Report 98-204

Wave-piercing catamaran ferry *Condor 10*

heavy weather damage

Wellington Harbour entrance

16 March 1998

Abstract

At about 0826 on Monday, 16 March 1998, *Condor 10* was proceeding out of Wellington Harbour into a moderate southerly swell, when the vessel encountered two short steep waves of approximately 4.5 m in height. The master reduced speed as *Condor 10* rose over the first wave, and the vessel dipped onto the face of the second wave. The resultant slamming displaced the bow visor and caused substantial damage to the surrounding hull structure. None of the 231 passengers and 22 crew were injured in the incident.

Safety issues identified included:

- the level of type-rating training for the crew of high speed craft,
- the quality of route assessment
- the adequacy of route information provided for the master
- the interpretation of the "worst expected conditions"

Safety Recommendations were made to the Managing Director of Tranz Rail, the Director of Maritime Safety, the Wellington Regional Council Harbourmaster and the Area Manager for Det Norske Veritas to address the safety issues.

Photograph showing an outside view of the crumpled ceiling of the car deck

Photograph showing the displaced bow visor on *Condor 10* shortly after the incident

Transport Accident Investigation Commission

Marine Incident Report 98-204

Vessel Particulars:

Name:	*Condor 10* (also known as "*The Lynx*")
Registered:	Singapore
Type:	Passenger/car wave-piercing catamaran ferry
Classification:	Det Norske Veritas +1A1 HSLC R1 Car Ferry A EO Naut B[1]
Built:	In 1992 by Incat Australia Pty Limited, Hobart
Propulsion:	Four 5 222 kW Ruston V16 turbocharged diesel engines, each driving a Riva Calzoni steerable water jet unit capable of displacing 11 cubic metres of water per second
Speed:	42 knots (maximum light ship) 37 knots (service)
Length (over-all):	74.16 m
Breadth:	26 m
Loaded draft:	3.2 m
Gross tonnage:	3 241 t
Maximum capacities:	553 passengers, 24 crew and 74 cars (or equivalent units)
Vessel owners:	Enterprise Trading Private Limited, of Singapore
Sub-charterer/Operator:	Tranz Rail Limited
Location:	Wellington Harbour entrance, off Barrett Reef,
Date and time:	Monday, 16 March 1998, at about 0830[2]
Persons on board:	Crew: 22 Passengers: 231
Injuries:	Nil
Nature of damage:	Bow visor displaced, causing significant damage to the visor andsurrounding hull structure
Investigator-in-Charge:	Captain Tim Burfoot

[1] A high speed craft (as applicable to the high speed code) of light weight displacement, certified to carry passengers and cars on voyages not exceeding 300 miles from its base port, with unmanned machinery spaces, built under the supervision of Det Norske Veritas (DNV).
[2] All times in this report are NZDT (UTC + 13 hours), and are expressed in 24 hour mode.

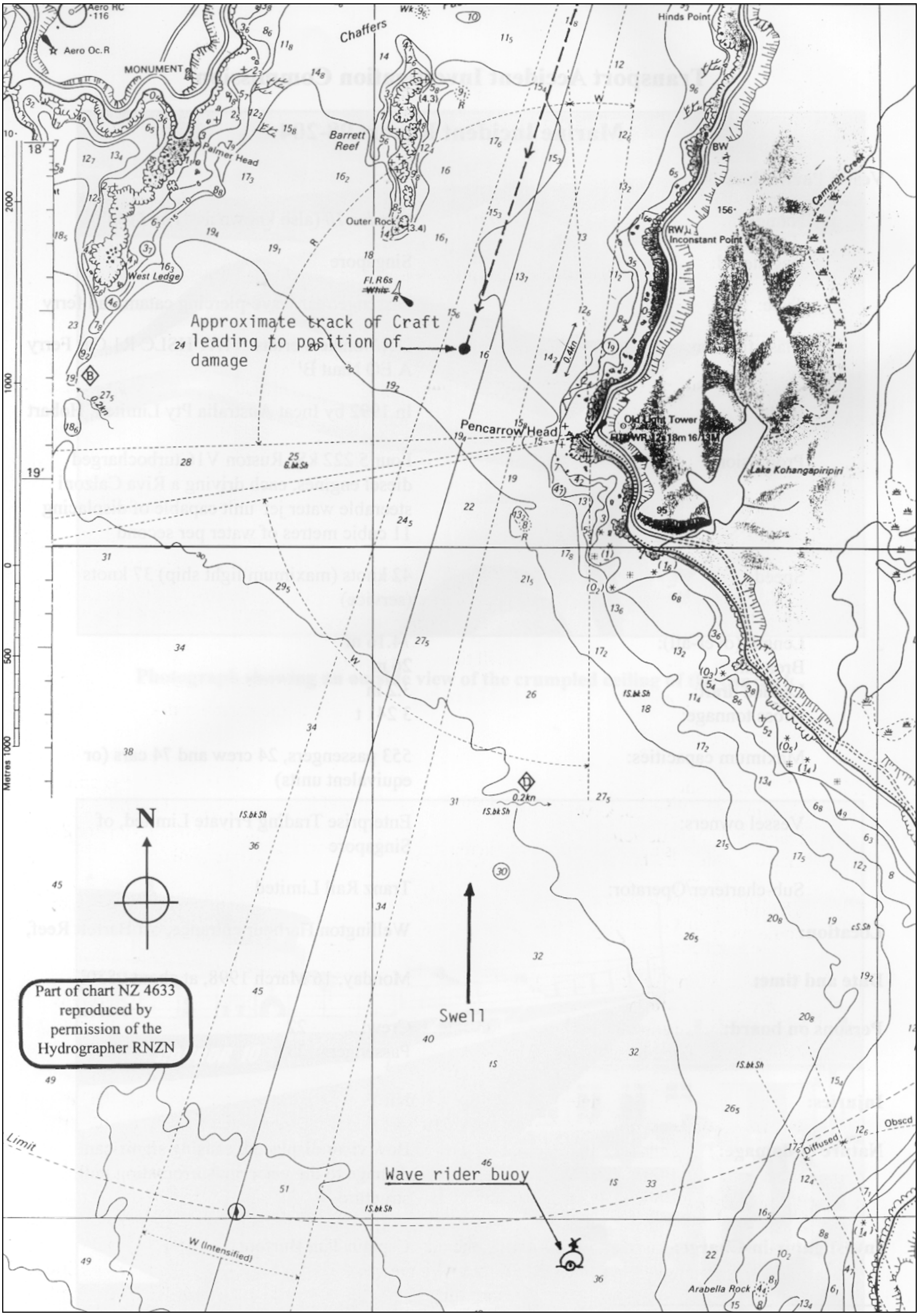

Figure 1
Part of chart NZ 4633 showing key information

1. Factual Information

1.1 History of the incident

1.1.1 At about 0700 on Monday, 16 March 1998, the master of *Condor 10* arrived on board the craft at Wellington to make it ready for the first crossing to Picton for that day. He read a weather facsimile situation and forecast from the Meteorological Service of New Zealand Limited (MetService), noting that the significant wave height for Cook Strait was 2.5 m, forecast to rise to 3 m that afternoon. The maximum allowable significant wave height in which the craft could operate was 3.5 m, so the master decided to make the first crossing.

