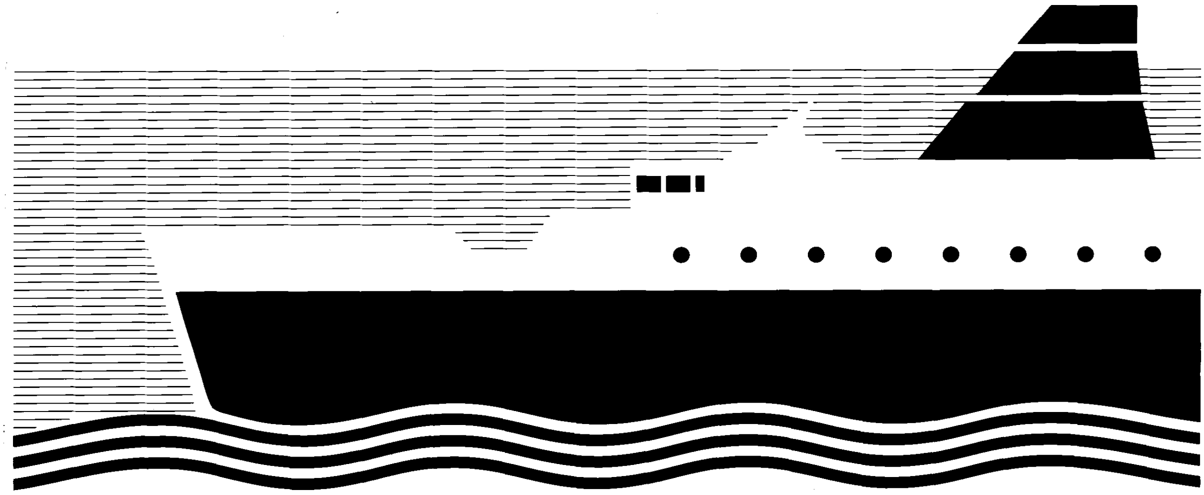
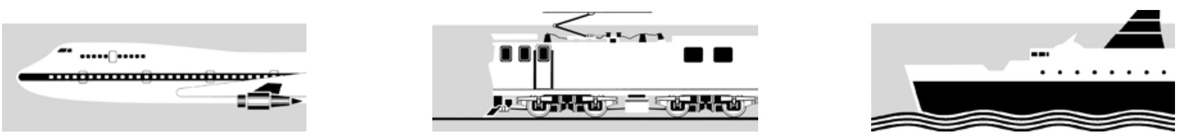


MARINE OCCURRENCE REPORT

02-204 coastal cargo ship Kent, collision and flooding, Wellington Harbour 14 July 2002



TRANSPORT ACCIDENT INVESTIGATION COMMISSION
NEW ZEALAND

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 02-204

coastal cargo ship

Kent

collision with pontoon and subsequent flooding of engine room

Wellington Harbour

14th July 2002

Abstract

On Sunday 14 July 2002, at about 1830, the coastal cargo ship *Kent* parted a mooring line while attempting to berth in storm force winds at Glasgow Wharf in Wellington Harbour. Subsequently, as the ship was proceeding back out into the harbour, it struck a pontoon and was holed below the waterline in way of the engine room. The engine room progressively flooded and the ship lost all power. The *Kent* anchored near Point Jerningham before being towed to the Overseas Passenger Terminal, where repairs were affected and the engine room pumped out.

Safety issues identified included:

- identification of significant risk for shipboard operations
- management of available personnel in order that tasks may be completed with minimum risk and maximum safety
- no watertight division between the engine room and the main vehicle deck

Safety recommendations were made to the Operations Manager of Strait Shipping Limited to address the safety issues.

Contents

Figures

Abbreviations

ARPA	automatic radar plotting aid
hPa	hectoPascal(s)
m	metre(s)
mm	millimetre(s)
MSA	Maritime Safety Authority
NIWA	National Institute of Water and Atmospheric Research Limited
nm	nautical mile(s)
NZST	New Zealand Standard Time (UTC +12 hours)
ro-ro	roll on – roll off
rpm	revolutions per minute
SOLAS	International Convention for the Safety of Life at Sea
SSM	safe ship management
t	tonne(s)
UTC	Coordinated Universal Time
UHF	ultra high frequency
VHF	very high frequency

Glossary

abeam	direction at right angles to the length of a ship
amidships	middle section of a vessel, mid length
aft	rear of the vessel
athwartships	transversely across a ship
backspring	a mooring rope leading aft from the bow or forward from the stern
ballast	weight, usually seawater, put into a ship to improve stability
beam	width of a vessel
bilge	space for the collection of surplus liquid
bitter end	the inboard end of the anchor cable, usually where it is fastened in the chain locker
bollard	a large solid post on a wharf for securing mooring lines
bow thruster	a small athwartships propeller mounted in a tunnel at the forward part of a ship used to manoeuvre a ship at slow speeds
bridge	structure from where a vessel is navigated and directed
class	category in classification register
dog	cleat or device for securing watertight openings
forecastle	raised structure on the bow of a ship
freeboard	distance from the waterline to the deck edge
free surface	effect when liquids are free to flow within a compartment
gypsy	sprocket wheels on a windlass used for hauling the anchor cable
headline	mooring line leading forward from the bow of a ship
heaving line	a small line thrown to an approaching vessel, or a dock as a messenger
in way of	connecting to or in the vicinity of
knot	one nautical mile per hour
okta(s)	a unit of cloud cover, equal to one eighth of the sky
port	left hand side when facing forward
shackle	marked length of anchor cable measuring 15 fathoms (90 feet, 27 metres)
shoulder	the part of a ship on each side of the bow where the straight sides begin
spring on/off	to manoeuvre the ship off of or onto the berth using a combination of a backspring and the engines
starboard	right hand side when facing forward
stability	property of a ship by which it maintains a position of equilibrium, or returns to that position when a force that has displaced it ceases to act
superstructure	permanent structure above deck level
squall	high wind that arrives and ceases suddenly not necessarily in the direction of the prevalent wind
sternline	mooring rope leading aft from the stern of a ship
track	the path intended or actually travelled by a ship
trim	difference between the forward and aft draughts of a floating vessel
windlass	winch used to raise a vessel's anchor

Data Summary

Ship particulars:

Name:	*Kent*
Type:	Coastal Cargo
Class:	100A1
Classification:	Lloyds Register of Shipping
Length (overall)	122.95 m
Breadth (extreme)	21.0 m
Gross tonnage:	6862 t
Built:	1977
Propulsion:	Pielstick 2 x 2685 kW
Service speed:	14 knots
Owner:	Berwick Bay Shipping Limited
Operator:	Strait Shipping Limited
Port of Registry:	Castletown, Isle of Man
Maximum passengers allowable:	12
Minimum crewing requirement:	13

Date and time:	14th July 2002	
Location:	Wellington Harbour	
Persons on board:	crew:	16
	passengers:	9
Injuries:	crew:	nil
	passengers:	nil
Damage:	Ship's port side shell plating holed in way of engine room with 1000 mm x 125 mm gash. Subsequent complete flooding of engine room and engine control room with associated damage to equipment contained therein.	
Investigator-in-charge	Captain D. Monks	

1 Factual information

1.1 Narrative

1.1.1 On the evening of 14 July 2002, the cargo ship *Kent* was bound for Wellington from Picton. At approximately 1753, the master handed over the watch, and the command of the ship, to the mate/master. As part of the handover the master passed on the weather information he had received from the Beacon Hill (Wellington Harbour radio) operator a short time before. This included continuing storm force winds with gusts up to 70 knots from the south-west. At this time, the ship was passing Barrett's Reef buoy in-bound into Wellington Harbour.

1.1.2 As the ship approached Point Jerningham (refer Figure 1) at about 1823, the engines were placed on standby and the ship's speed reduced.

