07-201	**passenger vessel, *Cruise Cat,* collision with navigational light beacon, Waikato River entrance Lake Taupo**	**22 February 2007**

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

Report 07-201

passenger vessel
Cruise Cat

collision with navigational light beacon

Waikato River entrance Lake Taupo

22 February 2007

Abstract

On Thursday 22 February 2007 at about 2200, the passenger vessel *Cruise Cat* collided with the outer starboard-hand light beacon at the entrance to the Waikato River at the northern end of Lake Taupo when returning from an evening dinner cruise with 90 passengers and 4 crew on board. After the skipper had checked the watertight integrity of the vessel and the passengers for injuries the *Cruise Cat* was returned to its berth at Taupo Marina where all the passengers were discharged without further incident.

One passenger suffered debris in the eye from the starboard-hand light beacon pile. Otherwise there were no injuries

The vessel sustained minor paint damage to the hull rubbing strip at the bow, but the navigational light beacon snapped off at the lake bed and was completely destroyed.

Safety issues identified included:

- vessels not using all the available sea room to make a "stabilised" approach and entry to a confined channel
- the possible onset of fatigue for the relief skipper

Because of the safety actions taken by the Lake Taupo Harbourmaster and Maritime New Zealand no safety recommendations have been made.

The *Cruise Cat* moored at Taupo

Contents

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Abbreviations

°	degrees
°C	degrees centigrade
°T	degrees true
AC	advisory circular
C	centigrade
HPa	hectopascal(s)
ILM	inshore launch master
LLO	local launch operator
km	kilometre(s)
kW	kilowatt(s)
m	metre(s)
m/s	metre(s) per second
Maritime NZ	Maritime New Zealand
MEC5	marine engineer class 5
MEC6	marine engineer class 6
nm	nautical mile(s)
s	second(s)
SPAN	safety profile assessment number
SSM	safe ship management
T	true
UTC	co-ordinated universal time

Glossary

con (conning)	direct the course and speed of a vessel
displacement	the weight of water displaced by a floating vessel, used as a measure of the vessel's size
fine	the direction of another vessel or object's bearing relative to the observer's vessel course, at a small angle to the observer's course
foredeck	deck at the front of a ship or boat
knot	one nautical mile per hour
occulting	a rhythmic light in which the total duration of light in each period is clearly longer than the total duration of the darkness and in which the intervals of darkness (occultations) are all of equal duration
port	left hand side of the vessel when looking forward
starboard	right hand side of the vessel when looking forward

Data Summary

Vessel Particulars:

Name:	*Cruise Cat*
Type:	passenger vessel
Limits:	enclosed waters, all navigable inland waters and district lakes of New Zealand
Safe ship management:	SGS M&I
Length:	16.0 m
Breadth:	6.2 m
Displacement tonnage:	27 tonnes
Built:	1995 by Robertson Brothers Boat Company Limited, Warkworth
Propulsion:	2 x 331 kW Iveco C78 ENT M 50 diesel engines each driving a fixed-pitch propeller through a Twin Disc reversing gearbox
Service speed:	20 knots
Owner	Lake Taupo Cruising Company Limited
Operator:	Chris Jolly Boats Limited
Home port:	Taupo
Minimum crew:	2
Maximum passenger capacity	98

Date and time:	22 February 2007 at about 2200[1]	
Location:	Waikato River entrance Lake Taupo	
Persons on board:	crew:	4
	passengers:	90
Injuries:	crew:	nil
	passengers:	one minor
Damage:	boat	minor
	navigational mark	destroyed
Investigator-in-charge:	Captain Iain Hill	

[1] Times in this report are New Zealand Daylight Time (UTC + 13 hours) and are expressed in the 24-hour mode

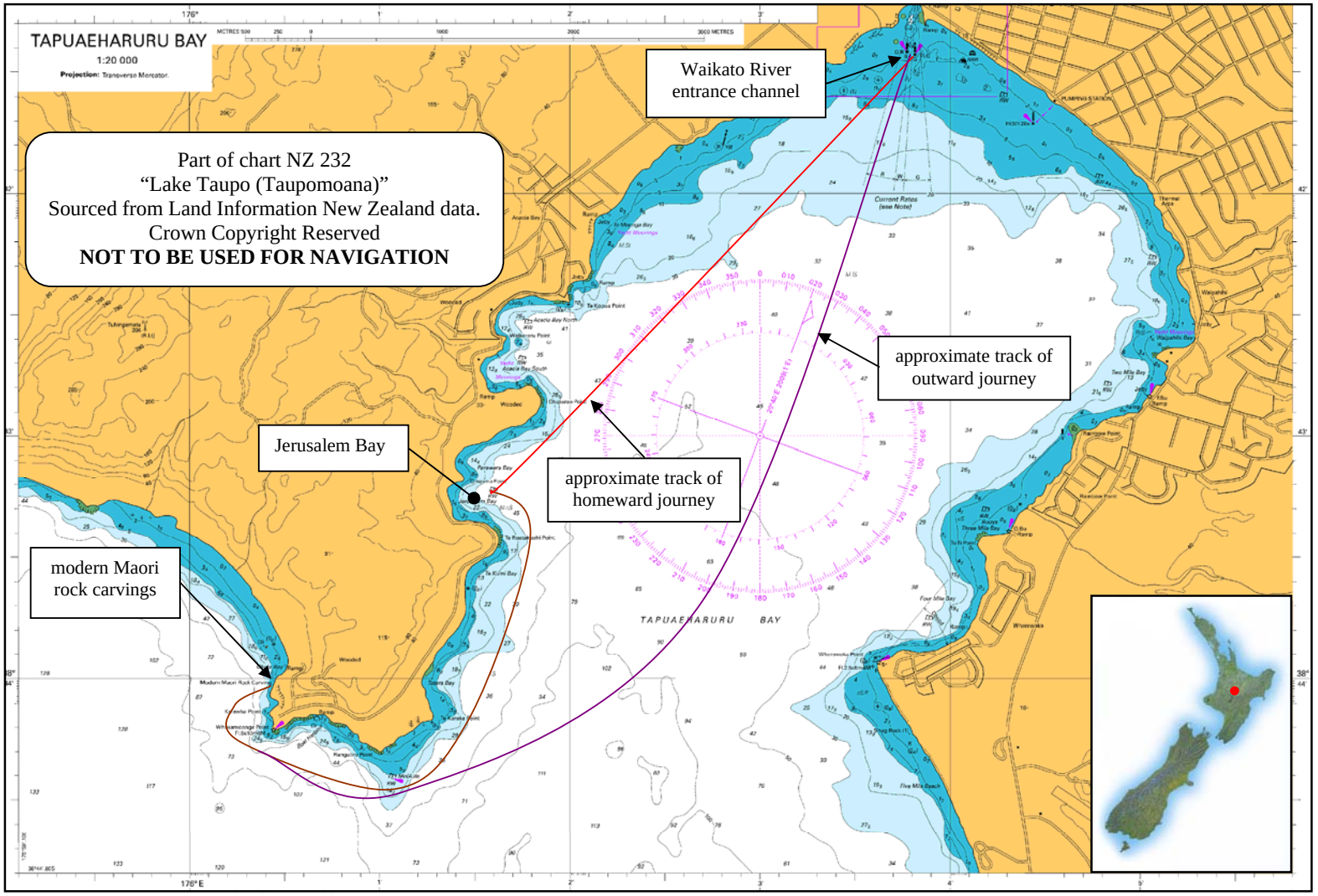


Figure 1
General area of the incident

1 Factual Information

1.1 Narrative

1.1.1 On Thursday 22 February 2007 at about 1800, a group of conference delegates from a local hotel boarded the *Cruise Cat* and the *Waikare II*, another vessel in the Chris Jolly fleet, for a scenic cruise, some fishing and dinner before returning to Taupo. As the *Waikare II* was a smaller vessel, 25 of the conference delegates boarded it and 65 boarded the *Cruise Cat.*