1.1.2 Shortly after 0700, the master called the Beacon Hill Signal Station (Beacon Hill) on very high frequency (VHF) radio channel 14 to inform the duty operator that *Condor 10* would be departing at about 0800, and to receive the current observed weather conditions at the harbour entrance.

1.1.3 The operator told the master that the wind was southerly 10 to 15 knots and the swell 2 to 3 m from the south.

1.1.4 *Condor 10* left the berth shortly after 0800. The master had the conduct of the craft and was hand steering from the centre bridge console. The chief engineer was monitoring the engine data from his console on the port side of the bridge, and the first mate arrived on the bridge to assist the master about two minutes after departure, having completed final checks around the car deck.

1.1.5 Upon clearing the berth, the master informed Beacon Hill that *Condor 10* was outbound. The operator advised the master that the wind had swung around to the north-north-east at 5 knots, and the swell was still 2 to 3 m from the south.

1.1.6 The master initially kept the engine revolutions per minute (rpm) at 480 to give the engines time to warm through, as was the normal practice on the first trip of the day. *Condor 10* reached Point Halswell at about 0815, at which time the chief engineer gave the okay for the master to increase to 680 rpm, and about three minutes later, to 740 rpm (full speed).

1.1.7 The ride control system was in operation; however, neither the chief engineer nor the master could recall the settings for pitch or roll.

1.1.8 By 0823, when *Condor 10* was abeam Steeple Rock, it had reached full speed of about 33 knots. Shortly after this, the craft encountered what the master described as medium swells. One of these swells caused the vessel to shudder, so the master reduced engine rpm to 640, which equated to about 25 knots.

1.1.9 For the ensuing three minutes, *Condor 10* continued out past Barrett Reef (see Figure 1) at what the master described as a "quite comfortable" ride through a 2 to 2.5 m swell. As the wind had fallen away to a five knot breeze, the sea surface was calm with only an occasional white cap. On passing Barrett Reef Buoy, the master and first mate saw two larger swells immediately in front of the vessel.

1.1.10 As *Condor 10* rose over the first wave, the master pulled back the engine combinators, reducing the engines speed to an idle, but with the water jet buckets still in the ahead position. With the resultant loss of speed the craft dipped into the trough and the bow "slammed" onto the face of the following wave, resulting in heavy spray enveloping the forward part of the craft.

1.1.11 When the spray cleared, all three of the bridge team noticed that the bow visor had been pushed up resulting in some buckling of the deck aft of it. The master immediately turned *Condor 10* in the channel at slow speed and proceeded back into the harbour, informing Beacon Hill of his intentions as he did so.

1.1.12 While *Condor 10* proceeded back to its berth, the first mate made a brief damage assessment from the car deck to ensure the vessel was not in imminent danger.

1.2 Vessel information

1.2.1 *Condor 10* was a wave-piercing catamaran, constructed mainly in aluminium, designed to ferry passengers and cars at high speed for short coastal voyages. The twin hulls were shaped to produce lift at speed and semi-plane when driven at or near full power. The fine entry profile of the hulls was designed to cut through significant waves up to about five metres in height, rather than ride over them, as with conventional vessels. When all motive power was stopped or reduced, the craft dropped off the plane quickly, with an associated rapid reduction in speed.

1.2.2 *Condor 10* was fitted with an articulated T-foil forward, under each hull. The T-foils resembled an inverted T and comprised a hydrofoil with an articulated elevon[3] at the trailing edge. The hydrofoil created lift to assist the vessel onto a semi-plane, thereby reducing the wetted surface area of its hulls and increasing the speed of the vessel. Using electro-hydraulics, the angle of attack of the hydrofoils could be adjusted together to act as pitch arresters, while the elevons were separately controlled to counter any roll.

1.2.3 Additionally, a controllable trim tab was fitted near the aft extremity of each hull. When in operation, the trim tabs, the hydrofoils, and the elevons were constantly adjusted by their hydraulic actuators, controlled by a common computer to operate as an integrated ride-control system. The sensitivity of pitch and roll adjustment could be controlled from the bridge.

1.2.4 Steering was achieved by using hydraulic actuators to swivel the water jet units in the horizontal plane. Speed was controlled, initially by a hydraulically driven deflector plate (bucket) within each water jet unit. The buckets diverted water aft for forward thrust, forward for reverse thrust, and equally forward and aft for neutral. The buckets could be set at any number of other positions within those three extremes. Once the buckets were fully opened in any one direction, further increase in thrust was achieved by increasing engine revolutions.

1.2.5 The watertight integrity of *Condor 10* was provided by the two outer wave-piercing hulls. Each hull was subdivided into seven watertight compartments. The propulsion and power plants were located in the largest of these seven compartments, towards the rear of each hull. A single car deck spanned the two outer hulls, with the passenger and service lounges located above the car deck. The navigation bridge was located forward of and above the main passenger lounges.

1.2.6 The forward end of the car deck narrowed into a centre bow which protruded forward of and above the two wave piercing hulls. The forward section of the centre bow was fitted with a bow visor and a drop down car ramp for forward loading and/or discharging of vehicles.

---

[3] Moving parts on the trailing edge which can act in tandem to control pitch, or in opposition to control roll.

1.2.7 The bow visor was hinged at the top and opened outwards and upwards. At sea, the visor was secured by two locking wedge pins on the main structure of the centre hull, which engaged sockets at the bottom of the visor. There was no weather-tight seal between the visor and the centre hull structure. Any water entering the bow visor was free to drain back out of the small gap through which it entered. The car ramp was hinged at the bottom and, when at sea, was pulled up and secured to form a weathertight bulkhead across the front of the car deck. A stern door at the rear of the car deck had a similar sealing arrangement to that at the bow.

1.2.8 The car deck was thus not intended to be a watertight compartment, but merely weather-tight to protect the payload. If water accumulated on the car deck, it could escape back to sea through drains fitted along its length.

1.2.9 The centre bow was shaped like a conventional bow, but in normal operation it was not water-borne. The centre bow did not contribute to the wave-piecing qualities of *Condor 10*, but merely acted as reserve buoyancy to counter any tendency of the vessel to bury its bows when operating at or near the top limit of its operating envelope.

1.3 Damage

1.3.1 The impact damage to the supporting centre hull structure and visor was such that the visor remained partly open.

1.3.2 Some of the internal T-section frames running along the hull plating of the centre bow were twisted, and torn away from the plating. Tubular struts between the floor and upper decks were distorted and some had been torn away at one end. The hull plating under the flare of the centre bow was set up between the frames on the starboard side only.

1.3.3 The starboard locking device and its surrounding structure had failed in overload. The socket was torn away from the visor in a direction both upwards and to port while it was still engaged on its wedge pin. The pin had been pulled out from its housing. There was a large degree of deformation associated with each failure.

1.3.4 The port locking device had failed in a similar way to the starboard one.

1.3.5 The damage would have occurred almost instantaneously, and was consistent with the centre bow impacting a wave with a bias on the starboard side.

1.3.6 The top of the car ramp and car deck ceiling was compressed, causing the car ramp supports to fracture and, as there was little horizontal bracing between the car ramp supports and surrounding hull structure, the car deck ceiling crumpled.