1.1.3 As the ship passed the light beacon off the south-west corner of the Thorndon Container Terminal, the mate/master adjusted the course to bring the ship's head round into the wind. The way was completely taken off the ship and it was then allowed to drop back under the control of the engines and the bow thruster. The stern entered the basin between Glasgow and Kings Wharves, and as the bow neared the outer end of Glasgow Wharf (refer Figure 2 – position 2) the seamen on the forecastle sent a heaving line ashore, followed by a headline. When the headline was secure on a bollard near the end of the wharf the crew heaved it tight.

1.1.4 At this point, the ship was lying at an angle of about 30° to the line of Glasgow Wharf with the stern about 30 to 40 m off the wharf. The mate/master adjusted the engine controls to start moving the stern towards the wharf. At about this time, the master of the *Kent* went onto the bridge, but was acting purely as an observer. The bow thruster was thrusting full to starboard continuously in an attempt to counteract the effect of the wind on the forward part of the ship. The configuration of the engines and the rudder moved the ship ahead until weight came on the headline, which was then acting as a forward backspring. The resultant forward thrust of the engines and the helm being hard-to-port caused the ship to pivot about the mooring line and moved the stern towards the wharf. During this manoeuvre the shoulder of the ship made contact with the corner of the wharf. A great deal of weight came on the mooring line and it parted just outside the fairlead. The mate/master immediately instructed the forecastle crew to get another line ashore as soon as possible, but this was never achieved. As the stern closed with the wharf, the after crew sent a heaving line attached to a sternline. Although they managed to get the stern line onto the shore, the linesman on the wharf was unable to secure it on a bollard.

1.1.5 For one or 2 minutes after the mooring line parted, the ship stayed close to the wharf, but then the bow started to pay off to port, towards Kings Wharf. The mate/master instigated his emergency plan, which was to proceed out, clear of the wharves, into Lambton Harbour in order to re-assess the situation. The mate/master ordered the engines to full ahead. By this time the ship's head had fallen off sufficiently for the mate/master to be concerned that the ship would collide with the beacon at the south-west corner of Thorndon Container Terminal, so he applied starboard helm to swing the ship clear of it. The ship's bow swung to starboard and the stern to port, while the ship continued to be pushed by the wind towards Kings Wharf. The master had gone to the port bridge wing and noticed that the stern was swinging towards the 2 pontoons moored off the reclamation at the southern end of Kings Wharf. He warned the mate/master and advised him to "go to port". The mate/master put the helm hard-to-port but before the action of the rudders could stop the ship swinging, its port quarter made contact with the outer of the pontoons (refer Figure 2 – position 4).

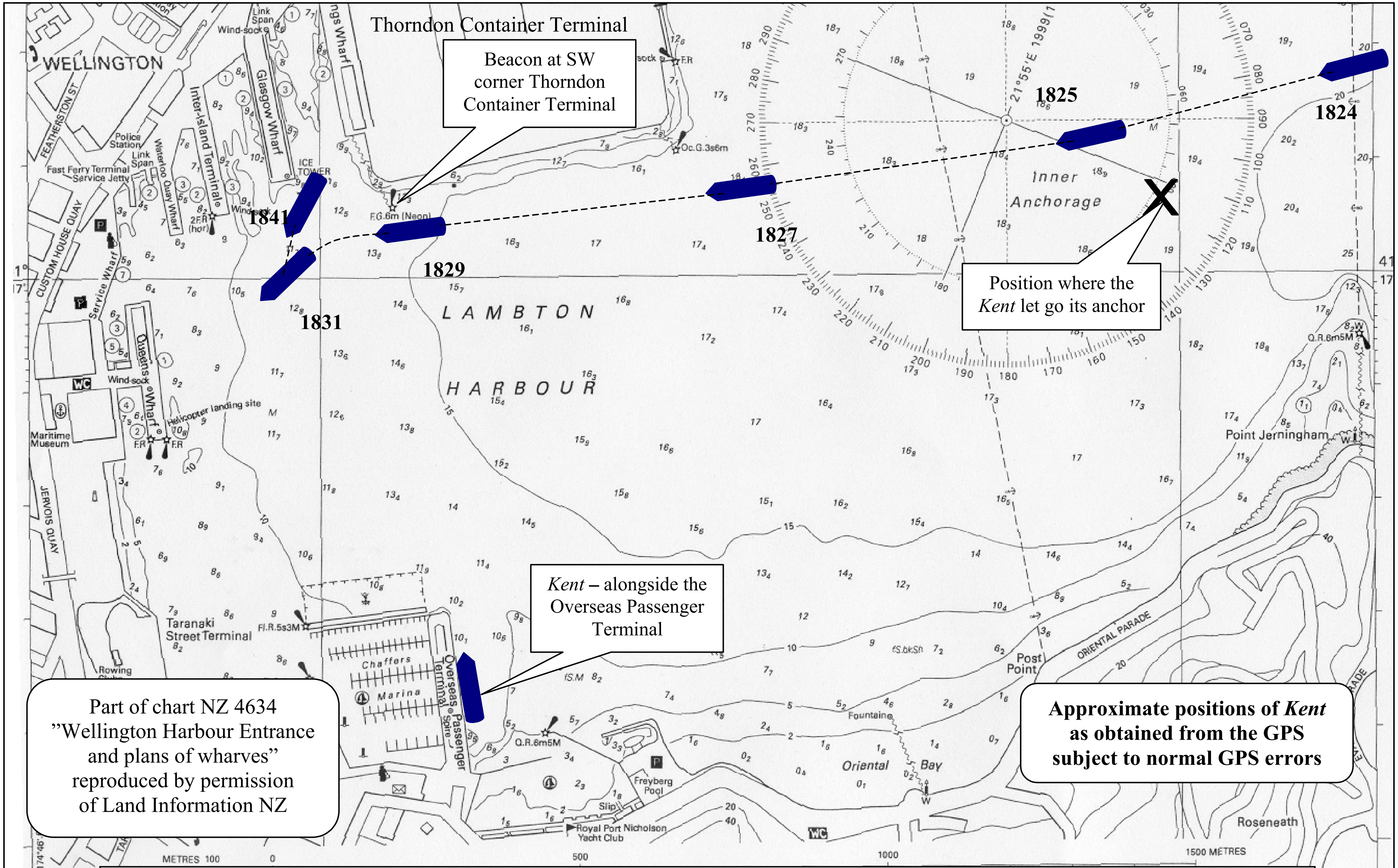


Figure 1
Section of chart NZ 4643 showing inward-bound track of the *Kent* and the position where it let go its anchor after the collision