1.1.2 The skipper of the *Cruise Cat* gave a short safety briefing after which he ordered the lines let go and conned the vessel out of the boat harbour and up the river channel to Lake Taupo. Once out of the channel the skipper conned the vessel across Tapuaeharuru Bay around Rangatira Point to the modern Maori rock carvings near Okuta Bay (see Figure 1).

1.1.3 After visiting the rock carvings the passengers did some fishing. The skipper conned the *Cruise Cat* back to Jerusalem Bay and made fast to the northern public mooring buoy. Shortly after the *Waikare II* moored alongside the *Cruise Cat* and the 2 vessels were rafted together for dinner to be served and to allow the passengers on the 2 vessels to mingle. After dinner the conference coordinator requested that all the delegates return to Taupo on board *Cruise Cat* so as to enhance the convivial atmosphere on board.

1.1.4 All the passengers on the *Waikare II* were transferred to the *Cruise Cat* and a member of the *Waikare II*'s crew was also transferred. The *Waikare II* then returned to its berth with the skipper and one crew member on board.

1.1.5 The skipper of the *Cruise Cat* decided that because of the number of passengers and crew on board he would remain on the main deck of the vessel to coordinate the crew and operate the entertainment system. One of the other crew members was a relief skipper qualified to drive *Cruise Cat*, and as he was not familiar with the sound system on board the skipper asked him to take the vessel back to the boat harbour instead.

1.1.6 The relief skipper conned the *Cruise Cat* back towards the Waikato River entrance on a nearly straight course at a speed of about 12 knots. As he was conning the vessel back several passengers had made their way to the upper deck away from the music below. Some had also made their way to the vessel's foredeck.

1.1.7 The *Cruise Cat* approached the entrance channel at an oblique angle with the port-hand beacon fine to port rather than lining up with the channel from a point further out in the lake. As the *Cruise Cat* neared the beacons the relief skipper reduced the vessel's speed, then turned to starboard across the channel and waited until he could see the white sector of the sector approach light before turning the vessel to port into the channel (see Figure 2). The relief skipper said later that he made the initial turn to starboard to get to the starboard side of the channel where he knew there was more water available.

1.1.8 As the *Cruise Cat* turned to port the relief skipper realised that the vessel was not turning swiftly enough to prevent a collision with the starboard-hand beacon so, he put both engines to astern, but before the engines had time to stop the vessel, the bow of the *Cruise Cat* collided with the starboard-hand beacon. The starboard-hand beacon snapped off at the lake bed.

1.1.9 The *Cruise Cat* came to a stop then started to move astern so the relief skipper turned the vessel into the channel and proceeded down the channel to its berth.

1.1.10 The skipper of the *Cruise Cat*, who was in the main cabin felt the vessel's engines go astern and realised that there was a problem, so he sent one of the crew members to the foredeck and made his way to the afterdeck. When he reached the afterdeck he could see where the *Cruise Cat* was in the channel, realised what had happened and made his way to the foredeck.

1.1.11 After arriving on the foredeck the skipper checked the passengers for injuries and that no one was missing. One passenger had suffered some debris entering his eye so the skipper arranged for a crewmember to take the passenger inside and administer eyewash which removed the debris. The skipper then checked the hull integrity before he made his way to the wheelhouse to check on the relief skipper.

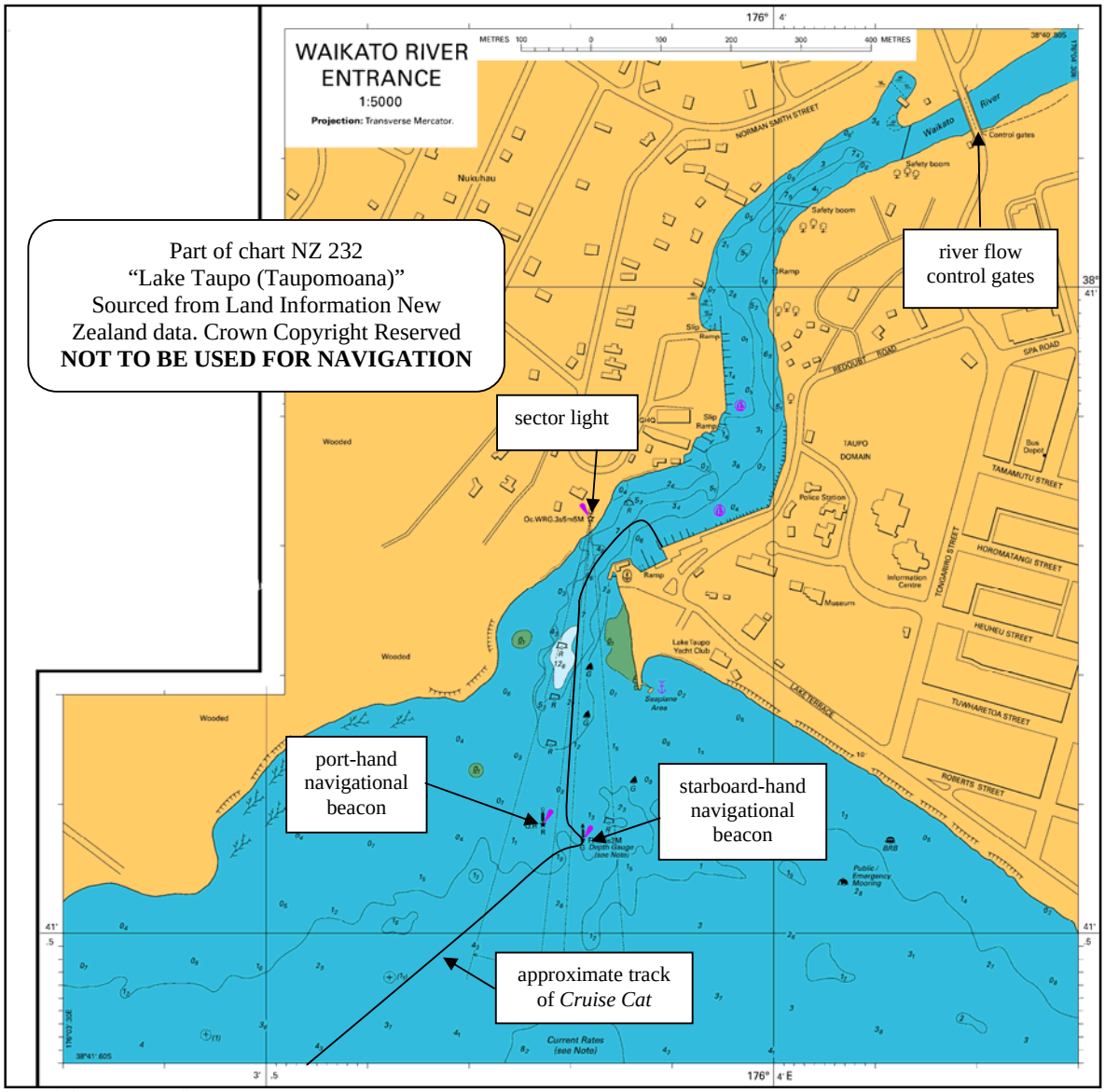


Figure 2
Waikato River entrance and entrance channel

1.1.12 Once the skipper had ensured that the relief skipper was fit to continue conning the vessel to its berth the skipper then checked with the conference coordinator that the remainder of the passengers were safe and uninjured.