1.4 Survey and operating history of *Condor 10*

1.4.1 At the time of the incident, *Condor 10* was owned by Enterprise Trading Private Limited of Singapore; bareboat chartered to Condor Private Limited of Singapore; sub-bareboat chartered to Holyman Ferries Private Limited of Singapore, and sub-bareboat chartered to Tranz Rail Limited of New Zealand, to provide a fast ferry service between Wellington and Picton over the summer season. During the New Zealand winter, *Condor 10* operated in the northern hemisphere. The summer period of 1997/98 was the fourth under such a charter arrangement.

1.4.2 *Condor 10* operated under the following Certificates:

- A Dynamically Supported Craft (DSC) Permit to Operate - because the vessel was classed as a high speed craft under the DSC Code at the time of build,
- A SOLAS Passenger Ship Safety Certificate, and

- SOLAS Exemption Certificate - because the DSC Permit to Operate specified certain limits for operation, and the craft was therefore exempt from certain requirements made of ocean-going passenger vessels.

1.4.3 DNV issued the SOLAS Passenger Ship Safety and Exemption Certificates, while the DSC Permit to Operate was the responsibility of the flag state, Singapore in this case. While *Condor 10* was operating in New Zealand, the New Zealand Maritime Safety Authority (MSA) issued the Permit to Operate, and other documents normally issued by the flag state, on Singapore's behalf.

1.4.4 *Condor 10* re-entered service in New Zealand in December 1997. The MSA issued a DSC Permit to Operate for *Condor 10* on behalf of and under authority from the Director General, Maritime and Port Authority of Singapore. The permit contained 15 points and conditions of issue, some of which are listed below:

- to trade as a passenger craft in New Zealand between the ports of Wellington and Picton,
- the operational crew should consist of master, mate, chief engineer and four seamen of Category one status (Time served on other dynamically supported craft and/or high speed craft to count as qualifying time for Category One status after undergoing type training to an approved standard),
- operational requirements listed in Chapter 18 of the International Code of Safety for High Speed Craft shall be complied with,
- the craft is to be operated in accordance with the approved Route Operational Manual to be kept on board,
- the craft shall not be operated if the significant wave height exceeds 3.5 m, and
- this permit is subject to acceptance by the local authorities where the vessel operates.

1.4.5 Chapter 18 of the High Speed Craft (HSC) Code places a great deal of emphasis on the Administration's role in ensuring that a high speed craft meets the operational requirements as laid out in the chapter. As the MSA not only issued the permit for *Condor 10* on behalf of the Administration (Singapore), but were also the local authority where the craft was operating, and MSA approved the route operations manual for *Condor 10*, then they in effect were the Administration under the code.

1.5 Design and operating criteria

1.5.1 *Condor 10* was built to comply with the Code of Safety for Dynamically Supported Craft (DSC Code) which was current at the time of building. The DSC Code was an International Maritime Organisation (IMO) document which was adopted in November 1977 to form a code of safety for the design, construction and operation of dynamically supported craft, such as hydrofoil boats and air-cushion vehicles, which were being introduced increasingly as a popular method of transporting passengers internationally.

1.5.2 As DNV Classification Society was considered to be the leading society for design approval of high speed craft, the owners chose to have *Condor 10* built to the DNV standard **+1A1 HSLC R1 Car Ferry A EO Naut B**. This meant that the vessel also had to comply with the DNV Rules For Classification of High Speed And Light Craft. The DNV rules were based on the DSC Code but were more detailed and stringent in their requirements in certain areas.

1.5.3 At the time *Condor 10* was being built, the DSC Code was undergoing a thorough revision to reflect the increasing size and speed of high speed craft, some of which were not necessarily dynamically supported, and that such craft were carrying a greater number of passengers over greater distances. The new International Code of Safety for High Speed Craft (HSC Code) was adopted by the IMO in May 1994, and entered into force in January 1996 as an amendment to the 1974 SOLAS Convention.

1.5.4 Although not applicable to *Condor 10* at the time it was built, the provisions of the draft HSC Code, which was in circulation at the time, were considered by the owners when the craft was at the design stage.

1.5.5 The design margins for high speed craft are allowed to be lower than those for conventional vessels because the craft are assigned operational limitations. The designer of *Condor 10* specified that the hulls and structures were to be built to withstand superimposed vertical accelerations of 1g (9.81 m/s^2) at the longitudinal centre of gravity of the craft. 1g was often used as the limiting design criteria for high speed craft because the HSC Code required special precautions to be taken for passenger safety if the craft was to be normally operated in conditions which exceeded that additional loading.

1.5.6 DNV then used a formula, to determine what maximum speed the craft could travel at for given significant wave heights without exceeding 1g accelerations, and produced the following table of speed restrictions:

Significant wave height in metres	Maximum speed in knots
0.0 to 2.5	44
2.5 to 3.0	35
3.0 to 4.0	32
4.0 to 5.0	28
over 5.0	slow speed to shelter

1.5.7 The table was reproduced under the heading "Operating Limitations" in the Route Operations Manual on board *Condor 10*, with the following statement:

> Significant wave height is the average height of the one third highest observed wave heights over a given period.

1.5.8 The DSC Permit to Operate contained an over-riding condition that *Condor 10* was not to be operated if the significant wave height exceeded 3.5 m. This condition was imposed because the marine evacuation systems on board were only rated for Force 6 to 7 sea conditions, which equates to about 3.5 m waves.

1.5.9 The following paragraph was included in the Route Operations Manual preceding the DNV speed restriction table:

> In accordance with the Dynamically Supported Craft Permit to Operate, the craft shall not be operated if the significant wave height exceeds 3.5 m

1.5.10 Although it was not specifically stated, it is assumed that where the table referred to speed restrictions for significant wave heights above 3.5 m, this applied to times when the craft was caught in such conditions when not forecast, or such conditions developed when the craft was en-route.

1.5.11 Paragraph 18.1.2 (Chapter 18) of the HSC Code states:

> The craft should not be intentionally operated outside the worst intended conditions and limitations specified in the Permit to Operate High Speed Craft [DSC for *Condor 10*], in the High Speed Craft [DSC] Safety Certificate, or in documents referred to therein.

1.5.12 The HSC Code defines the "worst intended conditions" as :

the specified environmental conditions within which the intentional operation of the craft is provided for in the certification of the craft. This should take into account parameters such as:

- the worst conditions of wind force,
- allowable significant wave height (including unfavourable combinations of length and direction of waves),
- visibility,
- depth of water for safe operation, and
- such other the administration may require in considering the type of craft in the area of operation.

1.5.13 Paragraph 18.1.3.1 of the HSC Code states that the administration should issue a permit to operate when it is satisfied that the operator has made adequate provisions to ensure:

> the suitability of the craft for the service intended, having regard to the safety limitations and information contained in the route operations manual.

1.5.14 The significant wave height was the single environmental limiting condition specifically stated on the Permit to Operate for *Condor 10*.

1.5.15 DNV referred to significant wave height in their table of maximum speeds. Their calculations included an allowance for the larger waves that can be encountered for a given significant wave height, and were based on what they deemed to be the "worst case" wave period effecting local and global loads on the craft, namely a longer wave period.

1.5.16 The effect on the craft of shorter wave periods was not a factor considered by DNV in formulating the significant wave height/craft speed table. The DNV rules were based on the assumption that the craft would be "competently handled and maintained", particularly with regard to "speed and navigation in heavy weather". The DNV plan approval for *Condor 10* contained a clause that approval was subject to compliance with the DNV rules.