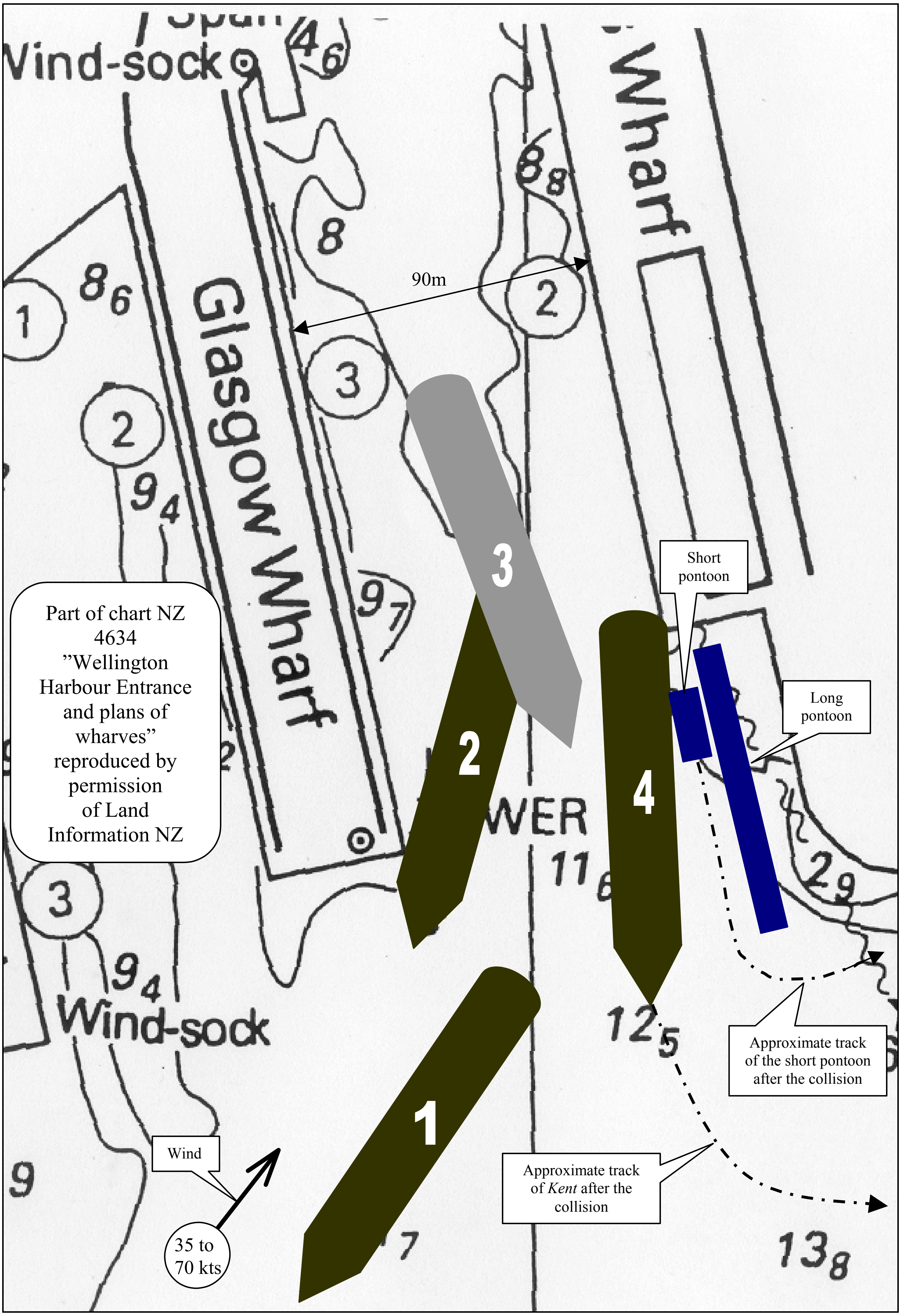


Figure 2
Section of chart NZ 4634 showing the approximate positions of the *Kent* during the berthing manoeuvre

1.1.6 The forward momentum of the *Kent* dragged the outer pontoon with it, breaking the mooring lines between the two pontoons. Eventually, the outer pontoon came free from the ship and drifted towards the southern shore of Thorndon Container Terminal. The *Kent* continued out into Lambton Harbour. At approximately 1852, the chief engineer, who was on watch in the engine room, informed the bridge team that the engine room was beginning to flood. Shortly after, the chief engineer informed the bridge team that propulsive power would soon be lost.

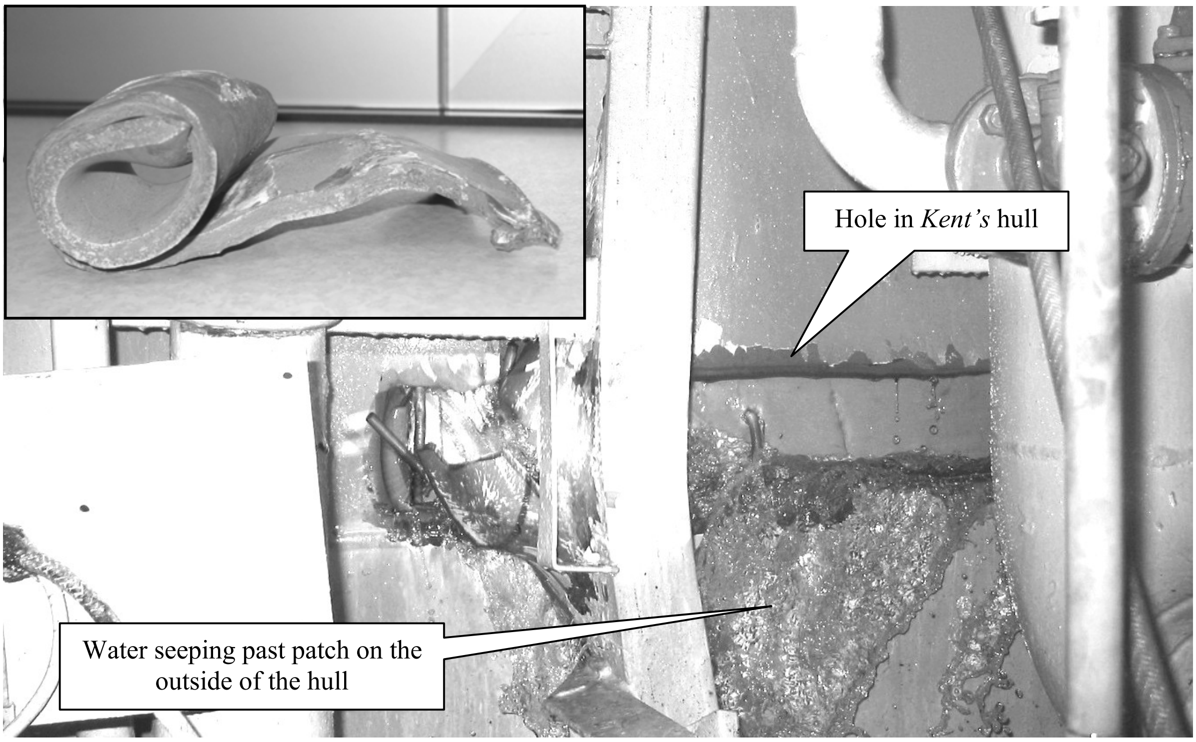


Figure 3
The hull plating of the *Kent* in way of the hole. A temporary patch in place over the outside of the hole. Insert shows section of hull plate peeled from the ship by the protrusion on the pontoon

1.1.7 At approximately 1901, the *Kent* anchored to the north of Point Jerningham using the starboard anchor (refer Figure 1). The anchor did not hold and the ship was driven by the wind towards the north. The Beacon Hill signal station operator was informed that the ship had collided with a pontoon that was now possibly adrift in the harbour. At 1907, the mate/master updated Beacon Hill and informed the operator that the ship had been holed on its port side (refer Figure 3), and that the engine room was flooding but the pumps were coping with the flow. The mate/master requested that a tug be called to stand by the ship. Shortly after this time, the chief engineer advised the bridge team that the pumps were no longer keeping pace with the ingress of water and that the ship would soon lose power. At 1909, the ship lost all power. The Beacon Hill signal station operator was advised of this.

1.1.8 At 1925, the harbour tug *Toia,* which had been assisting another ship berth, had a line onboard the *Kent* with the intention of towing it to more sheltered and shallower water in the vicinity of Post Point, Oriental Bay. At approximately 1930, the *Kent* slipped its anchor cable. This was done by removing the pin at the bitter end in the chain locker and allowing the cable to run off the windlass. At approximately 1945, the duty pilot boarded the *Kent* and discussed the situation with the master and mate/master. They decided that the ship should be towed to the Overseas Passenger Terminal at Freyberg Wharf to allow access for emergency services and equipment. At approximately 2040, the *Kent* was berthed alongside the Overseas Passenger Terminal.

1.1.9 During the remainder of that night and the following day, temporary repairs were carried out to patch the hole in the hull and portable pumps, supplied and operated by the local fire service, were used to pump out the engine room.

1.1.10 The pontoon grounded on the rocky shore to the south of the Thorndon Container Terminal close to the beacon on the south-west corner.

1.2 Ship and equipment information

1.2.1 The *Kent* was a roll on – roll off (ro-ro) cargo ship that was built in Japan in 1977. In 2001, it had been chartered by Strait Shipping Limited and brought to New Zealand for use on the Cook Strait freight service. It was primarily designed to carry road vehicles but also carried general cargo. As a SOLAS cargo vessel it was allowed to carry up to 12 passengers.

