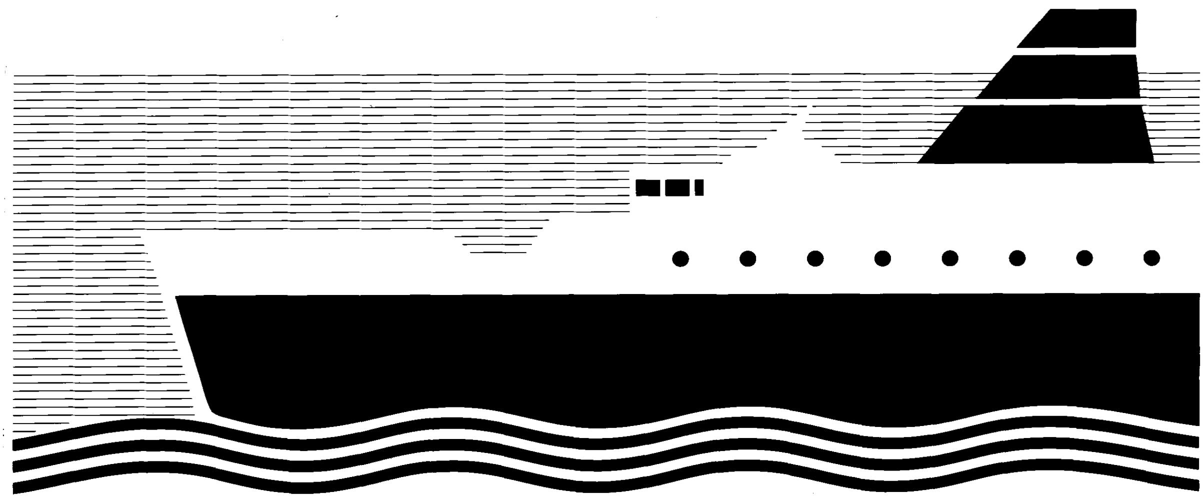

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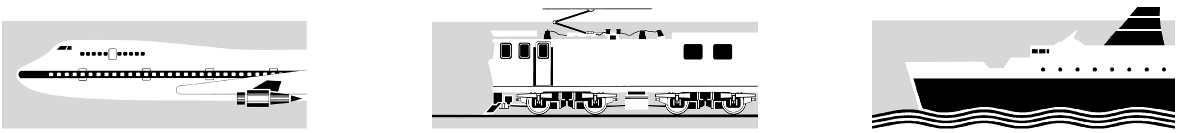
02-208 bulk carrier *Westport*, collision, Onehunga, Manukau Harbour 21 November 2002



TRANSPORT ACCIDENT INVESTIGATION COMMISSION
NEW ZEALAND

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Report 02-208

bulk carrier *Westport*

Collision

Onehunga, Manukau Harbour

21 November 2002

Abstract

On Thursday 21 November 2002 at about 0938, the bulk cement carrier *Westport* collided stern first with the Old Mangere Bridge when the controllable pitch propeller mechanism failed during departure from Onehunga. Both the ship and the bridge suffered extensive damage.

The safety issues identified included:

- the adequacy of knowledge of default conditions for the system
- the adequacy of knowledge of correct operating pressures for the controllable pitch propeller.

Safety recommendations were made to the General Manager of Holcim (New Zealand) Limited to address the safety issues.

The *Westport* at Onehunga

Contents

Figures

Abbreviations

hp	horsepower
KaMeWa	Aktiebolaget Karlstads Mekaniska Werkstad
kt (s)	knot (s)
kW	kiloWatt
LMC	Lloyds machinery certificate
m	metres
MPa	megaPascal
N	north
OD	oil distribution
POAL	Ports of Auckland Limited
t	tonne(s)
UHF	ultra high frequency
UMS	unmanned machinery space