1.5.17 More recently, DNV have included in their letter of class approval, a rider which states that, regardless of the significant wave height, the craft is not to be operated at speeds where slamming occurs. This rider was not included for earlier craft such as *Condor 10*.

1.5.18 Ultimately, as stated in the Route Operations Manual on board *Condor 10*, the master of the craft was responsible for deciding if sea conditions en-route were suitable to proceed on a trip. In deciding, the master was to make use of all the information available to him.

1.6 Weather and route information

1.6.1 Significant wave height is defined as the average height of the one-third highest observed wave heights over a given period.

1.6.2 The maximum expected wave height is generally taken to be 1.6 times the significant wave height; however, the statistical relationship is based using a period of 10 minutes. If a period of three hours is considered, a maximum wave height of 2 times the significant wave height can be expected, and 2.3 times the significant wave height over a 24 hour period[4].

1.6.3 Significant wave height refers to the height of waves in deep water. Other phenomena affecting wave height are shoaling, refraction and opposing tide or current. As waves enter shallow water, interaction with the sea bed causes them to slow. This loss in speed causes the waves to increase in height, thus retaining the same amount of energy. Opposing tide or current also causes waves to slow with the same consequences. The period of the waves is not affected by either phenomenon. As the waves approach land, they are refracted which can lead to areas where waves become focused. When considering the "worst intended conditions" for a fast ferry, these factors affecting wave form and pattern along its intended route should be considered.

1.6.4 The south facing entrance to Wellington Harbour is particularly exposed to waves from the southerly quarter. The depth of water in the approaches to the harbour ranged from 50 m, about three miles off, to about 15 m, at the harbour entrance. Heavy southerly swells approaching the entrance are refracted by the seabed and surrounding topography and become focused in the channel and, together with the shoaling effect, this causes waves to build up at the entrance. For this reason, Wellington is often referred to as a bar harbour. Tides at the entrance can reach rates of about one knot.

1.6.5 A signal station located on Beacon Hill at an elevation of 131 m overlooked the harbour entrance from Point Gordon to Palmer Head and out to about two miles south of Pencarrow Head. The station was manned 24 hours per day. The primary function of the duty operator was to provide traffic and weather information to the port users.

1.6.6 In 1988, the National Institute of Water and Atmospheric Research Limited (NIWA) deployed a wave rider buoy about 1.3 nautical miles south-south-west of Pencarrow Head for the purposes of gathering wave data off Pencarrow Head for a proposal to extend a sewer outfall pipe.

1.6.7 Data was transmitted from the buoy to a high frequency (HF) radio receiver located at Beacon Hill, from where it was periodically down loaded. As an incidental use, a real-time read-out was installed at Beacon Hill. During that period, the Beacon Hill operator was able to give any port user an accurate description of wave conditions at the entrance 24 hours each day.

1.6.8 In 1990, the wave rider buoy was removed, but its radio receiver remained at Beacon Hill. When Tranz Rail began its fast ferry service in 1994, it commissioned NIWA to re-deploy the wave rider buoy in its current position off Baring Head, 3 miles off the harbour entrance in 40 m depth of water.

1.6.9 Again, the data from the buoy was transmitted to the radio receiver at Beacon Hill, but this time the data was relayed by land line direct to MetService. Beacon Hill did not have the benefit of a real-time read-out.

1.6.10 Tranz Rail contracted MetService to supply *Condor 10* with actual and forecast weather conditions three times each day, at 0600, 1200 and 1800. There was facility in the contract for Tranz Rail masters to telephone the MetService duty marine forecaster at any other time to obtain information from the wave rider buoy, although few of the masters were aware of this as it had not been documented in the Route Operations Manual.

---

[4] M Darbyshire and L Draper, Forecasting wind-generated sea waves, *Engineering*, April 1963

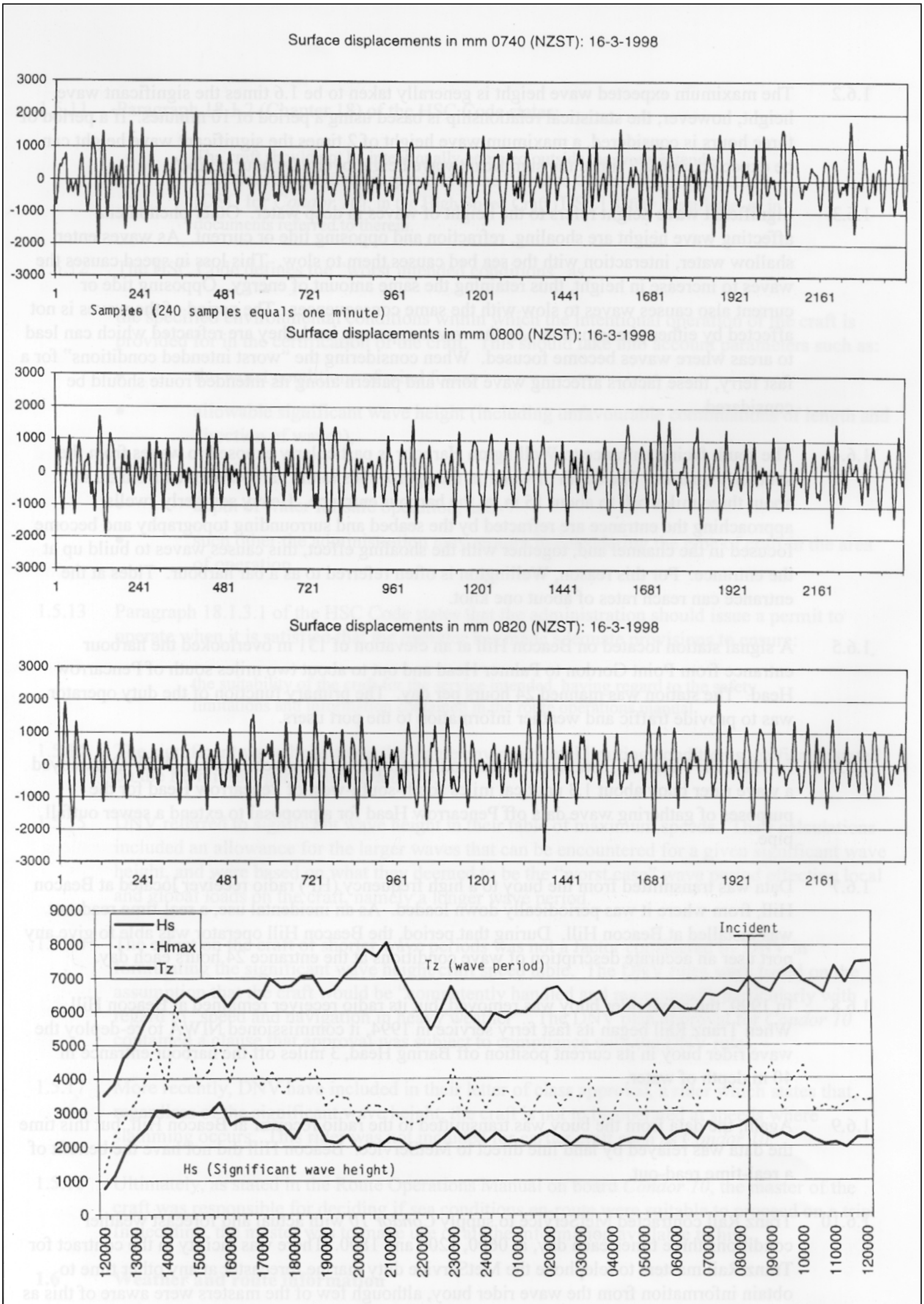

Figure 2
Graphs showing the surface displacements, significant wave height and period, and maximum wave heights over the period the incident occurred

1.6.11 Tranz Rail's decision to have the wave rider buoy deployed was made to enhance the ability of MetService to correlate wind speed with significant wave height in Cook Strait, with a view to removing the buoy once MetService were confident that the accuracy of their significant wave height predictions would meet the requirements of Tranz Rail's fast ferry operation.