1.1.13 The vessel was then conned back to its normal berth where the passengers were disembarked without further incident.

1.2 Vessel information

1.2.1 The *Cruise Cat* was a wooden 16m passenger-carrying catamaran. It was built in 1995 by Robertson Brothers Boat Company Limited of Warkworth, New Zealand. It had a beam of 6.2m and a displacement of 27 tonnes.

1.2.2 The *Cruise Cat* was owned by Lake Taupo Cruising Company Limited and operated by Chris Jolly Boats Limited.

1.2.3 The *Cruise Cat* was powered by 2 Iveco C78 ENT M50 diesel engines each producing 331 kW at 2600 rpm. Each engine drove a fixed pitch propeller through a reversing Twin Disc gearbox. The *Cruise Cat* had a cruising speed of about 17 to 18 knots and a maximum speed of about 22 knots.

1.2.4 The *Cruise Cat*'s helm station was located at the forward end of the upper deck. The position was not isolated from the remainder of the deck allowing free access for passengers to the forward windows (see Figure 3).

Figure 3
The *Cruise Cat*'s helm station

1.2.5 The *Cruise Cat*'s helm station was fitted with the following equipment for navigation

- magnetic compass
- Uniden MC 615 very-high-frequency (VHF) radio transceiver
- Furuno LS 6100 echosounder
- Furuno radar
- public address system throughout the vessel

1.2.6 Access to the foredeck was gained through a hatch at the front of the main cabin the hatch was hinged at the top and swung upward to near vertical to latch into place. There was no access to the foredeck along the sides of the vessel. Access to the afterdeck was via the main cabin doors

at the rear of the main cabin. Access to the upper cabin and helm station was gained by a vertical ladder from the afterdeck.

1.2.7 When the foredeck hatch was open, the hatch lid partially obscured the helmsman's view directly ahead and below (see Figure 4).

Figure 4
View from the helmsman's seat with the forward access hatch open

1.2.8 The *Cruise Cat* was certified to operate in Enclosed Water limits – all navigable inland waters and district lakes of New Zealand as defined in Maritime Rule 20 with the correctly qualified skipper and crew on board.

1.3 Navigational marks

1.3.1 The entrance to the navigable channel from Lake Taupo to the Waikato River was marked by 2 lit navigational beacons. The remainder of the channel was marked with a series of unlit red and green navigational buoys until the mouth of the river narrowed and the water depth increased.

1.3.2 The port-hand red beacon (see Figure 5) consisted of a single wooden pile of about 0.3 m diameter set into the lake bed; the pile was painted red above the normal lake water level. The pile extended about 3 m above lake level with a quick-flashing red light on the top. The focal plane of the light was about 0.5 m above the top of the pile.

1.3.3 The starboard-hand green beacon consisted of 2 wooden piles each about 0.3 m in diameter and set into the lake bed and strapped together. The piles were painted green above the normal lake water level and extended about 3 m above lake level with a light flashing green every 5 seconds (s) on the top. The focal plane of the light was about 0.5 m above the top of the pile. At the top of the pile a mast extended about 1.5 m with a wind sock attached to the top. A lake depth gauge was fixed to the side of the pile.

1.3.4 Attached to a building on the west shore of the Waikato River was an occulting 3 s sector light displaying: a white occulting light over a 3° sector from 002.5°T to 005.5°T, which designated the centre of the navigable channel, an occulting red light over a 8.5° sector from 005.5°T to 014°T; and an occulting green light over a 7° sector from 355.5°T to 002.5°T (see Figure 6). The two coloured sectors indicated to users whether they were to port or starboard of the centre of the channel.

Figure 5
Port-hand entrance channel beacon

1.3.5 The occulting light was about 460 m from the port and starboard hand beacons. At this distance, the width of the white sector would have been 24.08 m. Similarly, the green sector was about 56.19 m wide at the beacons. The starboard-hand beacon was about 16 m outside the white sector, with about a further 40 m of green sector outside that again. The red port-hand beacon was similarly disposed in the red sector of the light.

1.3.6 Close outside of the starboard-hand beacon and still within the green sector of the leading light, was a red port hand marker buoy delineating the edge of a secondary route into the main channel.

1.4 Personnel information

1.4.1 The skipper had been involved in the commercial boating industry for about 13 years. He held an Inshore Launch Master's (ILM) certificate of competency which he had gained in June 2006. Prior to this certificate he had held a Local Launch Operator's (LLO) certificate of competency for a number of years.

1.4.2 The relief skipper had been involved in recreational boating for about 35 years but had only been in the commercial maritime industry for about the previous 12 months. The relief skipper had been issued with a LLO certificate on 13 June 2006 which was endorsed with the vessel

Cruise Cat for the area Lake Taupo on 17 November 2006. The relief skipper also leased a fishing boat, berthed in Taupo Marina, so frequently used the entrance channel to the harbour both commercially and privately. The relief skipper later stated that at the time of the incident he had been completing his third 14-hour working day in succession; he also said that because of personal problems he had not been sleeping well.

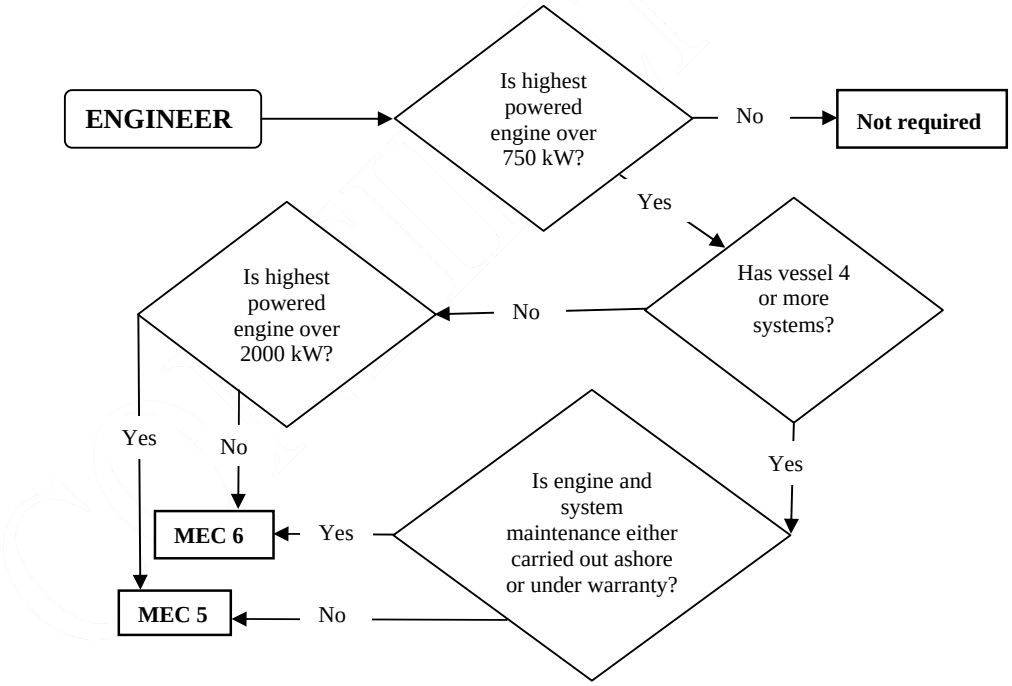
1.4.3 The other 2 members of the crew did not hold any maritime qualification.