Glossary

aft	rear of the ship
ahead	in the direction of the ship's head, or proceeding in a forward direction
astern	towards the rear of the ship, or proceeding stern first
back spring	a mooring rope leading aft from the bow or forward from the stern
bollard pull	measure of the static pull a ship can exert
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
bulwark	solid rail around the deck of a ship to prevent entry of the sea and exit of people from the deck
bridge	structure from where a ship is navigated and directed
chart datum	zero height referred to on a marine chart
class	category in classification register
command	take overall responsibility for the ship
conduct	directing the course and speed of a ship
draught	depth in water at which a ship floats
fender	a cushion placed between boats, or between a boat and a pier, to prevent damage
flood tide	rising tide
forecastle	raised structure on the bow of a ship
gross tonnage	a measure of the internal capacity of a ship; enclosed spaces are measured in cubic metres and the tonnage derived by formula
headway	the forward motion of a ship. Opposite of sternway
knot	one nautical mile per hour
neap tide	tidal undulation that has the highest low water, and lowest high water, in a lunar cycle
port	left hand side when facing forward
quarter	that part of a ship between the beam and the stern
range of tide	difference in height between successive high and low waters
shackle	a length of anchor chain cable, usually 15 fathoms [27.5 m]
shoaling	shallowing of the water
starboard	right hand side when facing forward
stern	the after end of a ship
spring on/off	to manoeuvre the ship off or onto the berth using a combination of a back spring and the engines
spring tide	period of highest and lowest tides in a lunar cycle
sternway	the reverse movement of a ship
telemotor	a device for controlling the application of power at a distance
under way	not attached to the shore or ground in any manner, but not necessarily making way through the water

Data Summary

Ship Particulars:

Name:	*Westport*
Type:	Bulk cement carrier
Class:	✠ 100 A1 ✠ LMC UMS
Classification:	Lloyds Register of Shipping
Length (overall):	94.65 m
Breadth (extreme):	14.25 m
Gross tonnage:	3091
Built:	1976
Propulsion:	2 x MAK 6M 452 AK 6-cylinder developing 2648 kW, driving a single controllable pitch propeller through a reduction gearbox
Service speed:	13.0 kts
Owner/operator:	Holcim (NZ) Limited
Minimum safe manning:	11
Date and time:	21 November 2002, at about 0938[1]
Location:	Onehunga, Manukau Harbour
Persons on board:	crew: 12 passengers: nil
Injuries:	crew: nil passengers: nil
Damage:	extensive shell plating damage above the waterline in way of the ship's stern, internal damage to tank tops of fresh water tanks in steering gear compartment extensive structural damage to the Old Mangere Bridge
Investigator-in-charge:	Captain I M Hill

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

1 Factual Information

1.1 Narrative

1.1.1 On Thursday 21 November 2002 at about 0940, the bulk cement carrier *Westport* collided stern first with the Old Mangere Bridge during manoeuvring for departure from Onehunga.

1.1.2 The *Westport* had arrived in Onehunga on Wednesday 20 November 2002 at about 1115, and berthed port side alongside B berth and after completion of cargo discharge and loading at 0815 was ready to depart at 0930 on 21 November. The harbour tug *Tika* was in attendance to assist the unberthing.

1.1.3 During the *Westport*'s stay in Onehunga, the ship's engineers overhauled a turbocharger on one of the main engines, so they commenced preparing for departure earlier than usual to complete and check their work. A pipe for the auxiliary alternator was not delivered until that morning so the auxiliary alternator could not be run until this was fitted.

1.1.4 As the auxiliary alternator was used to warm the main engines through, the main engines could not be tested until approximately 0900. Once the ship's engineers were satisfied with the machinery trials, they ran the main engines up to speed, changed generation of electrical power to one of the shaft alternators and then shut down the auxiliary alternator.

1.1.5 In accordance with the company's standard procedures, the steering gear and the controllable pitch propeller equipment were tested prior to departure. The test of the controllable pitch propeller equipment was done without the propeller rotating. Both pieces of equipment functioned normally.

1.1.6 Conditions on the day were such that the master was able to use his standard method of departure. He took command on the bridge and requested stand by engines at 0932 at which time the engines were started but with the propeller at zero pitch.

1.1.7 At 0933 the master ordered the aft crew to first release the back spring and then move one of the 2 stern lines to act as a back spring on which to swing the ship. When this had been done, the master ordered that the other stern line be let go and the forward crew to let go all their lines.

1.1.8 When the lines were let go, the master then engaged the propeller to "pitch 1" astern to keep the stern to the quay and the remaining back spring tight. This movement, with the bow thruster thrusting full to starboard and the *Tika* pushing on the port bow, swung the bow to starboard against the tide.