1.6.12 Tranz Rail opted to keep the wave rider buoy deployed for each successive fast ferry season. During the winter periods, when *Condor 10* was not operating, the data was relayed to and collected by NIWA.

1.6.13 Information given by MetService in each forecast included:

- present conditions in Cook Strait,
- outlook for the next 6 hours, and
- outlook for the next 12 hours.

1.6.14 The forecast included actual significant wave height and period recorded by the wave rider buoy, and the projected significant wave height.

1.6.15 On the day of the incident MetService faxed a forecast to *Condor 10* at 0620, which included the following information:

- a 15 knot southerly wind, gradually dying out during the morning,
- about 1 m sea at 2 second period,
- a 2.5 m southerly swell at 6 second period, rising to 3 m late this morning,
- combined waves of a little over 2.5 m rising to just over 3 m by noon,
- fine weather and good visibility,
- Wave rider buoy showing a 2.5 m significant swell at 6.3 second period with a maximum wave height of 3.8 m

1.6.16 On the bottom of the facsimile there was the following note:

> All wave heights refer to significant wave height. The significant wave height is the average value of the highest one-third of waves observed.

1.6.17 Following the incident, NIWA and Tranz Rail made available recorded data from the wave rider buoy for analysis. The wave rider buoy measured wave heights and wave periods for three 10 minute periods each hour; commencing on the hour, and 20 and 40 minutes past the hour. The data was analysed and averaged to provide a significant wave height, average wave period, and height of maximum recorded waves.

1.6.18 Figure 2 shows the actual recorded wave profiles at the wave rider buoy for the periods 0740 to 0750, 0800 to 0810 and 0820 to 0830, and a graph showing the average values for Significant wave height (Hs), maximum wave height (Hmax) and wave period (Tz).

1.6.19 The data is that recorded at the wave rider buoy. As waves approached the harbour entrance, they would slow, rise and steepen due to shoaling and refraction. The effect would have been exacerbated by the out-going tide, which was about one hour into the ebb at the time of the incident.

1.6.20 Note that from 0740 to 0800, about the time the Beacon Hill operator observed and reported to the master of *Condor 10* the swell conditions at the entrance, the wave pattern was relatively uniform at about 2.5 m significant height. The Beacon Hill operator's assessment was probably a little low, but from his position up on the hill, was fair.

1.6.21 However, over the ensuing 30 minutes the wave pattern became grouped, with periods of low activity interspersed with groups of much larger waves reaching 4 to 5 m at the buoy, probably larger at the harbour entrance.

1.6.22 Observers' estimates of the height of the two waves at the centre of the incident varied, but averaged 4.5 m. A passenger standing on the starboard aft deck was videoing the scenery on the passage out of the harbour, and by chance caught the two waves on video as the incident occurred. Although difficult to assess, analysis of the video footage indicated that 4.5 m was a reasonable estimate.

1.7 Personnel training

1.7.1 Chapter 18 of the HSC Code requires that the operating crew of high speed craft are to receive special training and be type-rated for their operation. Type-rating must be for a specific type and model of craft, on specific routes.

1.7.2 The code stated:

> The Administration should specify an appropriate period of operational training for the master and each member of the crew and, if necessary, the periods at which appropriate re-training should be carried out.
>
> The Administration should issue a type-rating certificate to the master and all officers having an operational role following an appropriate period of operational/simulator training and on the conclusion of an examination including practical test commensurate with operational tasks on board the particular type and model of craft concerned and the route followed.

1.7.3 In the first summer of operation, type-rated masters and chief engineers for *Condor 10* were supplied by Condor Limited. Before the craft was delivered to New Zealand, several Tranz-Rail masters travelled to the United Kingdom to become familiarised with the craft. When the craft began operating across Cook Strait, the combination of the Tranz Rail master's knowledge of the route, and the Condor Limited master's knowledge of the craft, ensured the provisions of the High Speed Code with regard to training were complied with.

1.7.4 For the ensuing three seasons, the MSA delegated their responsibility under the HSC Code for specifying training and issuing type-rating certificates, to Tranz Rail. Certain masters were designated by Tranz Rail to be "type-rating masters" responsible for training and type-rating other officers as required. MSA specified that the masters and first mates must have completed a high speed navigation course as part of the requirement for their type-rating.

1.7.5 No appropriate periods for training were specified by the MSA or by Tranz Rail. Over the ensuing three summers of operation, only one of the original type-rating masters remained to train, assess and type-rate subsequent officers. Type-rating certificates were issued by this master.

1.7.6 Initially, deck officers became type-rated as first mate on *Condor 10*, and then after an unspecified period of sailing as first mate, commenced training to become type-rated as master. Over time, the training schedules changed to meet company requirements. In some cases, officers became type-rated as master without serving time on *Condor 10* as first mate.

1.7.7 The master's sea-going career spanned some 38 years, during which, he operated a variety of craft, and spent 12 years as master on off-shore salvage tugs. He held a Norwegian master's certificate and a New Zealand Master of Foreign Going Ship Certificate with a current Sea-Going Licence.

1.7.8 During March and April 1996, the master spent five days training on *Condor 10* operating between Wellington and Picton, after which he gained his type-rating as first mate. From 2 April 1996, he served for two weeks as first mate before the craft returned to the northern hemisphere.

1.7.9 In November 1996, the master travelled to Liverpool in the United Kingdom, joined *Condor 10* as first mate, made the delivery voyage to Wellington, and crewed on the vessel on the service between Wellington and Picton over the ensuing 9 weeks.

1.7.10 On 7 December 1997, the master joined *Condor 10* as a trainee master, and for two weeks, operated the craft under the supervision of various masters. On 20 December 1997, he gained his type-rating as master of *Condor 10* for the Wellington to Picton service. On 22 December he was appointed as master of *Condor 10* and operated the craft on a four days on, two days off roster, completing some 180 return trips to Picton from Wellington prior to the incident trip.

1.7.11 Over the summer of 1997/98, six scheduled trips for the *Condor 10* had been cancelled due to bad weather, all of them due to southerly weather conditions, three by the master who was in command of *Condor 10* on the day of the incident. The master felt that with his route training, experience gained on the delivery voyage, and experience gained operating *Condor 10* in service, he knew the limitations of the craft, and was competent to navigate the craft safely.

2. Analysis

2.1 Concept and criteria

2.1.1 Any vessel, regardless of size or type, may sustain damage in heavy weather if it is operated outside its design criteria, or without due regard for good seamanship. High speed craft are built with relatively light scantlings so that they may attain the speeds which make them classed as such. To compensate for the lower design safety margins, the DSC Code, and later the HSC Code, was developed to ensure high speed craft maintained safety equivalence to that of ocean-going craft.