1.4.4 Maritime Rules 31B Crewing and Watchkeeping – Offshore, Coastal and Restricted (Non-Fishing Vessels) covered the manning requirements. Rule 31.B.10 stated:

> Except as provided by Rule 31B.6(1)(b), passenger vessels operating in the enclosed area must carry at least –
> (a) seafarers holding the minimum required qualifications specified in Table 3 and in the accompanying flow-chart; and
> (b) the minimum crew specified in Table 3

Table 3

Vessel length overall	Passengers on board	Minimum required qualifications	Minimum Crew
20 m or more	50 to 99	Master – ILM Engineer – in accordance with the flow chart and may be the master	2
	Less than 50		
Less than 20 m	50 to 99	Master – LLO endorsed for the area Engineer – in accordance with the flow chart and may be the master	
	Less than 50		1



1.4.5 Maritime Rule 31B.6 required that:

> (1) Except as provided in rules 31B.6(2) and (7), the owner and the master of a vessel must not operate that vessel unless there is on board the number of crew necessary to operate the vessel safely, taking into account the requirements of rule 31B.8, and at least the minimum number of crew including seafarers holding the qualifications required by -
> (a) the applicable tables and flow-charts in rules 31B.9 to 31B.15 inclusive; or
> (b) a Minimum Safe Crewing Document issued by the Director in accordance with rule 31B.7(3).

Cruise Cat was exempt from requiring a minimum safe crewing document because of its size and passenger capacity, so the owner and master were required to have on board the number of crew necessary to operate the vessel safely with the minimum number of crew as tabled above.

1.4.6 Maritime Rule 31B.16 required that:

> (1) The owner and the master of a vessel must establish and implement procedures in respect of the vessel's crew, taking into account the requirement in 31B.17(1), to ensure that all crew are fit for duty when keeping a watch.
> (2) The crew of a vessel must ensure, taking into account the requirement in rule 31B.17(2), that they are fit for duty at all times when keeping a watch.

1.4.7 Maritime Rule 31B.17 required that:

> (1) When the owner and the master of a vessel establish and implement procedures for ensuring a seafarer's fitness for duty, they must take into account that -
> (a) the level of alertness of a person keeping a navigational or engine-room watch may be affected by fatigue; and
> (b) whenever alertness is affected by fatigue, performance can be impaired.
> (2) A seafarer on a vessel, when considering his or her fitness for duty, must take into account -
> (a) the signs, symptoms, and effects of fatigue[2]; and
> (b) that fatigue affects alertness; and
> (c) that the performance of any person whose alertness is affected by fatigue can be impaired[2].

1.4.8 The vessel's safe ship management (SSM) manual made no reference to additional crew requirements above those prescribed in Table 3 regardless of how many passengers were on board and the nature of the trip, nor was any reference made to fitness for duty requirements for the skipper or crew.

1.4.9 The operator had a policy of training its employees to be multi-disciplined, so as to be able to provide its employees with regular employment and make best use of the personnel available. For example, a skipper would be certified for several of the company's vessels and would also be required to act as crew throughout the fleet when required.

1.5 Climatic and environmental conditions

1.5.1 The skipper of the *Cruise Cat* described the weather at the time of the incident as being fine and clear with an extremely light breeze and no distinguishable swell. He also opined that there was about a quarter of a metre lift in the lake surface, from a southerly wind blowing at the southern end of the lake, that was causing the vessel to roll gently, but there was no evidence of broken waves, white peaks or crests.

1.5.2 The weather recorded by Taupo automated weather station, located at the airport, at the time of the incident was as follows:

Date	Time	Wind direction (°)	Wind speed (m/s)	Temperature (°C)	Pressure (HPa)
22/07/2007	2200	260	3.6	18.0	1021.1
	2300	280	3.6	17.0	1021.6

1.5.3 Land Information New Zealand noted on nautical chart NZ232 Lake Taupo that

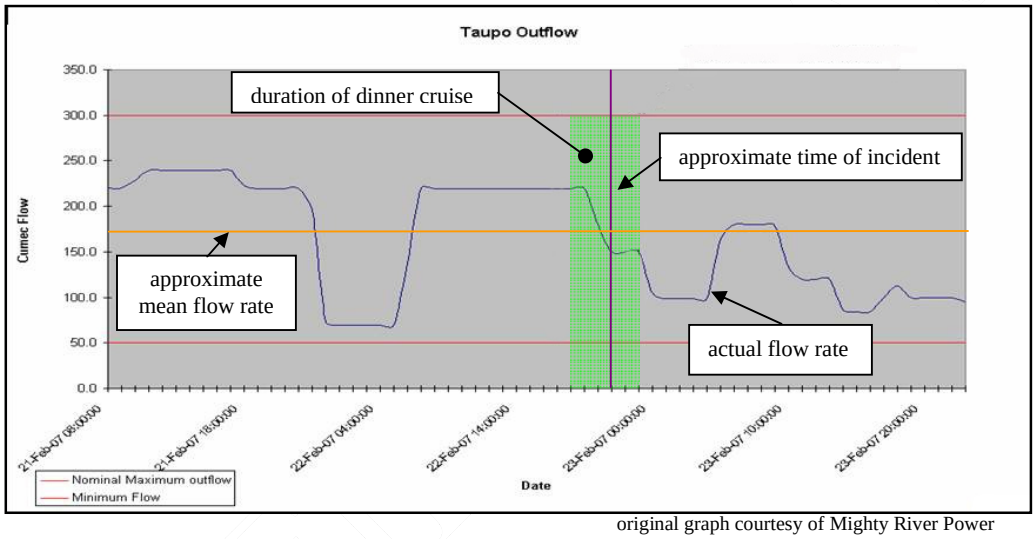
> Current rates in the vicinity of the lake outlets will vary depending on the control gate setting and lake level. Rates of up to 3.5 knots have been noted.

[2] Guidance on the effects and the signs and symptoms of fatigue is provided in the Advisory Circular to Part 31B

The relief skipper said later he thought that he had possibly been caught out by the current flow. The skipper of the *Cruise Cat* stated that there was no distinguishable current flow at the channel entrance by the navigational beacons, but the current was distinguishable from about the second marker buoy onwards. This information was corroborated by the Harbourmaster's office.