1.1.9 When the ship had swung through about 140°, the master ordered the back spring to be let go and engaged the propeller to "pitch 3" ahead (refer Figure 1, positions 2 and 3) with the intention of moving away from the berth and into the approach channel. The master ordered the helmsman to line the ship up with the centre of the channel.

1.1.10 The master noticed that the ship was not gathering headway as he expected, and so increased the pitch setting to "pitch 6" ahead. He then realised that the ship was actually gathering sternway and on closer inspection saw the pitch indicator showing full astern pitch. The master rushed to the telephone on the centre console to advise the engine room team of the problem. While on the telephone he brought the pitch lever back to zero but the propeller remained at full astern pitch.

1.1.11 The master considered using the engine emergency stop buttons, located on the centre console, but decided not to because he knew that this would also stop all electrical power at a critical moment.

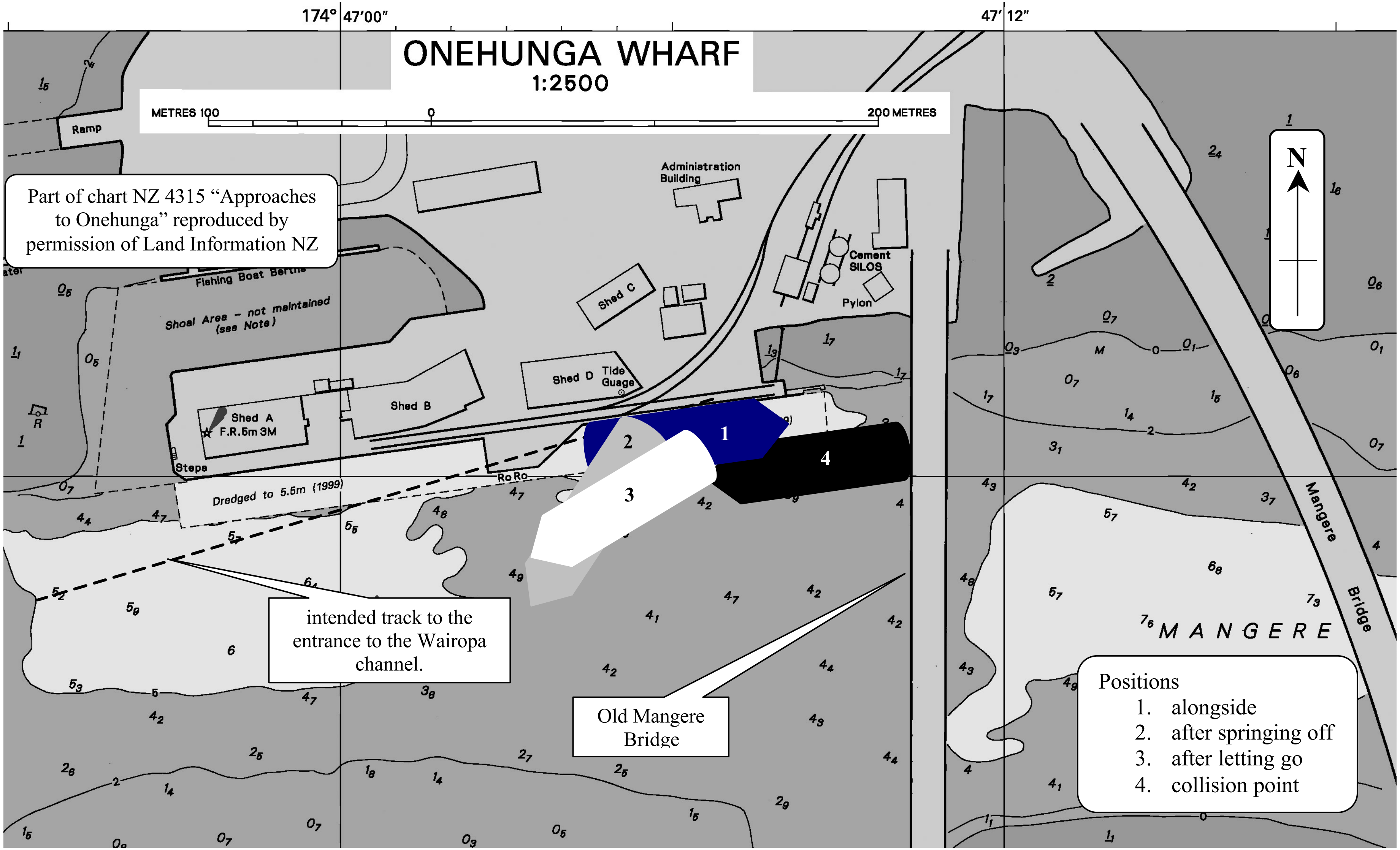

Figure 1
The approximate positions of the *Westport* during un-berthing

1.1.12 The chief officer, who was stationed on the forecastle, noticed that the ship was going astern and asked the master via the UHF radio if he should let go the anchor as a precautionary measure. Receiving what he thought was a positive confirmation, he ordered the crew to let go the starboard anchor, and pay out the cable to one shackle [27.5 m] before holding on.

1.1.13 The ship continued to gain momentum astern and at about 0938 on 21 November 2002, it collided stern first with the Old Mangere Bridge in the region of the second pier (refer Figure 1, position 4).

1.1.14 The engine room team had been unable to regain control of the propeller and zero the pitch before the ship collided with the bridge. Mooring ropes were then run from the ship back to the berth and the ship was heaved, with assistance from the bow thruster and tug, back to the berth where it was re-secured starboard side alongside.

1.1.15 The *Westport* remained in Onehunga carrying out emergency repairs until 25 November 2002, when it then sailed for Lyttelton for permanent repairs. The *Westport* re-entered service on 19 December 2002.