2.1.2 To compensate for the relatively light scantlings of high speed craft, operating limitations for the craft were imposed, and the operating crew were required to be specially trained for that type of craft and for a specific route.

2.1.3 The concept of wave-piercing catamarans is to use their hull form at speed, in conjunction with the ride control system to achieve a level ride. If the waves become too high, or the wave period becomes such that a level ride cannot be achieved, then the craft will begin to pitch and roll. *Condor 10* was designed to withstand superimposed vertical accelerations of 1g. In the absence of fitted accelerometers to guide the master, DNV produced a set of speed restrictions for certain significant wave heights. Significant wave height is the internationally accepted measure for reporting and forecasting sea conditions.

2.1.4 It is well documented that mariners can normally expect to encounter waves 1.6 times the size of the significant wave height. Not so well documented, is that in extreme cases, waves of 2.3 times the size can be experienced, even larger if other factors such as shoaling, tide and wave refraction are considered.

2.1.5 The DNV speed/significant wave height table for *Condor 10* did not take into account the effect of different wave periods on the structure of the craft, but rather focused on wave height for what they deemed to be the "worst case" wave period. For shorter wave periods, where the craft could struggle to maintain a level ride and possibly incur slamming under the bow, it was left up to masters to "competently handle" their craft. While this in itself is a reasonable expectation, it would have been prudent for DNV to have made this abundantly clear, rather than rely on a reference to their rules, which were at least twice removed from the working document used by masters, the craft operating manual.

2.1.6 Clearly, it would be easy for the master of *Condor 10* to exceed the design parameters of his craft if he relied on the reported significant wave height alone, which was the single limiting environmental criterion imposed by the DSC Permit to Operate. There is a need for classification societies and other authorities involved in approving high speed craft for operation to consider and document the effects of wave period on each type of high speed craft.

2.1.7 The operational limits imposed on the craft by DNV per se, allowed the craft to be operated in conditions that required of the master, a high level of expertise to operate the craft safely. Additionally, the concept of the craft required of the master special considerations as to speed and direction versus wave height and period. In order to operate *Condor 10* within its limiting criteria, masters relied on obtaining accurate data on sea conditions on route, and to a large extent, on their visual "reading" of the water ahead by day, and by "seat-of-the-pants" operation by night, particularly when operating near the top limit of the craft design operating envelope.

2.1.8 Type-rating of the master was therefore crucial to the safe operation of the craft, as were the tools to enable the master to assess the conditions likely to be encountered.

2.1.9 *Condor 10* was being operated in a 2.6 m deep-water significant swell at the time of the incident, as recorded by the wave rider buoy. The significant wave height was probably larger at the harbour entrance where the incident occurred due to shoaling and wave refraction, but it is unlikely that it would have exceeded the 3.5 m allowable significant wave height.

2.1.10 The wave that inflicted the damage was from all accounts about 4.5 m in height, and the speed of *Condor 10* was reducing from about 25 knots. Both parameters were still within the DNV allowable limits of 28 knots for significant waves up to 5 m. If it had been dark, the master probably would not have seen the waves, and would have encountered them head-on at a speed of 25 knots. With full ride control in operation, it is conceivable that no damage would have occurred other than slamming under the centre bow causing some discomfort for the passengers, after which the master would probably have either reduced speed, altered course, or both.

2.1.11 An encounter with waves in excess of 7 m is quite conceivable when operating within a 3.5 m significant wave height, particularly at the entrance to Wellington Harbour. According to the DNV calculations, *Condor 10* should have been able to withstand waves of this height, but only for a specific wave period. If *Condor 10* had been passing through the harbour entrance at night or in poor visibility, and encountered such waves with a short period, the design criteria for the craft would likely be exceeded unless the master was aware of the waves and had taken appropriate action.

2.1.12 An operator with about 9 years experience operating a 74 m class wave piercer reported that they had found over time that a uniform wave period of 7.5 to 9 seconds is a critical period for these craft, and can cause ride problems without full ride control in operation, especially when the significant wave height exceeds 2 m. The master of *Condor 10* was not aware of this, nor was the type-rating master for Tranz Rail, nor the flag or port state administrations. Nothing in any manuals on board referred to wave period being a factor.

2.1.13 The recorded average wave period at the time of the incident was some seven seconds. The larger groups of waves passing through the area at the time of the incident would have had a longer period, and would probably have fallen within the reported range of critical wave periods for the craft.

2.1.14 It was apparent that the ride control system on *Condor 10* was looked upon by the master as a system for smoothing the ride for the passengers and cars, rather than a system for aiding the craft to operate within its design parameters. Although the ride control system was not taken into account by DNV when considering the limiting operating criteria for *Condor 10*, it did assist the craft to maintain a level ride and therefore should have been used to its fullest potential.

2.1.15 There are several other known incidents of wave piercing catamarans sustaining damage to their bow visors. In each case the operating speed of the craft was different, as were the sea conditions; however, a common element appeared to be when the speed and direction of the craft, relative to the wave height and period, caused the craft to strike a wave when in a bow-down attitude, causing the tip of the bow visor to enter the wave first. At normal level attitudes, the brunt of any wave impact on the centre hull is absorbed as a glancing blow near the bottom of the structure, which normally provides sufficient reserve hydrodynamic buoyancy to lift the bow over the wave without placing undue forces on the bow visor.

2.1.16 With the light winds present at the time of the incident, and few white caps, it would have been difficult for the master of *Condor 10* to appreciate the size of the approaching larger waves until they were close. His reaction of reducing the engine speed to an idle, when suddenly faced with waves of a size he was not expecting, was instinctive. In doing so, the craft lost the advantage of hydrodynamic lift at speed provided by the hulls and the ride control system. Additionally, the vessel assumed the usual bow-down attitude associated with a rapid speed reduction as it encountered the following wave. The result was the bow visor took the brunt of the relatively high speed impact, something the craft was not designed to do.

2.1.17 Options available to the master that would have reduced the likelihood of *Condor 10* sustaining the bow damage were:

- to have the ride control system in full operation, and
- to maintain the reduced semi-displacement speed but commence a zigzag course (subject to other traffic movements), or
- to have made the radical speed reduction earlier, and encountered the waves at slow speed with the craft in a level attitude in the displacement mode (providing he had sufficient warning of the pending waves).

2.1.18 Whichever option the master chose, it should have been possible for *Condor 10* to have passed the Wellington Harbour entrance in safety, in the conditions that prevailed on the day of the incident.

2.1.19 The damage to the centre bow was not caused by the failure of the two securing devices. If the securing devices alone had failed, then the bow visor would have been relatively free to pivot about its top hinges. With only its hydraulic rams to hinder such movement, damage to the structure behind it would have been minimal. The fact that the structure behind the visor also sustained significant damage, indicates that the whole centre bow was subjected to forces beyond its design parameters, rather than just the bow visor itself. If the securing devices had not failed, then the damage to the main structure of the centre bow could have been worse.

2.1.20 In view of the considerations in 2.19, the interface between the bow visor and the main structure of the centre bow on *Condor 10* is not considered to have been a weak point in the construction of the craft, but rather the point of least resistance when the design parameters for the craft were exceeded.

2.1.21 Although the damage sustained by *Condor 10* in this incident did not affect the watertight integrity of the craft, or pose a significant threat to the safety of the passengers and crew, it is not desirable from either a safety or commercial point of view to have these craft sustaining such damage. The potential exists for a serious accident that does affect the watertight integrity of such craft, or does endanger the lives of the passengers and crew.