1.5.4 The control gate settings and lake level were controlled by Mighty River Power which used the Waikato River, among other sources, to generate electricity from hydroelectric power stations along the river. Mighty River Power controlled the flow of water from Lake Taupo to suit its generation needs; this control was by the control gates located about 800 m downriver from the *Cruise Cat*'s berth. The amount of water being allowed through the gates would directly affect the strength of the current in the Waikato River.

1.5.5 Information on the flow of water through the control gates and by inference the amount that they were open was available from the Mighty River Power free information line.



original graph courtesy of Mighty River Power

Figure 6
Graph of water outflow through the Taupo control gates

1.5.6 Lake Taupo lies in a caldera created following a huge volcanic eruption; it is the largest freshwater lake in Australasia. The lake has a maximum length of 46 kilometres (km) [24.8 nm] and a maximum width of 33 km [17.8 nm] and the lake surface is about 356 m above sea level. The shore of the lake being volcanic in origin tends to being rocky with interspersed cliffs rather than sandy shelving beaches.

1.5.7 One of the controlling aspects of water wave height prediction is the distance that wind blows without obstruction over open water. This is called fetch. Lake Taupo would have a maximum fetch of 46 km.

1.6 Damage

1.6.1 The *Cruise Cat* sustained minor damage to the rubbing strake on the bow of the vessel.

1.6.2 The navigational mark was destroyed and required a new pile to be driven into the lake bed.

1.7 Organisational and management information

1.7.1 The *Cruise Cat* was under SSM with SGS M&I. The certificate was issued on 26 May 2006 after the specified 4-yearly survey and, subject to periodic audit/inspection of the ship and its management system, was valid until 24 May 2010.

1.7.2 Since 1999, Maritime New Zealand (Maritime NZ) had sought to introduce a system to benchmark the safety performance of all commercial vessels. The Safety Profile Assessment Number (SPAN) system was introduced; however, the system had suffered some initial problems and had been reviewed and amended in 2003.

1.7.3 The SPAN system in place at the time of the incident used a number of elements to calculate the SPAN for each vessel. The primary element was a word picture, which was used to evaluate the general condition of a vessel and the way its SSM system was operating. Word pictures were a standard auditing procedure and helped provide a standard method of evaluation for all the vessels, irrespective of who carried out the inspection. The Maritime NZ word picture (see Appendix 1) was used both by Maritime NZ Maritime Safety Inspectors, and by SSM company surveyors and auditors. It consisted of descriptions for 11 assessed areas against which an inspector could evaluate a vessel against a total score of 100, where 0 was safest and 100 was least safe. The total from the word picture was adjusted for each of 5 other factors (oil spills, accidents or incidents, complaints, inherent risks and deficiencies from surveys) to give the final SPAN for the vessel. The SPAN was intended to reflect the current state of a vessel including its maintenance and operations.

1.7.4 The most recent SSM word picture had been completed on 24 May 2006 by a SSM surveyor for the *Cruise Cat* and gave a score of 7, noted no system-related deficiencies and no deficiencies raised at previous inspection. On 1 July 2006 Maritime NZ advised all owners of their current SPAN information, which for *Cruise Cat* was a score of 8.43 with the average SPAN for all similar vessel type being 11.12 (see Appendix 2).

1.7.5 The penultimate SSM word picture completed on 14 June 2005 for the *Cruise Cat* gave a score of 68, noting document-related deficiencies and that previous deficiencies raised had all been closed out within agreed timeframe by the agreed method.

1.8 Fatigue

1.8.1 There are many definitions of fatigue but no universally accepted one. The extent to which individuals may be affected by a given set of circumstances will vary. The definition most widely accepted by the shipping industry was that used by the International Maritime Organization, namely:

> A reduction in physical and/or mental capability as the result of physical, mental or emotional exertion which may impair nearly all physical abilities including strength; speed; reaction time; co-ordination; decision-making or balance.

1.8.2 Work-related fatigue has three main causes:

1. excessively long and/or hard work (time-on-task fatigue and workload)
2. inadequate, irregular or poor-quality sleep
3. working and resting at inappropriate times in the circadian rhythm[3], which leads to reduced task performance and impaired sleep quality respectively.

1.8.3 Sleep is not equally possible across the 24-hour day. How quickly a person can fall asleep and how long they remain asleep are regulated by their circadian body clock. This can be visualised in terms of competing sleep and wake "drives". The sleep drive is highest in the early hours of the morning when the urge to fall asleep is most overwhelming and can be completely uncontrollable.

1.8.4 Not only the amount of sleep but also the quality of sleep can have important effects on wake-time functioning. Sleep that is restless and fragmented by frequent awakenings leaves a person sleepy and at increased risk of making errors. Sleep can be disrupted by a wide variety of

[3] The inherent pattern of physical and mental characteristics related to a 23 to 25-hour internal central nervous system activity cycle.

factors, including physical sleep disorders and other health problems, changing work and rest schedules, poor sleep habits and ill-informed attitudes about increasing wake-time activities by cutting back on sleep.

1.8.5 In October 2001 Maritime NZ issued an advisory circular (AC) to Maritime Rules Part 31B. AC 31B.9 contained information on fitness for duty and fatigue including a table giving guidance on the effects of fatigue and associated signs and symptoms.

1.8.6 At the time of writing Maritime NZ had been working for several years on a suite of fatigue management resources for use in the SSM industry. Training for SSM companies and for Maritime NZ's own field staff was to commence in September 2007, with the resources being available to industry by the end of 2007.

2 Analysis

2.1 Because the *Cruise Cat* was certified for use on Lake Taupo, was less than 20 m length overall and carried a maximum of 98 passengers, it was exempt from requiring a minimum safe manning certificate, so the manning required was derived from Table 3 in Maritime Rule 31B.10. This required a qualified skipper and one unqualified crew member as minimum crew for up to 99 passengers, however the Rule also required the number of crew necessary to operate the vessel safely. This was left to the discretion of the SSM company and the commitment of the operator to ascertain whether enough crew were on board for any particular voyage.

2.2 The operator, in this case, considered 4 crew excluding the skipper to be sufficient for a dinner cruise with up to 98 passengers on board. However, none of these crew was required to hold any maritime qualification other than basic onboard training. Had an emergency developed during the cruise the skipper may have been in the position of having to deal with an emergency while at a critical point in the voyage. As the *Cruise Cat* could navigate to the remotest points of the lake there was a risk of a minor incident becoming more serious without enough appropriately trained personnel on board to deal with the situation.

2.3 In this case the operator had above the minimum number of qualified crew due to operational requirements; however, the operator could have operated the vessel with just a skipper and one other crew member on board. The Commission concluded that a crew of 2 with 98 passengers would not meet the requirement to operate the vessel safely. The SSM system ship's policy and procedures manual, a joint responsibility between the SSM company and the operator, omitted reference to any requirement for the operator and skipper, when deciding on the number of crew required on board to operate safely for any voyage, to take into consideration:

- the purpose of the voyage
- the number of passengers
- the area of the lake in which the vessel was to operated and
- the expected environmental conditions such as darkness and weather

The Commission has already made a safety recommendation to the Director of Maritime NZ to undertake a full review of the SSM system so no further safety recommendation covering this aspect has been made in this report. However, the results of the programme of work will be monitored through the Commission's recommendation status report instead.