1.2 Port information

1.2.1 The main wharf at Onehunga consisted of two berths (refer Figure 1). 'A' berth to the west with a length of 135 m and 'B' berth to the east with a length of 95 m. The berths were separated by a roll on - roll off ramp, which extended 18 m into the harbour. The eastern end of 'B' wharf was about 50 m from the Old Mangere Bridge, an old road bridge used only for pedestrian traffic. Chart NZ 4315, indicated a depth of 5.5 m alongside both berths in 1999.

1.2.2 The port of Onehunga came under the jurisdiction of Ports of Auckland Limited (POAL). POAL had carried out a risk assessment of the Manukau harbour in 2001. The assessment identified the possibility of a collision between a ship and the Old Mangere Bridge. Although not categorically stated in the assessment, it was envisaged that such a collision would be caused by a ship losing motive power or steering and drifting into the bridge, rather than a collision involving a ship under power.

1.2.3 It was not normal practice to secure the tug to the ship as the tug was only used to assist the bow to swing by pushing. The stern of the *Westport* had a specially fitted fender around the stern so that this manoeuvre could be undertaken without damage to the stern.

1.3 Ship information

1.3.1 The *Westport* was a bulk cement carrier built in 1976 in Germany. The ship was registered in Lyttelton, New Zealand and had an overall length of 94.65 m, a breadth of 14.25 m and a gross tonnage of 3091. The ship was fitted with a 300 hp [224 kW] bow thruster, that gave about 3 t thruster force.

1.3.2 The ship had valid certificates issued by, or on behalf of, the government of New Zealand and Lloyds Register of Shipping.

1.3.3 The minimum safe crewing document issued by the Maritime Safety Authority of New Zealand required a complement of 11 crew. The ship was in compliance with this document.

1.3.4 The *Westport* was powered by 2 MAK 6M 452 AK 6-cylinder diesel engines developing a total of 2648 kW, driving, through a reduction gearbox, a single four-bladed controllable pitch propeller. A single rudder located in line behind the controllable pitch propeller effected steering.