2.1.22 The answer does not necessarily lie in increasing the scantlings of high speed craft, nor does it lie with imposing unrealistic restrictions on operating criteria, as both would be counter-productive to their concept. The answer lies in finding an acceptable balance by:

- carrying out a critical safety assessment of each high speed craft and the route on which it is engaged,
- identifying the special needs of the operating crew with regard to equipment, information and training for that route,
- ensuring that those special needs of the operating crew are met, and
- continually reviewing the total operation with a view to continuing safety improvement.

2.1.23 The DSC code, and more recently, the HSC Code were formed to achieve this, but it would seem that the provisions of the codes have not been met by the various authorities responsible for their implementation.

2.1.24 While it would be easy to attribute the damaged bow visor to the actions of the master, the incident raises wider issues regarding assessment of those factors limiting operation, crew training, and route assessment.

2.2 Weather

2.2.1 The wave rider buoy was not being used to its full potential. A readout was available from the buoy for 30 minutes in each hour of the day, yet spot information from the buoy was only given to the master of *Condor 10* three times each day. Masters could have obtained data from the buoy at other times, but were not aware this option was available to them. Figure 2 shows how quickly wave height, period and pattern can change over a half hour period at the Wellington Harbour entrance. Had the latest information been available to the master of *Condor 10* on the morning of the incident, he would have been better informed of conditions at the entrance as the craft approached the area.

2.2.2 Although the Beacon Hill operator was able to provide the master with his visual assessment of wave conditions at the entrance, this service was only available in daylight, and was reliant on what the operator saw when he chose to look out of the window from his position on the hill.

2.2.3 It would be logical for the read-out to be relocated at Beacon Hill. Not only would Tranz Rail gain the maximum benefit from the wave rider buoy for its fast ferry service, but the buoy would prove to be a useful year-round aid to safer navigation for the port.

2.3 Route analysis

2.3.1 There are three areas on the normal route taken by *Condor 10* where the craft could encounter difficult conditions caused by a combination of sea, weather, tide and topographical factors:

- the entrance to Wellington Harbour,
- the Karori Rip, and
- the entrance to Tory Channel.

2.3.2 Only the entrance to Tory Channel is specifically mentioned in the Route Operation Manual, where the master was given an alternative route to follow. Masters were generally aware of conditions in the Karori Rip and if conditions were unfavourable, they would avoid the area.

2.3.3 If a trip from Wellington was to proceed, the master had no alternative but to pass through the harbour entrance. The Route Operations Manual made no mention of the special conditions that could be encountered in southerly weather conditions at the entrance, and gave no guidance to the master on how a passage could be effected in marginal conditions.

2.3.4 In southerly conditions, a master is likely to encounter the worst conditions for the trip at the entrance to Wellington Harbour. It is accepted therefore, that the craft will sometimes need to encounter sea conditions near the top end of its operating envelope at the entrance in order to reach more open and predictable waters beyond. Provided the master is aware of the true sea conditions at the entrance, through good communication with Beacon Hill and other traffic, and provided he/she makes prudent use of the sea-keeping and manoeuvring characteristics of the craft, there is no reason why *Condor 10* should not pass the entrance in conditions such as those encountered on the day of the incident, in safety.

2.4 Type-rating

2.4.1 Type-rating training for high speed craft should not only ensure that the correct information is passed to the trainee, but also that the trainee has adequate time on the type to demonstrate he/she has acquired the necessary handling skills before a certificate is issued. The type-rating certificates were intended to be issued by the MSA following a "specified appropriate period of operational training".

2.4.2 Following the first season of operation, the MSA adopted a hands-off approach to the type-rating of officers on board *Condor 10*, passing the responsibility for the task to the operator, Tranz Rail. In the absence of set criteria for sea service, the standards for the type-rating appear to have relaxed over time to a point where Tranz Rail and the MSA did not fulfil the requirements of Chapter 18 of the HSC Code with regard to training.

2.4.3 The training material required by Chapter 18 of the HSC Code was mostly provided in the various operational and safety manuals on board *Condor 10*, with the exception of "handling characteristics of the craft and limiting operational conditions". Guidance on the concept of wave piercing craft, and how they should be handled in various seas was sparse. This type of information was left to the type-rating masters to hand down to trainees, and then for masters to make their own decision based on their experience. Without any formal document containing such information, the possibility existed for the benefit of such knowledge and experience to be filtered with time, rather than built on.

2.4.4 The designer, and in this case the builder of a new type of craft, which required special driving skills to operate, should have provided clear handling instructions to the owners that should have formed part of the Craft Operating Manual. Subsequent owners and operators of the craft could then have expanded on the instructions as time and experience with the type provided new information. The instructions could then have provided valuable information to masters, without removing their freedom to exercise prudent seamanship.

2.4.5 Although the master of *Condor 10* had received a reasonable amount of training on the craft before receiving his type-rating as master, he displayed a reluctance to use the hydrodynamic characteristics of the craft when confronted with unexpected marginal wave conditions at the entrance to Wellington Harbour, and opted instinctively for the traditional approach of slowing his craft instead.

2.4.6 If the master had been type-rated for the 74 m class wave-piercing catamarans in accordance with all the requirements of Chapter 18 of the HSC Code, and if he had the combined knowledge of the craft designer, builder and other operators before him, the outcome of the trip may have been different.

3. Findings

The findings and safety recommendations are listed in order of development, and not in order of priority.

3.1 *Condor 10* was crewed as required by the DSC Permit to Operate, and its statutory certificates were current at the time of the incident.

3.2 *Condor 10* was being operated within the operating limitations imposed by the DSC Permit to Operate and the DNV Classification Society.

3.3 The speed at which *Condor 10* was travelling in the sea conditions immediately before the incident, was close to the top limit of, but within the design capabilities of the craft.

3.4 The bow visor became displaced when *Condor 10* dipped into a trough between two waves and encountered the second wave in a bow-down attitude, as a result of the master de-powering the craft at an inopportune moment.

3.5 The master's action in de-powering the craft when suddenly faced with waves larger than he was expecting, was an instinctive reaction stemming from the traditional practice of slowing a vessel down in the face of bad weather.

3.6 The Craft Operating Manual on *Condor 10* did not cover the concept of wave piercing craft adequately, nor the intricacies of operating the craft in various wave patterns; instead, past operators relied on the type-rating process for masters for the dissemination of handling procedures for *Condor 10*.

3.7 Because no record was kept of good driving practices, the benefit of 9 years knowledge and experience accumulated by the various operators of the 74 m class wave piercing catamaran was not passed on to the master in sufficient detail during the type-rating process.

3.8 Before passing the responsibility for type-rating to Tranz Rail, the MSA should have ensured that Tranz Rail had an adequate type-rating training system.

3.9 Because qualifying operational time was not specified, and because important craft handling characteristics were not effectively disseminated to the masters, Tranz Rail's type-rating process did not meet the requirements of Chapter 18 of the HSC Code.

3.10 Critical assessment of the route through the entrance to Wellington Harbour, the factors affecting the safe passage of *Condor 10* along that route, and the tools necessary for the master to assess those factors, were not adequately considered by Tranz Rail or the MSA when formulating and approving the Route Operation Manual.