2.4 The SSM word pictures, which in turn affected the Maritime NZ SPAN, had been completed on a regular basis as evidenced by the documents themselves. However, the scoring for each of the questions depended on an individual inspector's interpretation, so produced variations in the evaluations between inspectors. Thus the scoring for a vessel and its associated systems could vary widely between inspections as shown by the score of 68 in June 2005 and a score of 7 in

May 2006. There was no pass or fail score, but the higher the score the more rigorous the audit and inspection regime became.

2.5 The skipper of the *Cruise Cat* was aware that the relief skipper who was acting in the capacity of deckhand did not understand or like operating the entertainment system. As the relief skipper was certified to operate and had skippered the *Cruise Cat* on many occasions, both in daylight and at night, it was reasonable for the skipper to ask him to con the vessel back to its berth.

2.6 The relief skipper could have declined the offer to con the vessel back to berth if he felt that he was too tired, but was probably relieved at not having to do a job that he disliked, so readily agreed.

2.7 Although it is unlikely that the relief skipper was chronically fatigued at the time of the incident it is possible that he was suffering from the symptoms caused by the onset of fatigue, and may not have recognised the symptoms himself. His history of work hours coupled with events in his personal life leading to sleep problems would have made the possibility of fatigue more likely.

2.8 Had the relief skipper been suffering from the onset of fatigue, his decision-making on when to alter course, his coordination of amount of helm and use of engines, and reaction time on reaching his chosen alter course position could all have been adversely affected, making the probability of collision with the navigational mark all the more certain.

2.9 The type of business in which the operator was engaged was seasonal depending mainly on tourist activity, so also was the need for crews for its vessels. The operator would not have required full-time employment for all its crews on all its vessels for the whole year, so catered for this by providing full employment for fewer core crew, who were multi-disciplined, and bringing in part-time staff for the "high season". However, with the core crew this could mean they were required to do several different jobs on different vessels throughout the day and evening; during the high season this could lead to extended working hours and the possibility of fatigue if not managed properly.

2.10 The operator should have been extra vigilant and had measures in place to deal with the possibility of fatigue affecting its crews especially skippers, however the operator through its SSM system had no defined policies in place to deal with crew fitness for duty. With the introduction of Maritime NZ's suite of fatigue-management resources the operator, skippers and crew should be better prepared to handle fatigue-related issues.

2.11 The design of the *Cruise Cat* was such that the helm station and conning position were not segregated from the passengers on the upper deck. This may have been an advantage when used for scenic tours as it would allow the person conning the vessel to interact with the passengers possibly allowing for a dialogue to be undertaken between the helmsman and passengers at less critical points of the voyage. However, passengers who are on board enjoying the hospitality and entertainment of a dinner cruise or suchlike may inadvertently distract the helmsman at a critical point of the voyage. It is unclear whether this was a factor in the relief skipper misjudging the turn into the channel, but it could not be ruled out.

2.12 The eye level of the person conning the *Cruise Cat* was higher than the focal plane of the navigational mark. So as the *Cruise Cat* closed with the starboard-hand navigational mark the person conning the vessel would have been looking down at the navigational mark. If the mark had been directly ahead, then the mark could have been obscured by the open access hatch to the foredeck (see Figure 4). However, by the time the mark was obscured in the narrow arc directly ahead caused by the open hatch, the possibility of averting collision with the mark would have been minimal.

2.13 Had the river control gates been open more than was normal, the current at the river entrance channel could have been greater than expected. This would have affected the water flow over the rudders making the turn into the channel more difficult and increasing the ground speed of

any inbound vessel. However, from the information supplied by the control gate operator the flow at the time of the incident (see Figure 6) was considerably less than the maximum flow over the previous few days and was in fact lower than the average flow. It is unlikely that this amount of flow would have affected the *Cruise Cat* to any great extent at the distance the vessel was from the channel's narrowest point at the entrance to the river.

2.14 Although the *Cruise Cat* could most likely have turned into the channel near the light beacons using the helm alone there was no latitude for error. Because of the reduced speed of the vessel through the water and the reduced water flow over the rudders the effectiveness of the rudders would have been reduced increasing the turning circle of the vessel. An alternative method would have been for the relief skipper to have used the port engine astern and the starboard engine ahead in conjunction with the helm to reduce the turning circle, or to even have turned to starboard in a full circle and entered the channel from further out.

2.15 The safest way to approach the entrance to the narrow channel would have been to do so broadly in line with the direction of the channel. A vessel should be established on the line of the channel early, in this case depicted by the white sector of the sector light. That way the relief skipper could have chosen where in the sector light he wanted to be depending upon draught limitation, other vessel traffic or any other factor. The vessel would have been steadied on an approach and could have been moved within the 3 light sectors with subtle changes of course instead of having to make last-second large course alterations to make the channel entrance.

2.16 The width of the white sector of the sector light was about 24 m at the beacons. The starboard-hand beacon was about another 16 m into the green sector, giving a total of 40 m from the time the *Cruise Cat*'s bow entered the white sector to when it was in line with the starboard-hand beacon. The conning position was 6 m back from the bow, reducing the distance to 34 m from the time the relief skipper saw the sector light turn from red to white. At a reduced speed of say 10 knots (5.1 m/s) it would have taken about 6.5 s for the bow to go past the line of the starboard-hand beacon, depending on how oblique the course was to the line of the leading light.

2.17 The 6.5 s could have been further reduced in the worst case to 5 seconds depending on whether the occulting sector light was in its 1.5 s dark phase or not. At that point collision with the starboard-hand beacon would have been highly likely. Any further delay in turning to port due to fatigue or distraction by the passengers would have increased that likelihood. For these reasons the relief skipper's technique for entering the channel was in this case flawed.

2.18 Leading sector lights are an effective aid for guiding vessels through narrow channels and fairways. In this case the sector light was installed some time after the existing light beacons and unlit buoys. The beacons and buoys could have been construed as being a secondary means of gauging a vessel's lateral position in the channel, but also for gauging how far down the channel a vessel had travelled.

3 Findings

3.1 The *Cruise Cat* collided with the starboard-hand entrance beacon to the Waikato River channel on Lake Taupo because the relief skipper on the helm misjudged the vessel's position in relation to the beacon.

3.2 The *Cruise Cat*'s angle of approach to the channel entrance, together with the relief skipper's method of judging when to make the turn, was not appropriate for the night conditions and size of vessel in relation to the size of the channel entrance.

3.3 The following factors may have contributed to the relief skipper misjudging the turn into the channel:

- the onset of fatigue due to the relief skipper nearing the end of his third consecutive 14-hour day
- the raised foredeck hatch partially obscuring his view of the light beacon
- distraction by passengers close to the conning position

3.4 The *Cruise Cat* complied with the Maritime Rules for crewing requirements and was appropriately crewed for its intended voyage, but the SSM manual did not require any minimum manning dependent upon the number of passengers carried and the vessel's intended use.