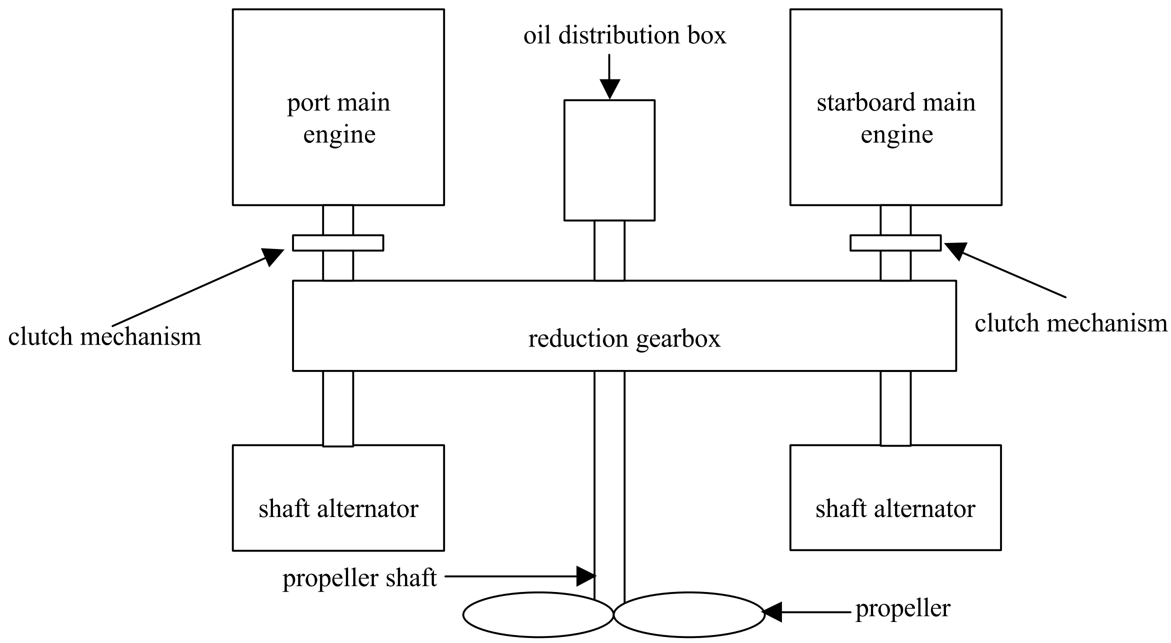

Figure 2
Diagram illustrating connections between main engine, shaft alternators, gearbox and propeller shaft

1.3.5 The controllable pitch propeller was of Aktiebolaget Karlstads Mekaniska Werkstad (KaMeWa) design. The main control for it was in the engine control room but could be switched to the navigating bridge consoles for bridge control. The controllable pitch propeller control allowed the pitch of the propeller blades to be adjusted ahead and astern, or if required, in combination with variations of engine revolutions, known as a combinator.

1.3.6 The navigating bridge of the *Westport* was fitted with 3 manoeuvring consoles, one located at each of the port and starboard extremities of the wheelhouse and the other in the centre. All the consoles had controls for the bow thruster and controllable pitch propeller, but only the centre console had telephone communication, emergency stops for the main engines, engine room telegraph and the steering position. The 3 bridge control levers were synchronised, that is, when one lever was operated the others followed. There was no facility to de-clutch the main engines on any of the bridge consoles.

1.3.7 The *Westport* was equipped with an auxiliary alternator, which could be used to provide limited electrical power for the ship. However, the electrical power provided by the auxiliary alternator was not sufficient to run all the ship's systems. At sea, or if required in port when shore electrical power was unavailable, electrical power was supplied by shaft alternators, each main engine having a shaft alternator coupled to it (see Figure 2). The company had investigated the possibility of running the auxiliary alternator in parallel to the shaft alternators. It had found that this was not possible, however, the auxiliary alternator would start automatically should the shaft alternators fail. Batteries supplied emergency electrical power.

1.3.8 The tug *Tika* was a 730 hp [544.6 kW] twin engine harbour tug that was capable of about 7.3 tons bollard pull.

1.4 Operation of the controllable pitch propeller

1.4.1 The ship's movement ahead and astern, and speed were dictated by a combination of engine speed and the pitch of the propeller blades. When a shaft alternator was connected, and on electrical load the engines had to be run at constant speed.