3.11 Had the master been type-rated in accordance with all the requirements of Chapter 18 of the HSC Code, and had he been given the appropriate level of information to assess local sea conditions in the entrance to Wellington Harbour, he could have completed the trip without the craft sustaining any damage.

3.12 The interface between the bow visor and the main structure of the centre bow on *Condor 10*, failed because it was the point of least resistance when the design parameters for the whole craft were exceeded, not because of any design or structural inadequacy.

4. Safety Recommendations

4.1 On 21 September 1998 it was recommended to the Managing Director of Tranz Rail that he:

4.1.1 Includes in the Route Operation Manual for *Condor 10*, or any other high speed craft operated by it, relevant information to assist masters in passing through the Wellington Harbour entrance in safety, (077/98); and

4.1.2 Reviews its policy and procedures for type-rating to ensure set minimum standards that comply with the HSC Code are maintained, (078/98); and

4.1.3 Liaises with the designer, builder and other operators of wave piercer catamarans to collate ideas on driving techniques for wave piercing craft, and reflect those ideas in the Craft and Route Operations Manuals, in such a way that does not restrict masters in their ability to apply prudent seamanship, (079/98)

4.1.4 Liaises with the Wellington Regional Council and NIWA to arrange for the read-out from the existing wave rider buoy to be relocated at the Beacon Hill Signal Station, and any other appropriate location, on a year-round basis. (080/98)

4.2 On 25 September 1998 the Managing Director of Tranz Rail responded as follows:

4.2.1 **077/98**

This information will be included in the revision of the Route Operation Manual currently being written.

Completion date: early November 1998

4.2.2 **078/98**

A book detailing the procedures for type rating has been drafted. We feel that the recommendation should reflect that the type rating procedures in place at the time of the incident were only deficient in that the qualifying time was not specified.

Completion date: early October 1998

4.2.3 **079/98**

Condor Ferries have undertaken to provide this information from various sources on our behalf.

Completion date: early November 1998

4.2.4 **080/98**

We consider that the provision of wave rider buoy data for Wellington Harbour is entirely within the province of the Wellington Regional

Council and that it is they who should initiate any action on this. Tranz Rail would naturally liaise with the Council together with other port users. Tranz Rail has for the past four years provided a wave rider buoy for the duration of the season of it's high speed ferry service. This has been to provide information to enhance the weather forecasts the vessel received from the Metservice. There is no requirement for Tranz Rail to do this and it is relevant to point out that the provision of this facility at considerable cost, benefits all shipping in the Cook Strait area.

We cannot give a completion date for any action that the Regional Council may or may not take.

4.3 On 21 September 1998 it was recommended to the Wellington Regional Council Harbourmaster that he:

4.3.1 Liaises with Tranz Rail and NIWA to consider an arrangement where the read-out from the existing wave rider buoy be relocated at the Beacon Hill Signal Station, and any other appropriate location, on a year-round basis, with the data being available to other port users. (081/98)

4.4 On 9 October the Wellington Regional Council Harbourmaster responded in part as follows:

4.4.1 While wave height information is always of interest to ship operators and Masters, in our view it is unlikely that the cost can be justified. If shipping operators or Port of Wellington are prepared to pay for the cost of installing and maintaining a wave rider buoy, it is likely that the Council will agree to have a read-out at Beacon Hill, on an "information on request" only basis. The Council is unlikely to want to take an active role in the control of shipping based on wave height.

4.5 On 21 September 1998 it was recommended to the Director of Maritime Safety that he:

4.5.1 Reviews Tranz Rail's high speed craft operation, and that of other operators of high speed craft in New Zealand, to ensure that they are complying with the relevant codes before a Permit to Operate is issued, (082/98); and

4.5.2 Ensures that, before MSA passes its responsibilities under the DSC and HSC Codes to an operator, MSA conducts an audit on that operator to ensure they have a system in place that meets the requirements of the code, (083/98); and

4.5.3 Forwards a copy of this report to IMO, as requested under paragraph 1.14 of the HSC Code, for the information of other member states, in the interests of safety. (084/98)

4.6 On 7 October 1998 the Director of Maritime Safety responded in part as follows:

4.6.1 **082/98**

This accords with a finding from MSA's own investigation into the accident and will be complied with. Discussions with Tranz Rail with respect to the probable return of *Condor 10* are ongoing.

4.6.2 **083/98**

Since this accident, all operators of passenger vessels such as *Condor 10* are required to comply with the International Safety Management (ISM) code. To operate under this code, compliance with the above responsibilities is mandatory. Tranz Rail has already been advised by MSA that it plans to carry out an audit of its ISM system before the end of the year to ensure that it has been adapted to suit the operation of high speed ferries.

4.6.3 **084/98**

The flag state for Condor 10 is Singapore on whose behalf MSA issued the vessel with its operating permit. It was also on that State's behalf that the MSA undertook its investigation into the incident and to whom we passed our final report.

There may be merit in both the MSA and TAIC reports being forwarded to the IMO for its information.

I certainly have no difficulty with TAIC's report into this incident being referred to the flag State. I am happy to arrange for this if you wish. As with the MSA's report, it would then be a matter for Singapore to refer the TAIC report to the IMO if it wishes.

4.7 On 21 September 1998 it was recommended to the General Manager of DNV Plan Approvals, through their New Zealand District Area Manager that he:

4.7.1 Reviews its rules for assigning limiting speed/wave height criteria for high speed craft, ensuring that due regard is given to the effect of different wave periods on such craft, and ensuring that for each craft, its speed/wave height table is accompanied by a clear and concise statement as to any other factors an operator must take account of when using the table. (085/98)

4.8 On 12 October the General Manager of DNV responded as follows:

4.8.1 We will firstly clarify what we mean by "worst Case" wave period.

The worst case scenario is a function of Significant Wave Height and Wave Period. It can be extremely difficult to visually estimate wave period, especially at different headings and speeds. That is why our table only refers to significant wave height. For each wave height band, the speed limit is determined for the worst case wave period but due to the above mentioned difficulties in observation the speed limit applied to all wave periods within that band.

For a vessel that is classed to be able to trade in numerous locations around the world it is not possible to do a <u>full</u> analysis of the effect of wave period on the safe operation of each craft. This is because of the difficulty in taking into account <u>all</u> the local factors that may influence the vessel response, such as shoaling, adverse currents, thermoclines, etc. Thus, the Speed Waveheight curve is based on fully developed seas. If, due to the local variations, normal wave steepness limits are exceeded it is the Masters responsibility to ensure the vessel is handled in a prudent manner. We would have assumed that the principles of prudent seamanship would not need to be reiterated, as it is one of the fundamental requirements of a Ship's Master.

With regard to your final safety recommendation, we would state that due regard is already given to the effect of different wave periods in normal operation. We would also comment that our Rules and Procedures are being constantly monitored and updated and your comments are noted as part of this process. In particular, if we have regular occurrences of prudent seamanship not being observed we will examine the issuance of a Classification Circular or Casualty Note to all Owners of High Speed Craft classed with DNV.

5. Additional Comment

5.1 By the 1998/99 summer season, operators of international high speed passenger vessels will be required to have their vessels operating under the IMO International Safety Management Code, the provisions of which will require that some of the above recommendations be implemented.

Approved for publication 30 September 1998

Hon. W P Jeffries
Chief Commissioner