1.2.2 The ship was registered in the Isle of Man and had valid certificates issued by, or on behalf of, that Government and Lloyds Register of Shipping classification society.

1.2.3 The ship was built in accordance with the 1975 international convention on ship construction. This convention did not require a vessel to have a watertight division between the main vehicle deck and the engine room. The *Kent* was not fitted with watertight doors at the 2 main entrances into the engine room.

1.2.4 When the engine room and control room flooded, the water level rose to between 600 and 1000 mm below the sill of the entranceways from the main vehicle deck. The main vehicle deck was fitted with scuppers that voided into heeling tanks on each side of the ship.

1.2.5 The main vehicle deck, and therefore the engine room deckhead, sloped downwards from aft towards forward. This resulted in the after end of the engine room being about 1.7 m higher than the forward part.

1.2.6 Besides the 2 main entrances into the engine room from the main vehicle deck, there was an engine room stores/maintenance hatch and an engine room emergency escape hatch. The stores/maintenance hatch was in the centre of the engine room deckhead and was flush with the deck of the main vehicle deck. It was bolted into position and had a watertight gasket. The emergency escape hatch was on the forward starboard side of the engine room and had a trunkway extending about 600 mm above the main vehicle deck. The level of flooding in the engine room was above the top of the emergency escape hatch, so it was under pressure from the water below. This hatch was secured by 4 dogs and had a rubber watertight seal but it was observed to be weeping slightly when the engine room flooded. As a precaution the emergency escape hatch was further lashed down by nylon web ratchet tie downs and a quantity of lashing chain was placed on top of it.

1.2.7 A watertight door secured the access from the after end of the engine room, behind the control room, to the steering gear compartment. This door maintained its watertight integrity throughout.

1.2.8 Vehicle access to the lower vehicle deck was via a ramp from the main vehicle deck. A hydraulically operated hatch, fitted with a rubber seal, secured this opening in the main vehicle deck.

1.2.9 The stern ramp was fitted with a watertight rubber seal. When the stern ramp was in the closed position it sealed the main vehicle deck from the sea. In normal operating conditions, the base of the stern ramp was usually well clear of the seawater level. During this incident, owing to the loss of freeboard due to the flooding, the base of the ramp became immersed and slight seepage was noticed when the tugs were operating nearby.

1.2.10 The main engines of the *Kent* were 2 single acting, air-cooled, turbocharged, non-reversing diesels, each with an output of 3600 brake horsepower. These were connected to two 4-bladed, controllable pitch propellers. The engines were run at constant speed with the speed of the ship being varied by the controllable pitch propellers.

1.2.11 Steering was effected by 2 synchronised rudders, one placed abaft each propeller. The direction of the ship could also be controlled by varying the pitch of each propeller. A bow thruster was fitted to control the athwartships motion of the bow at slow speeds. It was rated at 750 kW, which in effect gave about 10 t thruster force.

1.2.12 There were 2 mooring winches (windlasses) on the forecastle of the *Kent* (refer Figure 4). Each winch comprised an anchor cable gypsy and a mooring rope drum, both of which could be separately engaged or disengaged by clutches, and secured by separate brakes. There was also a warping drum end that was used to tighten ropes that were not on the dedicated mooring rope drums. The warping drum end was driven directly by the winch and rotated constantly when the winch was running. On either side of the forecastle there was a cage in which additional mooring lines were stowed. These additional mooring lines had to be manually handled and led via a centrally mounted dolly (vertical mounted free standing fairlead) to the drum end for tightening. The ship usually moored to a headline and a backspring forward. These 2 mooring ropes were those permanently rigged on the mooring rope drums.

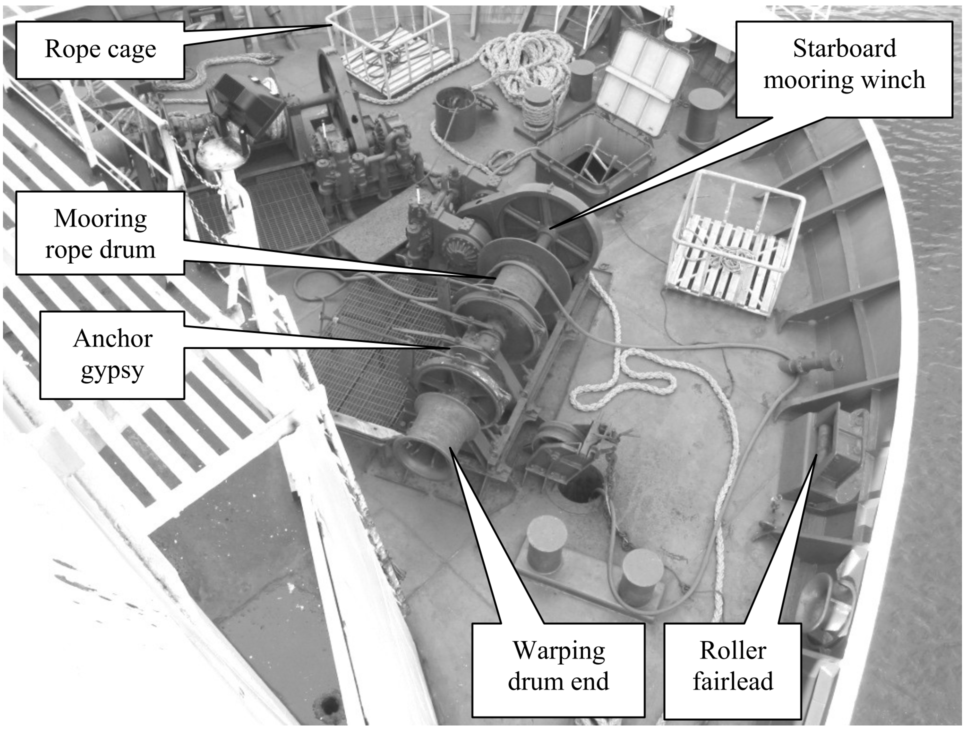


Figure 4
Forecastle of the *Kent* showing the mooring winches

1.2.13 The headline that parted was manufactured to international and British standards by the DSR Corporation of Korea under the trade name of Superdan 8 S/T. The rope was an 8-strand multiplait rope constructed of long strand polypropylene. The rope had a nominal loose diameter of 70 mm, and an under load diameter of 56 mm with a tabulated minimum breaking strain of 52.80 t. It was in a generally good condition, with no areas of excessive wear. The rope size was within the rope manufacturer's recommended guidelines for use on a ship the size of the *Kent*. The roller fairlead the rope passed through was regularly maintained and the rollers were free to rotate.

1.2.14 The ship was constructed with the accommodation block and navigation bridge forward, about 15 m from the bow. The funnels and the stern ramp were located right aft. This resulted in the ship having an uneven windage outline, with the bow more affected by the wind than the stern. The total area of the ship above the waterline was between 1400 m^2 and 1500 m^2.

1.3 Pontoon details

1.3.1 In 1993, Tranz Rail Limited purchased a number of small barges, which had been originally constructed for use in the shore pits of the Waverly ironsands project north of Wanganui. In December 1994 when the wave piercing high-speed ferries first started operations on the Cook Strait service, they were unable to use the conventional ferry berths and needed a floating linkspan to allow vehicle access to the ferry. The small barges were welded together to form 2 pontoons of watertight box construction, one for Wellington (refer Figure 5) and one for Picton (refer Figure 7). Eventually, the fast ferries moved to different berths and the pontoons became redundant. CentrePort, Wellington, purchased the pontoons in 2002, and on 5 July 2002, the shorter Picton pontoon was towed to Wellington. It was originally moored at the south end of the Interisland Wharf but was moved alongside the longer Wellington pontoon, at the southern end of Kings Wharf, on 8 July; 6 days before the accident.