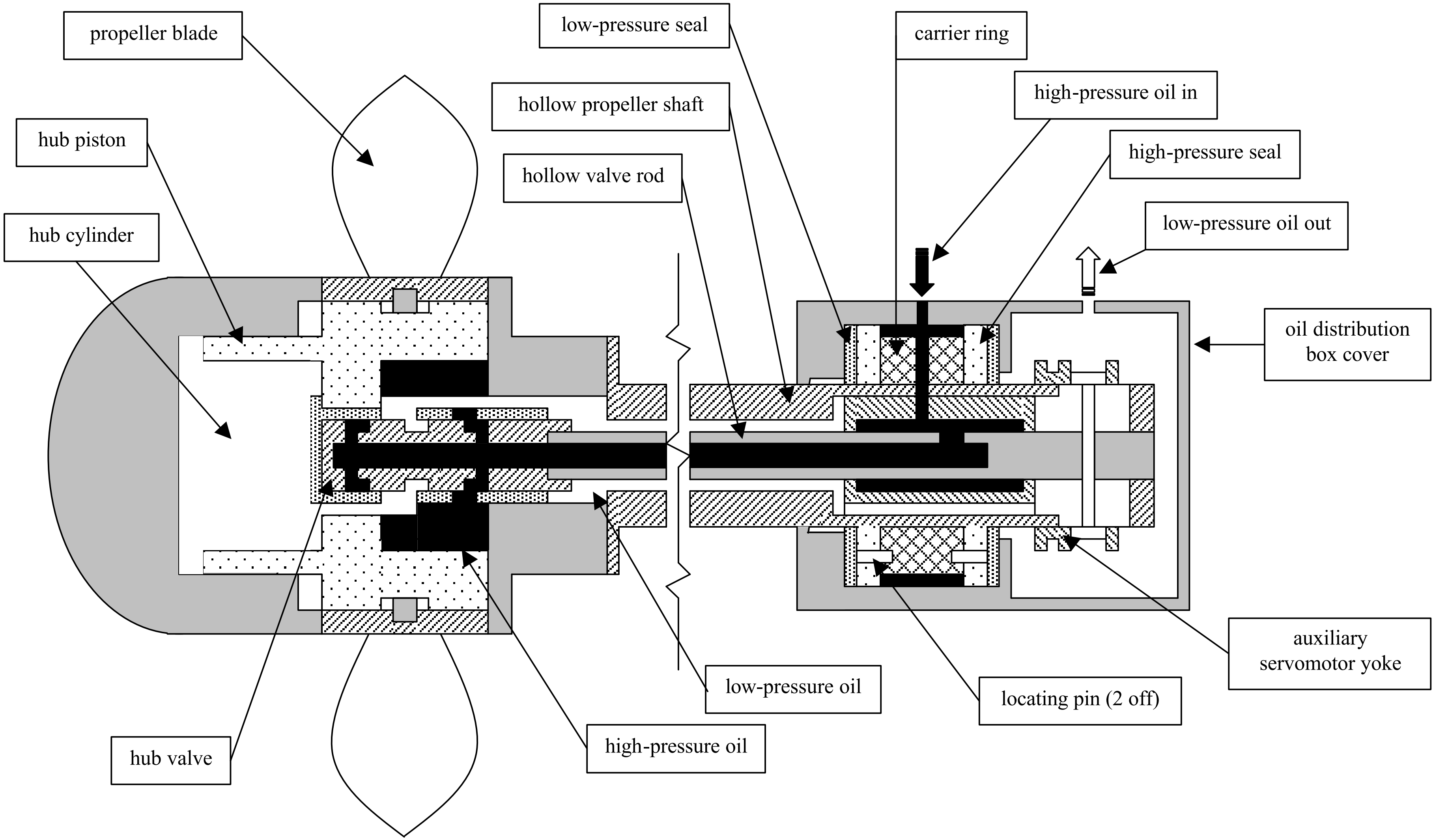

Figure 3
Diagram of controllable pitch propeller and oil distribution box, not to scale, simplified and expanded for clarity

1.4.2 The propeller actuating mechanism consisted of a hollow propeller shaft with a hollow valve rod located inside, an oil distribution box and a remote control system for controlling the pitch of the propeller blades. Two pumps supplied high-pressure hydraulic oil to the system. Both pumps were used during manoeuvring operations and one pump when the ship was clear of confined waters. The remote control system actuated an auxiliary servomotor attached to the oil distribution box.

1.4.3 The propeller comprised of 4 blades each bolted to the propeller hub. Inside the propeller hub there was a piston, which turned the blades to the required pitch setting (refer Figure 3).

