marine Accidents

Press Enquiries: 020 7944 4691 / 3387; out of hours: 020 7944 5925
Public Enquiries: 020 7944 3000
INTERNET ADDRESS FOR DFT PRESS NOTICES:
http://www.dft.gov.uk

SAFETY RECOMMENDATIONS

Background

Trent Bridge is one of the major crossings over the Trent in the city of Nottingham. In the spring of 2002 Nottinghamshire City Council undertook a major painting operation of the bridge which involved the erection of scaffold around the bridge. British Waterways, being responsible for safety of navigation on the river, were consulted regarding the scaffold. The navigable width through the centre arch was reduced from 30 m to about 15 m due to the scaffold. The work was initially expected to be completed in September, however, it was delayed due to the old paint requiring removal by sand blasting and continued through the autumn.

Nottingham Princess was a class V category B river cruiser, 5 years old and of 24.5 m length, licensed to carry 172 passengers on the River Trent only. She was carrying 131 passengers and 8 crew when she left her moorings at just after 2000 on 15 November 2002 intending to go for a 3 hour cruise. The river level was high and the current strong due to persistent rainfall over the preceding few days.

At about 2035, whilst transiting the bridge's centre arch, she struck the scaffolding, was swung to starboard and was pinned into position on the bridge's upriver north buttress by the strong river current. Some damage was done to the vessel by the initial impact and further damage by the subsequent impact including a scaffolding pole going through one of the windows on the lower deck.

The passengers were taken off the vessel with the assistance of the emergency services which included the use of a hydraulic lift. Only minor injuries such as cuts and bruises were suffered by a small number of passengers, however the boat was unable to be freed from the bridge until the afternoon of Monday 18 November. She subsequently underwent repairs.

The MAIB considers that the potential consequences of this incident were far more serious.

Safety Recommendations

To all UK competent harbour authorities and all bodies responsible for safety of navigation on UK rivers:

1. Conduct a risk assessment of passenger carrying craft, in any area under your jurisdiction, where there has been an alteration made to the navigable width of bridges or channels, or any other constraint placed on navigation, through scaffolding or other such temporary structures.

2. Advise owners of passenger carrying craft, to conduct their own risk assessments before using such areas.