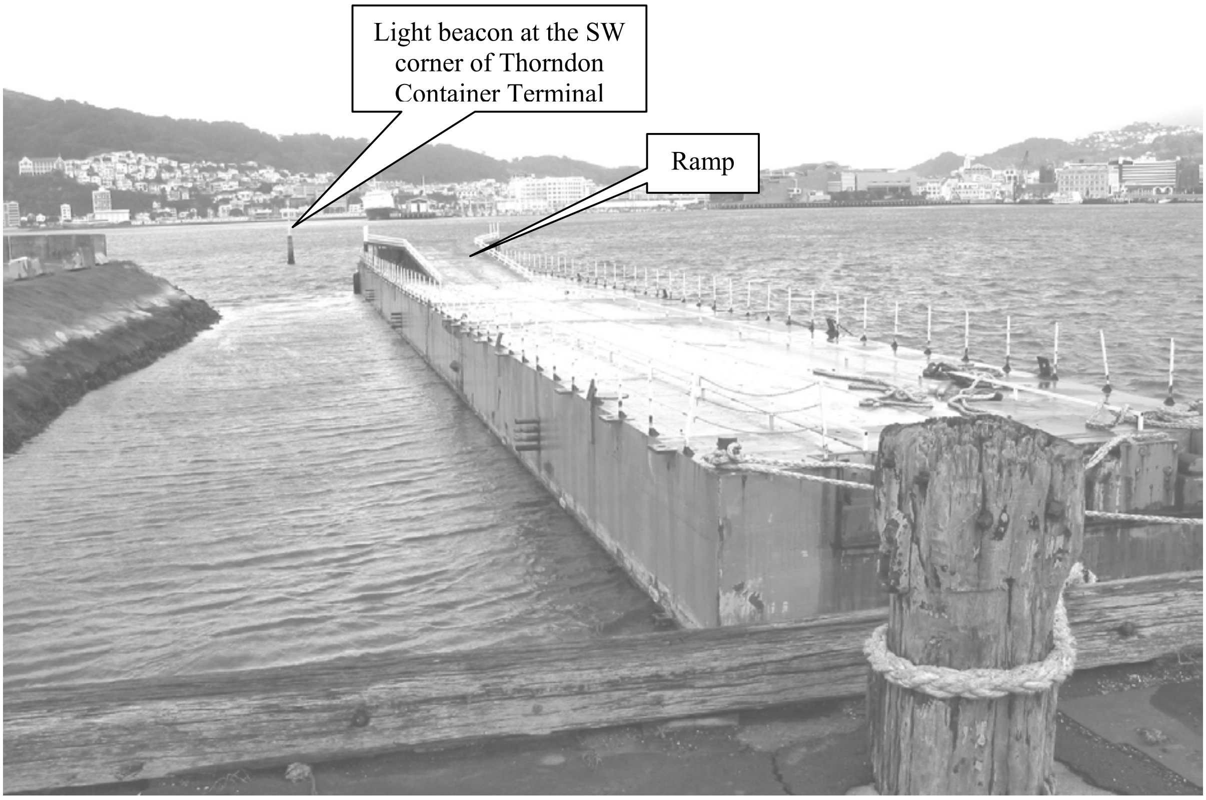


Figure 5
The Wellington (long) pontoon, photographed looking south from the end of Kings Wharf

1.3.2 In their original configuration the small barges had numerous lugs protruding from their sides for mooring arrangements in the ironsand pits. When the barges were re-configured into the pontoons the majority of these protrusions were removed, however one remained on the Picton pontoon (refer Figures 6 and 8). The remaining protrusion had a shallow cut on its after side indicating that there had previously been an attempt to remove it.

1.3.3 The lug that remained on the Picton pontoon was located on the outboard side approximately 4.23 m from the ramp end, 380 mm below the waterline and extended outwards approximately 300 mm from the side of the pontoon. It was approximately 250 mm wide and 180 mm deep at the root, tapering to a rounded point at the outboard end (refer Figure 8).

1.3.4 CentrePort, the Wellington harbourmaster and the operators of ships using Kings and Glasgow Wharves were not aware that there was a dangerous underwater projection on the pontoon.

1.4 Berths, berthing operations and arrangements

1.4.1 Glasgow Wharf was not a purpose designed ro-ro berth, but a link span had been fitted at its inner end. The wharf was approximately 240 m in length with the link span protruding 10 m into the length. There was a clear water width of approximately 90 m between Glasgow Wharf and Kings Wharf. Glasgow Wharf had large automotive and tractor tyres as fenders to prevent damage to the concrete capping of the wharf and the hulls of ships using the berth. However, the concrete capping showed signs of damage along its length where numerous ships had, in the past, made contact with it whilst berthing.

1.4.2 Kings Wharf was approximately 222 m long. Its inner end was about 25 m further north than that of Glasgow Wharf and it therefore extended southwards about 45 m less than Glasgow Wharf. At its southern end there was an indentation where the wharf met the reclamation of the Thorndon Container Terminal. The indentation extended a further 90 m to the south of the wharf and had a steep to rocky shore (refer Figures 2 and 5).

1.4.3 At the time of the collision both pontoons were moored in this indentation. The long pontoon was moored to the end of Kings Wharf and to the remains of a pile in the seabed. The short pontoon was moored with ropes to the long pontoon, with tyre fenders between them.

1.4.4 The Duties and Responsibilities part of the Strait Shipping Limited Safety Management System stated that the master (mate/master) was responsible for the safe and efficient navigation of the ship. This suggested, but did not explicitly state, that the master (mate/master) was responsible for deciding whether or not to use a tug when berthing or unberthing. This intent was confirmed by the operations manager and both the master and mate/master.

1.4.5 When he was appraising the berthing procedure the mate/master considered whether to use a tug and decided that he would be able to attempt the berthing operation, with little risk, without the use of one. He also considered dredging an anchor on the bottom to hold the bow against the wind but he dismissed the use of an anchor because it was likely to hinder the execution of his escape plan.

1.4.6 In conditions preventing the ship from being directly manoeuvred into its berth, the person in command would often use a line from forward to the end of the wharf to control the bow. On this occasion, the bow thruster was set to thrust to starboard throughout the operation to offset the effect of the wind on the starboard side of the bow. As the ship approached the berth the pitch of the starboard propeller was ahead and the pitch of the port propeller was astern. The pitch of the propeller blades was continually adjusted to maintain the desired track. As soon as the headline was fast ashore, the mate/master reversed the direction of pitch on the two propellers, the port propeller ahead and the starboard propeller astern. The rudders were set hard-to-port throughout this part of the manoeuvre. This enabled him to spring the ship in, effectively using the headline as a forward backspring.