1.4.4 The piston was moved when high-pressure oil flowed to either side of the piston. A directional valve in the hub controlled which side of the piston the high-pressure oil was fed to. The hollow valve rod from the oil distribution box controlled the movement of the valve (see Figure 3).

1.4.5 High-pressure oil entered a pressure chamber formed by the space between 2 high-pressure sealing rings in the oil distribution box. From here it flowed through a hole drilled in the propeller shaft, through the sleeve for the valve rod, into the hollow valve rod and thence to the hub. The lower pressure return oil flowed through the hollow propeller shaft outside of the valve rod back to the oil distribution box, and into a collection tank (see Figure 3).

1.4.6 Should the system lose high-pressure oil, the hydrodynamic forces acting on the propeller blades whilst under load would result in them moving to the full astern mechanical end stop.

1.4.7 Should air enter the high-pressure oil system, the pitch response would have been noticeably slow and uneven. To prevent this, the pressurised oil system was fitted with an air-purging device.

1.4.8 Should the high-pressure oil system become contaminated, the blades would either not respond or default to the full astern position. Hydraulic oil samples were regularly taken and sent for analysis to determine whether there were any contaminants or foreign particles present in the oil system. A sample had been taken shortly before the accident and the results showed no indication of any foreign particles in the oil.

1.4.9 The remote control system operates the auxiliary servomotor, which controls the movement of the valve rod by means of a yoke. The remote control system was pneumatically operated with control panels situated in the engine control room and on the bridge. Reduced pressure air gave ahead pitch and increased air pressure gave astern pitch. In the engine control room there was a changeover switch, which changed control between the control room and bridge consoles. Should the control air fail then the system would drive the propeller to full ahead pitch.

1.4.10 The chief engineer was the only member of the ship's crew who was aware of the default condition in the event of various failures in the system. Immediately after the accident there was some confusion among the crew as to which way the propeller should default.

1.4.11 The oil pressure required to operate the system varied with the pitch of the propeller blades; the maximum pressure required being between zero and 5% of the pitch ahead or astern. This was primarily due to the blade surfaces taking up a pitch direction from the neutral position. Other factors such as the loading of the ship, the tide, current, weather and whether or not the propeller is rotating also affect the pressure required to adjust the blade pitch.

1.4.12 The pressure chamber was formed by the space between the 2 metal high-pressure seals, which were kept apart by means of a carrier ring that was fixed to the outside of the propeller shaft. The carrier ring had a radially bored hole for the high-pressure oil to pass through, a series of 6 axial holes drilled through it for the expansion springs that held the 2 seals apart assisting the seal to form with constant tension, and a locating pin on each face, which locates the metal seals in place and ensures rotation with the shaft (refer Figures 3 and 4).

1.4.13 On the inner face of each high-pressure metal seal was a groove to locate the springs and an axially bored hole to accept the locating pin.

1.4.14 The high-pressure white metal seals bore onto bronze high-pressure/low-pressure seals, which fitted against the oil distribution box casing and were designed not to rotate. A low-pressure 'O' ring seal was fitted to the circumference of the bronze seal.