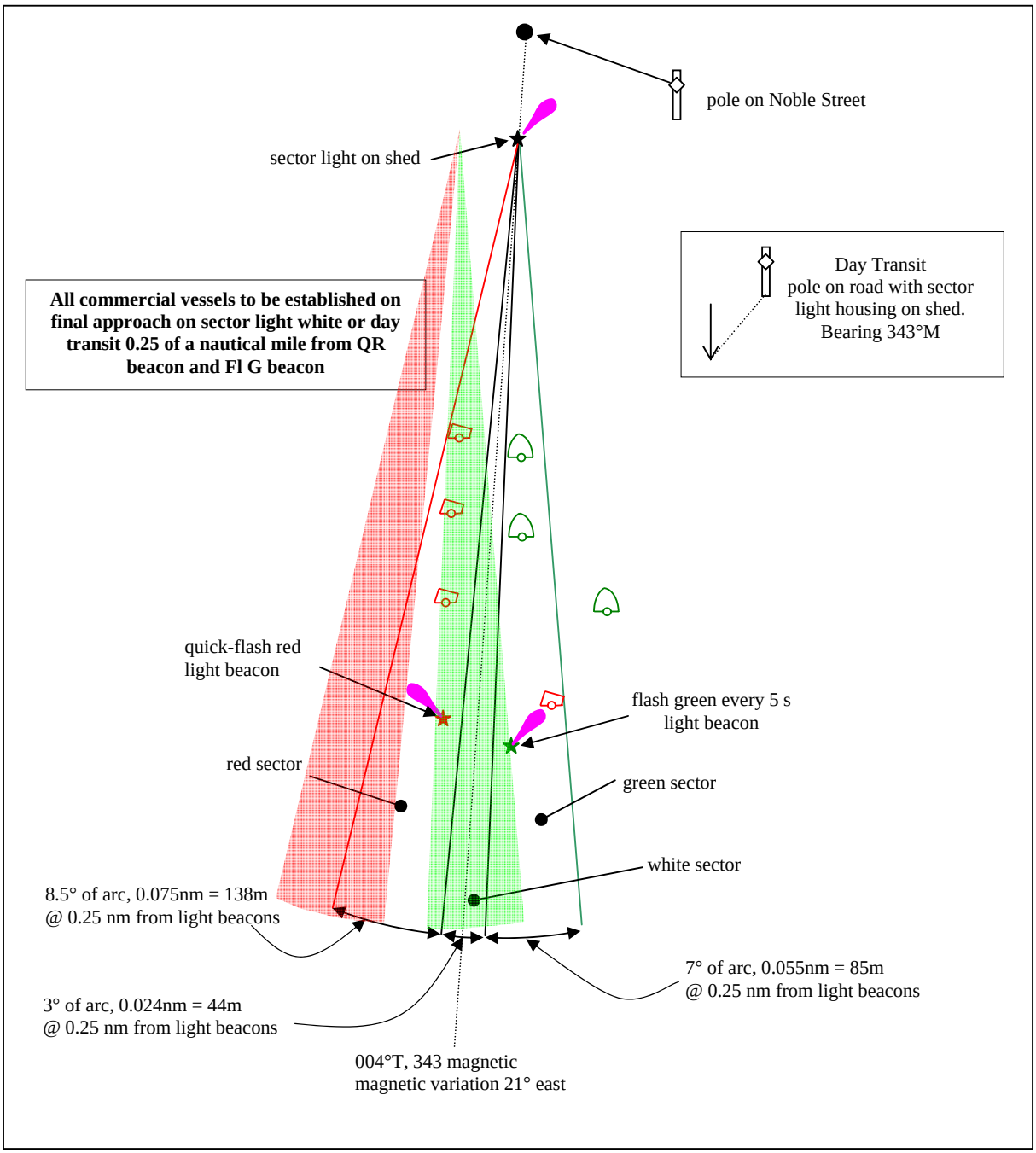


Figure 7
Diagram as supplied with the Harbourmaster's directive

4 Safety Actions

4.1 On 20 March 2007, the Lake Taupo Harbourmaster issued a directive stating that:

> All commercial vessels operating at night are to establish on the white sector of the Harbour entrance sector light at no less than 0.25 of an nm (1/4 of a nautical mile) from the lit port and starboard hand channel markers.

4.2 In view of the action taken by the Taupo Harbourmaster, no further safety recommendations covering these aspects have been made to the Taupo Harbourmaster

4.3 In view of the work presently being undertaken by Maritime NZ with respect to fatigue-management resources for the SSM regulated industry no further safety recommendations have been made covering this aspect.

5 Previous Safety Recommendations

5.1 On 2 April 2007, a safety recommendation was made to the Director of Maritime Safety in Marine Occurrence Report 05-212, to:

> undertake a full review of the Safe Ship Management system and make changes to ensure the system promotes and effectively regulates a safe and sustainable maritime industry consistently throughout New Zealand.

5.2 On 24 July 2007, the Director of Maritime NZ replied:

> MNZ constantly monitors the SSM system, which has been formally reviewed three times since its introduction in 1998. Each review, by independent bodies external to MNZ, found that the philosophy behind the system was sound, and since the system was introduced safety statistics in all commercial maritime sectors have improved. While feedback from the industry indicates solid support for the intent of the system MNZ considers that there is still room for improvement in how the system is implemented and delivered by MNZ and SSM companies.
>
> In line with our continuous improvement policy, a review of the SSM system has been identified as the key strategic priority for MNZ in its 2007-2010 Statement of Intent. MNZ has commenced a programme of work to enhance the sustainability and effectiveness of the SSM system by:
>
> 1 Ensuring that the regulatory framework supporting SSM is robust and appropriate by reviewing the maritime rules that govern its operation. A draft discussion document summarising proposed changes to Maritime Rules Part 21 (Safety Management Systems) and Part 46 (Surveys, Certification and Maintenance) is due for public release in late 2007;
>
> 2 Complementing existing guidance material (Health and Safety: A Guide; FishSAFE Health and Safety Guidelines; various leaflets) with additional material including a comprehensive resource to support owners in the development of their SSM systems, specific fatigue management material, and health and safety guidelines for passenger and non-passenger operations. This additional material is being progressively released through until December 2007 in association with targeted training material;
>
> 3 Increasing the amount and quality of formal and informal training and education that is available to all those working in the system, including MNZ and SSM Company staff, surveyors, owners and operators. This training will be supported by the development of a mentor network utilising experienced industry participants to provide support and advice to their peers;
>
> 4 Reviewing the current capacity and quality of service delivery by both MNZ and SSM Companies in the area of SSM and comparing this with

requirements in order to identify and address necessary areas for improvement;

5 Allocating additional resources to the SSM team within MNZ to allow for more responsive contact with industry and other stakeholders, along with the provision of personalised assistance where required to owners and operators; and

6 Structured auditing by MNZ of SSM service providers.

This work is being actively progressed and monitored within MNZ. It is also intended to establish an external consultative group to ensure that all industry and other stakeholders remain fully involved with, and aware of, the programme as it is developed and implemented.