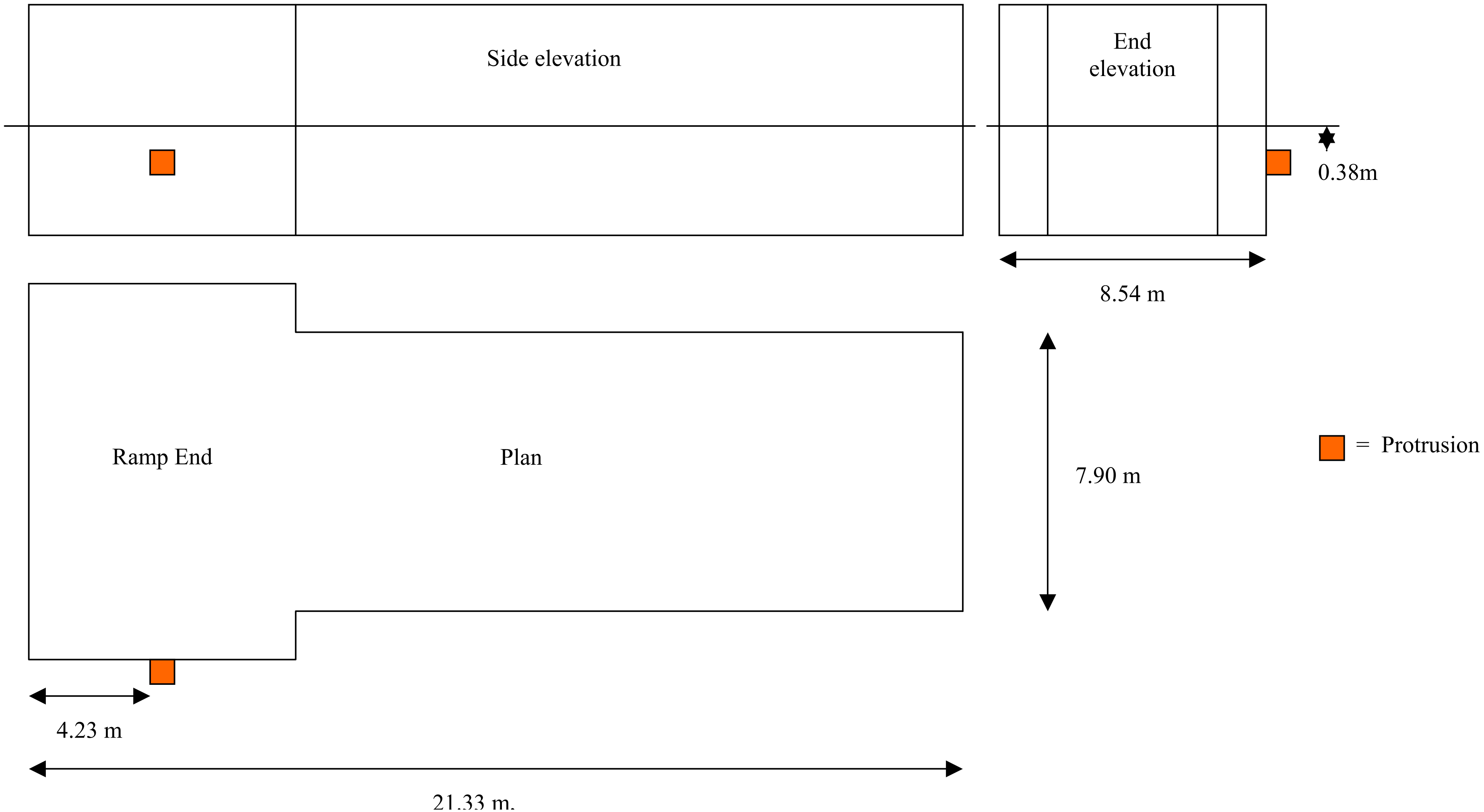


Figure 6
Plan of the Picton (short) pontoon, showing position of the protrusion (not to scale)

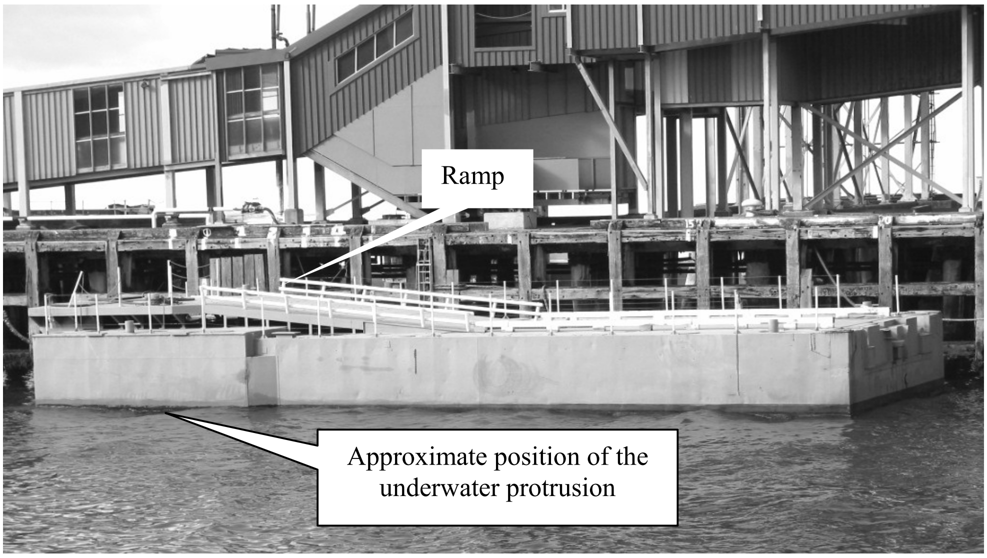


Figure 7
The Picton (short) pontoon

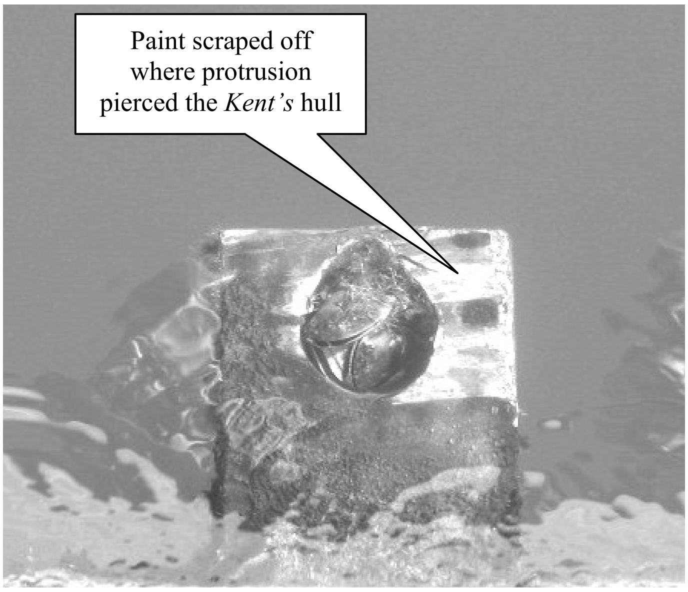


Figure 8
Underwater protrusion on the Picton pontoon

1.4.7 The shore linesgang comprised of 3 staff who worked at the shore terminal. A driver and a general wharf worker had been assigned forward, and the terminal supervisor was aft. All the men had received rudimentary on-the-job training in handling lines. The driver had also had familiarisation training on board one of the company's ships. The forward shore linesmen had been requested by the mate/master, prior to the ship's arrival at the berth, to station themselves at the seaward end of Glasgow Wharf to take the lines as soon as possible. The after linesman was in position, approximately midway along the wharf.

1.4.8 Prior to arrival at the berth, the seamen of the forecastle mooring party had arranged the ropes ready for mooring. The rope on the starboard mooring rope drum was to be used as the headline and had been laid across the deck to the forward starboard roller fairlead and a heaving line had been attached. The rope on the port mooring rope drum was to be used as the backspring and had been laid across the deck to the aftermost fairlead on the starboard side of the forecastle and a shorter heaving line had been attached. Another mooring rope was removed from a cage and flaked out between the winches ready for use through the panama fairlead in the bow of the ship. No heaving line was attached to this line.

1.4.9 As soon as the ship was in range the seaman on the forecastle sent a heaving line followed by the headline ashore. When this mooring line was fast on a bollard near the end of Glasgow Wharf, the weight was taken up on it. The mate/master then started to manoeuvre the stern towards the wharf and as soon as it was close enough a seaman aft threw a heaving line ashore. The sternline was then sent ashore but was never made fast to a bollard because it got caught under one of the tyre fenders and the lone after shore linesman was unable to free it.

1.4.10 When the headline parted, the crew on the forecastle were ordered to "get another line out". Initially, they retrieved the broken part of the headline and attempted to form a new eye by tying a bowline. When the mate/master realised what they were doing he urged them to send another rope ashore. Instead of sending the backspring, which was already made up to a heaving line, they decided to send the additional mooring line. This did not have a heaving line attached, so one of the crew untied the heaving line from the backspring and tied it onto the additional line. By the time they had done this, the ship was too far off the wharf to pass the heaving line and rope.

1.4.11 The entire staff of Strait Shipping Limited were provided with Ultra High Frequency (UHF) hand held radios to allow intra-ship and ship to shore communications. During mooring operations the ship's crew were in contact with each other and with the shore linesmen.