Approved on 14 November 2007 for publication

Hon W P Jeffries
Chief Commissioner

SSM Vessel Safety Profile

Date _____ Auditor_____ Company _____

Vessel Name _____ Port _____ MSA Number _____

General Condition

1. General Condition of Vessel
- ☐ Excellent appearance (0)
- ☐ Good appearance (2)
- ☐ Average appearance (4)
- ☐ Poor appearance (8)

2. System Related Deficiencies/ Corrective Actions raised at this inspection/ audit
- ☐ Safety related deficiencies (8)
- ☐ Document related deficiencies (4)
- ☐ General deficiencies (6)
- ☐ No system related deficiencies (0)

3. Deficiencies raised at previous inspection
- ☐ Previous deficiencies raised and all closed out within agreed timeframe and by agreed method. (2)
- ☐ Previous deficiencies raised but not all closed out within agreed timeframe and by agreed method. (4)
- ☐ Previous deficiencies raised, some still outstanding (6)
- ☐ Previous deficiencies raised, all still outstanding (8)
- ☐ No deficiencies raised at previous inspection (0)

4. Awareness and Acceptance of Rules
- ☐ Owner and Skipper are aware of all applicable maritime rules and show acceptance and compliance of these rules. (0)
- ☐ Owner and Skipper show awareness of all applicable maritime rules but show no evidence of acceptance and compliance. (8)
- ☐ Owner and Skipper show no awareness of all applicable maritime rules. (8)

Safe Ship Management

5. Awareness and Acceptance of SSM
- ☐ Excels in procedures and practices - owner self-audits and all personnel actively support the system (0)
- ☐ Satisfactory level of awareness - supported by all personnel (2)
- ☐ Negative response to and acceptance of SSM, does not improve/maintain/customise manual over time (8)
- ☐ Unsatisfactory (8)

6. Ship Specific Manual
- ☐ All procedures, maintenance plans, training and hazard identification is specific to the vessel & being implemented. (0)
- ☐ Some procedures, maintenance plans, training and hazard identification is specific to the vessel & partially implemented. (5)
- ☐ The Manual is not ship specific or a generic manual is on board. (9)

7. Documentation
- ☐ Exceptional documentation – exceeds requirements (0)
- ☐ Good, tidy, well thought out and maintained (1)
- ☐ Average, but could be improved (3)
- ☐ Poor or untidy, various parts don't meet requirements or manual not tailored to the vessel (5)

Health and Safety

8. Crew Participation and Training
- ☐ Owner has effective &comprehensive training procedures & it's being implemented & recorded. (0)
- ☐ Owner has effective & comprehensive training procedures but they are not being implement and recorded. (8)
- ☐ No training procedures are in place or procedures are not effective & comprehensive. (8)

9. Hazard Identification
- ☐ Very effective proactive identification and management of hazards (0)
- ☐ Regularly scheduled identification and management of hazards (2)
- ☐ Documented system for identifying and managing hazards – not being implemented (8)
- ☐ Hazard identification processes in place but not documented (4)
- ☐ No hazard identification process in place (10)

10. Accident Register
- ☐ Excellent system for recording accidents and incidents, clear evidence of lessons being learnt and acted upon (0)
- ☐ Good system for recording accidents & incidents, some evidence of lessons being learnt and acted upon (4)
- ☐ System in place to record accidents and incidents, but no evidence of lessons being learnt and acted upon (6)
- ☐ No system for recording accidents & incidents in place (8)
- ☐ Excellent system for recording accidents and incidents, has not been involved in any accidents or incidents (0)

11. Owner Review
- ☐ Owner conducts reviews the system and evidence of continual improvement. (0)
- ☐ Owner conducts reviews, but not verifying the effectiveness of systems. (15)
- ☐ No reviews conducted, not verifying effectiveness of systems. (20)

TOTAL:

Appendix 2

Safety Profile Assessment Number
01 July 2006

Vessel Name: CRUISE CAT

MSA Number: 106160

Vessel Type: Restricted Passenger Ship

Safe Ship Management Company: SGS/M&I

Safety Profile Assessment Number (SPAN): 8.43

Human Risk Factor: 0
Vessel Risk Factor: 8.43

This is comprised of:

Element	***Highest Possible Risk Score[3]***	***Your Vessel Score***
Complaints	7.00	
Oil spill History	12.00	0
Inherent Risk	7.00	5.6
Maritime NZ Deficiencies	12.00	
Maritime NZ Safety Profile Vessel	8.00	0.56
SSM Company Deficiencies	18.00	0
SSM Company Safety Profile Vessel	11.00	0.56
Maritime NZ Safety Profile Human	11.00	1.71
SSM Company Safety Profile Human	14.00	0
Total	*100.00*	*8.43*

This vessel has been assessed as having a **Priority 1** risk level.

The average SPAN for all vessels in Safe Ship Management is **11.72**.
The average SPAN for all vessels within your Safe Ship Management Company is 10.78.
The average SPAN for all vessels of a similar vessel type is 11.12.

The total number of accidents for vessels of your type over the past year is 65.
The total number of incidents for vessels of your type over the past year is60.
The total number of mishaps for vessels of your type over the past year is 1.
The total number of injuries for vessels of your type over the past year is 24.
The total number of fatalities for vessels of your type over the past year is 1

[3] The higher the score, the greater the assessed risk level of the vessel.

Recent Aviation Occurrence Reports published by the Transport Accident Investigation Commission (most recent at top of list)

06-205	fishing vessel, *Lady Luck*, collision and subsequent foundering, Motiti Island, Bay of Plenty, 23 June 2006
06-203	fishing vessel *Venture*, grounding, Tipi Bay, Tory Channel, 19 April 2006
06-201	passenger freight ferry *Aratere*, Heavy weather incident resulting in cargo shift, Cook Strait, 3 March 2006
05-211	container ship *Spirit of Resolution*, collision with bridge, Onehunga, 8 October 2005
05-210	restricted limit passenger vessel *Milford Mariner*, engines' stall resulting in grounding, Harrison Cove, Milford Sound, 18 September 2005
05-208	passenger freight ferry *Santa Regina*, near grounding, Tory Channel eastern entrance, 9 June 2005
05-207	freight and passenger ferry *Santa Regina* and private launch *Timeless*, collision, off Picton Point, Queen Charlotte Sound, 2 May 2005
05-206	passenger/freight ferry *Arahura*, loss of propulsion, Cook Strait, 24 April 2005
05-205	restricted limit passenger vessel *Black Cat*, control cable failure and collision with rock wall Seal Bay, Akaroa Harbour, 17 April 2005
05-202/204	passenger freight ferry *Aratere*, steering malfunctions, Wellington Harbour and Queen Charlotte Sound, 9 February and 20 February 2005
05-201	passenger ferry *Quickcat* and restricted passenger vessel *Doctor Hook*, collision, Motuihe Channel, 4 January 2005
04-219	restricted limit passenger vessel *Tiger 111*, grounding, Cape Brett, 18 December 2004
04-217	fishing vessel *San Rochelle*, fire and foundering, about 96 nm north-north-west of Cape Reinga, 27 October 2004
04-216	passenger freight ferry *Aratere*, total power loss, Queen Charlotte Sound, 19 October 2004
04-215	restricted limit passenger vessel *Southern Winds*, grounding, Charles Sound, Fiordland, 15 October 2004

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