1.5 Climatic conditions

1.5.1 The weather recorded at Beacon Hill signal station, situated on the western side of the entrance to the harbour, was as follows:

Time	Wind		Weather
	Speed	Direction	
1800	35 kts gusting 70 kts	240°	5-8 oktas cloud, intermittent rain, mist
2000	48 kts gusting 80 kts	210°	overcast with rain
2200	42 kts gusting 78 kts	210°	overcast with rain

1.5.2 The weather as observed by the *Kent* during the sea passage from Picton to Wellington was as follows:

Wind, Direction & Speed	Barometer	Sea state	Swell	Visibility & Weather
SSW x 40 kts	1006.5 hPa	Rough	SSW x 4 m	moderate vis. partly cloudy, 3 oktas cloud

1.5.3 The weather aftercasts at selected stations recorded by National Institute of Atmospheric Research (N.I.W.A.) at 1800 were as follows:

Station	Wind		Barometer	Cloud
	Speed	Direction		
Beacon Hill	55 kts	240	1007.0 hPa	7 oktas
Wellington Aero	37 kts	210	1008.6 hPa	7 oktas

1.5.4 The weather experienced in the harbour may have differed to that observed above but reports confirm that severe winds and gusts were experienced while the ship was berthing. The wind was accompanied by driving rain.

1.6 Personnel and training

1.6.1 The *Kent's* deck officer complement comprised a master, a mate/master, a second mate and a third mate. Two watches were formed; one included the master and third mate and the other the mate/master and second mate. The navigational and cargo duties were divided between the 2 watches. They worked a roster of 4-hours on, 8-hours off, 8-hours on, 4-hours off. The changeover times were 1400, 1800, 0200 and 1000. The officers worked a 2-week on and 2-week off work/leave roster.

1.6.2 At the time of the accident the mate/master and second mate were on the bridge. The mate/master was on the starboard bridge wing where he was controlling the bow thruster and helm using a control box on a wandering lead. The second mate was also on the bridge wing, slightly inboard of the mate/master, and was adjusting the engine controls, at the bridge wing control station, to the mate/master's orders.

1.6.3 There were 4 crew available at the time of the incident; the assistant leading hand and 3 seamen. The forecastle party comprised of 2 seamen while the after party was the assistant leading hand and the other seaman. The way the watch system was organised did not allow for an officer to stand-by the forward or aft mooring stations.

1.6.4 The designation of mate/master allowed the incumbent to fulfil the role and obligations of master when the assigned master was on his rest period. When the master was not on watch, sole command of the ship lay with the mate/master, this did not change until the master officially assumed command again.

1.6.5 The mate/master had been at sea since 1962. He held a Foreign Going Master's Certificate that had been issued in 1971, and current pilotage exemption certificates for Wellington and Picton. He joined Strait Shipping in May 2001, as mate/master and had occasionally sailed as master. He had rejoined the ship after 2 weeks' leave on 10 July, 5 days before the incident.

1.6.6 During the previous year the mate/master had berthed the ship in a wide variety of conditions both in Picton and Wellington. He was aware that south-west was the most difficult direction for the wind because it tended to blow the ship off Glasgow Wharf as it reversed into the basin between the wharves. Once he had managed to get a headline ashore, the mate/master thought that he had successfully completed the most difficult part of the manoeuvre.

1.6.7 The second mate had been at sea since 1982. He had sailed as a seaman until 1991, when he obtained his Second Mate's Certificate. In 1995, he gained his Foreign Going Master's Certificate. He had worked on a variety of trans-Tasman and New Zealand coastal ships until he had joined the *Kent* in September 2001, as second mate and relieving mate/master. He had rejoined the ship after a period of 2 weeks' leave on 3 July, 11 days before the incident.

1.6.8 The deck crew comprised a leading hand, an assistant leading hand and 4 able seamen. The 4 seamen worked a 9-hours on, 3-hours off, 3-hours on, 9-hours off shift system with each man starting at a different time. The leading hand and assistant leading hand worked an 8-hours on 4-hours off, 4-hours on, 8-hours off, shift system. The watch roster was arranged so that when the ship was arriving in port, working cargo and leaving port 4 crew members were available. At sea there were 2 crew members available. Start times for the seamen were 0600, 1200, 1800 and 2400. Start times for the leading hands were 0300 and 1100, 1900 and 2300.

Crew Watch Rota System – MV. Kent																								
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Ship's Posn	Picton		Sea			Wellington			Sea			Picton			Sea			Wellington			Sea			Picton
Leading Hand	ON	ON									ON	ON	ON	ON	ON	ON	ON	ON					ON	ON
Ass Leading Hand			ON	ON	ON	ON	ON	ON	ON	ON									ON	ON	ON	ON		
Seaman 1	ON	ON										ON	ON	ON	ON	ON	ON	ON	ON	ON				ON
Seaman 2						ON	ON	ON	ON	ON	ON	ON	ON	ON				ON	ON	ON				
Seaman 3	ON	ON	ON	ON	ON	ON	ON	ON				ON	ON	ON										ON
Seaman 4	ON	ON				ON	ON	ON										ON	ON	ON	ON	ON	ON	ON

1.6.9 The safe manning certificate for the *Kent,* issued by the Government of the Isle of Man, required a minimum complement of 13 persons comprising a master, chief officer, 2 officers in charge of a navigational watch, chief engineer, second engineer, an officer in charge of a engineering watch, 5 general purpose ratings (seamen) and a cook. The certificate was valid for the Cook Strait and Tasman Bay areas. In addition to this minimum complement, Strait Shipping carried an additional seaman, an additional officer in charge of an engineering watch and a trainee engineering officer, a total of 16.

1.7 Damage and damage control

1.7.1 During the collision, the hull of the *Kent* was torn open by the protrusion on the pontoon. A hole that measured approximately 1000 mm by 125 mm was cut into the hull. The hull plating in way of the hole was curled into a tight spiral by the forward momentum of the ship at the time of impact (refer Figure 3). Two frames were also bent as the protrusion tore into the side of the ship. The hole was initially about 380 mm below the waterline, this increased as the ship settled in the water.

1.7.2 The first indication of flooding in the engine room was the high-level bilge alarm at 1852. About 10 seconds later, the second high level bilge alarm sounded. On investigation it was found that the main engine flywheels were picking up and spraying water around the engine room. Initially this was thought to be caused by a broken pipe. The chief engineer instructed the watch engineers to start the bilge pumps and informed the bridge of the flooding, then went to investigate the cause. On inspection, he found that the hull had been breached in the port forward corner of the engine room, above the purifiers, he informed the bridge of this. He was unable to accurately identify the extent of the breach because of the volume of water cascading into the engine room. The engineers started pumping the engine room using all the rotary pumps available, using direct suction and discharging overboard. They tried to start a large-capacity reciprocating pump but were unable to do so. Soon after, the chief engineer informed the bridge that the pumps were not coping with the volume of water entering the engine room and that he would soon have to shut the machinery down. Almost immediately, the pumps stopped because their wiring had become immersed and short-circuited.

1.7.3 When the water level reached the shaft alternators, attached to the propeller shafts, the chief engineer informed the bridge that he had to stop the main propulsion engines. The auxiliary diesel alternators were situated on a higher level and continued to provide electrical power for about 5 minutes until about 1909, when they were stopped because the water level had risen to their bases. The emergency alternator, situated above the accommodation block, was started to provide essential lighting and services.

1.7.4 When water started to enter the control room, the engineers closed the fire door between the 2 spaces. It slowed the passage of water into the control room but because it was not a watertight door it did not prevent the eventual flooding of the control room. The engineers vacated the engine room after closing the watertight door between the control room and the steering gear. They then closed all vents into the engine room.

1.7.5 During this time, the second mate and one of the crew from the after mooring station checked the lower vehicle deck for flooding and found no evidence of water ingress. They then went to the engine room to check the situation and relayed their observations to the bridge by UHF radio. On their way back to the bridge they instructed the passengers to go to their muster station on the after starboard bridge deck. The second mate, with the assistance of the third mate, started to prepare the starboard lifeboat.

1.7.6 The approximate rate of flow of floodwater into the engine room was 14 t per minute. The ship's officers did not calculate the effect the flooding of the engine room would have on the survivability of the ship. However, the water level was monitored and stopped rising at between 600 mm and 1000 mm below the sill of the door into the main vehicle deck. The flooding stopped because the ship reached equilibrium i.e. there was sufficient reserve buoyancy to support the weight of the ship including the flooded engine room.

1.7.7 At no time during the occurrence was a distress signal sent nor was the general alarm sounded on the ship. The passengers and non-essential crew had been mustered abaft the bridge and the ship was in continuous radio contact with the shore and the Beacon Hill signal station operator was kept informed of developments. The shore authorities were aware that the ship was holed and was making water but were unaware of the severity of the situation.

2 Analysis

2.1 After the headline broke the mate/master became absorbed with the efforts of the forecastle crew to get another line ashore. He was both watching and trying to direct the crew to send the most available line ashore. By the time the crew had explored the options, it was impossible to get another line ashore and the bow of the ship was swinging towards Kings Wharf. The distraction delayed the implementation of the mate/master's emergency plan sufficiently to prevent him being able to steam straight out of the basin as intended. Instead, he had to bring the ship's head to starboard, up into the wind, to avoid the beacon at the south-west corner of Thorndon Container Terminal.

2.2 The instructions to the crew on the foredeck were given both over the hand held UHF radios and directly over the wing of the bridge. Each of these forms of communication were subject to ambient noise caused by the strong winds and rain and might have resulted in misunderstandings. The mate/master and the master instructed the crew to get another line out as soon as possible. The crew may have misheard or misunderstood these instructions.

2.3 In the minds of the forecastle crew members, the headline and backspring were designated lines. Consequently, "another line" was the additional mooring line that they had partially prepared. They did not consider using the backspring that was ready to be passed immediately. They may also have been unaware how critical getting another line ashore was to the safe berthing of the ship. A qualified and experienced person on the foredeck may have been able to comprehend the urgency of the situation and the instructions, and been able to direct the crew accordingly.

2.4 It is possible that even if the crew on the foredeck had immediately tried to send the prepared backspring ashore it may not have been successful because the heaving line attached to that rope was shorter than that used to pass the headline.

2.5 The mate/master had arranged for the forward shore linesgang to be at the end of the wharf ready to take a line but had not discussed with the ship's crew the importance of getting a headline ashore quickly.

2.6 The mate/master having managed to get the ship into the basin and get a mooring rope ashore thought that he had accomplished the most difficult part of the operation. He had not allowed for the rope parting or being unable to get a replacement rope ashore.

2.7 In planning the berthing manoeuvre the mate/master had considered the use of a tug and the use of an anchor but chose not to use either. Had he done so he may have been able to better control the bow of the ship and prevent the ship being set towards Kings Wharf.

2.8 The company policy regarding the use of tugs was not specifically stated but was implied in the master's (mate/master) section in the Duties and Responsibilities part of the Safety Management Manual.

2.9 Having one person in the after shore linesgang may have been sufficient on a normal mooring operation but, on this occasion he was unable to free the sternline from beneath the tyre fender and was therefore unable to make the stern line fast on a bollard.

2.10 The breaking of mooring lines is a fairly commonplace occurrence during berthing and would not normally be expected to result in the near loss of a ship.

2.11 A glancing collision with a relatively small box-shaped pontoon would be expected to produce minor damage to the hull plating of a ship but not the rapid and complete flooding of an engine room and the near loss of a ship.

2.12 The effect of the flooding on the buoyancy of the ship was not ascertained while the engine room was flooding so no one knew whether the ship would remain afloat. Had the water level risen above the door sill between the main vehicle deck and the engine room there would have been continuous downflooding into the heeling tanks. This would have further increased the bodily sinkage of the ship and thus the flooding would have continued unchecked. The weight and the free surface effect of the water on the main vehicle deck would have rapidly reduced the stability of the ship to the point where it might have sunk or capsized. Similarly, had the emergency hatch in the forepart of the engine room failed, water would have been free to flow onto the main vehicle deck causing the same continuous flooding. The additional height of the deckhead in the after end of the engine room prevented water crossing the sill into the main vehicle deck.

2.13 The flooding stopped because the ship reached equilibrium with its reserve buoyancy equalling the total weight of the ship.

2.14 The damage to the machinery was minimised because the diesel engines were stopped before they were engulfed by water. Similarly, all the alternators were shut down before the water could short-circuit the wiring.

2.15 The crew carried out the emergency procedures efficiently. The action of closing all the engine room ventilators was futile because at no time was the engine room watertight due to the open access from the main vehicle deck.

2.16 The number of crew on the *Kent* was above that required by the safe manning certificate. Owing to the nature of the service that the ship was engaged on, the crew had been divided into 2 watches, effectively almost halving the available officers and crew. The exception was that 4 seamen were made available for berthing, unberthing and cargo operations. Under normal operating conditions this may be an acceptable arrangement but when severe conditions exist, where speed and efficiency are critical, it would be prudent to use all available crew members.

2.17 The headline that parted was found to be in a generally good condition. When it broke there were many forces acting on it. The mate/master was using the engines to spring the stern onto the wharf, there were strong wind gusts and the ship made contact with the corner of the wharf. Any one or combination of these forces may have caused the rope to exceed its breaking strain.

2.18 The absence of a distress or urgency signal did not in this instance detract from the rescue effort but may have done so had water gained access to the main vehicle deck where time would have been critical.

3 Findings

Findings and any safety recommendations are listed in order of development and are not in order of priority.

3.1 While attempting to berth the *Kent* in storm force winds, the headline parted because excess weight came on it.

3.2 The mate/master was directing the foredeck crew from the bridge but they were not under the immediate supervision of an officer or other suitably experienced person. Such a person might have better appreciated the urgency of the situation and been able to get a replacement mooring line ashore in sufficient time to prevent the ship being blown towards Kings Wharf.

3.3 The mate/master's escape plan was not actioned in sufficient time because he was distracted directing the foredeck crew. The delay resulted in the port quarter of the *Kent* colliding with the outer of the 2 pontoons moored at the southern end of Kings Wharf.

3.4 A previously unknown underwater projection on the pontoon holed the *Kent* below the waterline in way of the engine room, causing the rapid and total flooding of that space, totally disabling the ship within 20 minutes.

3.5 The flooding progressed until it reached a level equal to the draught of the ship, at which point the sill of the doorway from the main vehicle deck into the engine room was between 600 mm and 1000 mm above the level of the water in the engine room. Had the ship been more deeply laden or further trimmed by the stern, or a combination of both, so that the sill was below the water level, the flooding would have continued and the consequences would have been catastrophic.

3.6 The action by the engineers of stopping the diesel engines and shutting down the alternators minimised long-term damage to the machinery.

4 Safety Actions

4.1 On 7 August 2002, the operations manager of Strait Shipping Limited issued a memorandum to all masters and mate/masters, which reiterated the company's policy that the use of tugs for berthing was at the discretion of the master or mate/master.

4.2 In addition, Strait Shipping Limited has commissioned a naval architect to produce wind polar curves for all the vessels. The polar curves will show the maximum vessel thrust against wind-generated thrust for different wind directions.

5 Safety Recommendations

5.1 On 6 December 2002 the Commission recommended to the Operations Manager of the Strait Shipping Limited that he:

5.1.1 Undertake a risk analysis of critical voyage events to identify areas of significant risk and counter measures necessary to minimise the hazard to personnel, ship and harbour installations (047/02).

5.1.2 Ensure that crewing levels on all company ships are sufficient to enable the ship to be operated safely in all circumstances. Consideration should be given to effective management of on- and off-duty staff (048/02).

5.1.3 Investigate the watertight integrity of the company's ships with a view to enhancing their ability to withstand flooding damage. Consider upgrading the ships' stability data to enable the master of the ship to calculate by rapid and simple means the residual stability of the ship under varying conditions of service, including a damaged condition (049/02).

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Hon. W P Jeffries
Chief Commissioner

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