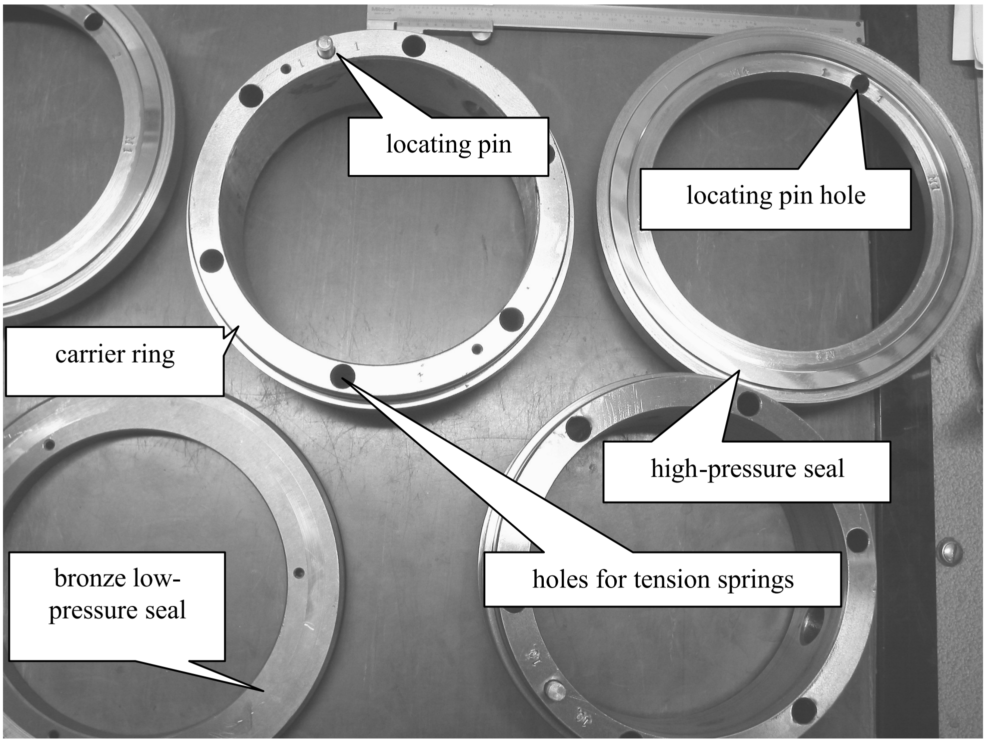

Figure 4
High-pressure oil seal components

1.5 Previous incidents involving the controllable pitch propeller

1.5.1 The *Westport* had suffered controllable pitch propeller problems in the past, some of which were applicable in this investigation.

- In May 1997, with the ship underway, pitch ahead could not be increased. The ship was only able to proceed at low engine speed because any increase in engine speed or pitch resulted in the pitch going astern. Investigation found that the high-pressure seals in the oil distribution box had failed. These seals were those originally fitted when the ship was built in 1976. The high-pressure seals were removed and found to be either disintegrating or badly scored, and the 'O' rings on the low-pressure seals had hardened with age. At this time it was discovered that the seal manufacturer's recommended a renewal interval of 10 years.
- In September 1997, the master reported that there was a gradual reduction of maximum pitch both ahead and astern. Investigation found that the sliding shoe and yoke linkage had moved and an adjusting screw had severely stripped threads. No reason for the fault was given at the time. A manufacturer's representative rectified this fault.
- In May 2002, the *Westport* hit a large wooden mooring pile while manoeuvring in the Buller river in thick fog, causing large fluctuations in hydraulic pressure above "pitch 5" ahead, due to the damaged propeller. The ship was dry-docked in June 2002, when stress fractures of the hub and propeller blade bearing ring threads were found. The propeller blades were deformed by the contact with the pile. The damage was repaired at dry-dock.

1.6 Post accident testing

1.6.1 After the accident the oil distribution box was dismantled in the presence of the manufacturer's representative. Difficulty was encountered in removing the carrier ring and the 2 seals due to the limited space and also as they had been installed in reverse order. A manufacturer's representative had been present during the installation in May 1997.

1.6.2 Polished wear marks on the outer face of the after static bronze seal ring indicated that it had possibly rotated in its housing.

1.6.3 Unusual wear patterns on the inner faces of both static bronze seal rings indicated minimal mechanical contact between them and the white metal sealing rings.

1.6.4 The hole for the locating pin on the forward high-pressure seal was elongated and a slight step had formed inside the hole. Both locating pins on the carrier ring showed signs of excessive wear and fretting on their faces. On examination it was possible to get the locating pin on the seal carrier to become lodged against the step causing the seal to adopt a small cant in its housing and thus not form a perfect seal.

1.6.5 A complete new seal and seal carrier unit was installed in the oil distribution box and the system extensively tested. A range of pressures and temperatures were taken while the system was connected to the engines. The pressure for given movements from zero to 5% ahead or astern was 80 bar [8.0 MPa], whereas prior to the accident it had been reported as being 55 bar [5.5 MPa]. Due to the disparity in the 2 pressure readings, technical advice was sought from the KaMeWa office. The manufacturer suggested that the expected pressures in the system for these movements should be about 83 bar [8.3 MPa] but 80 bar [8.0 MPa] was considered to be acceptable.

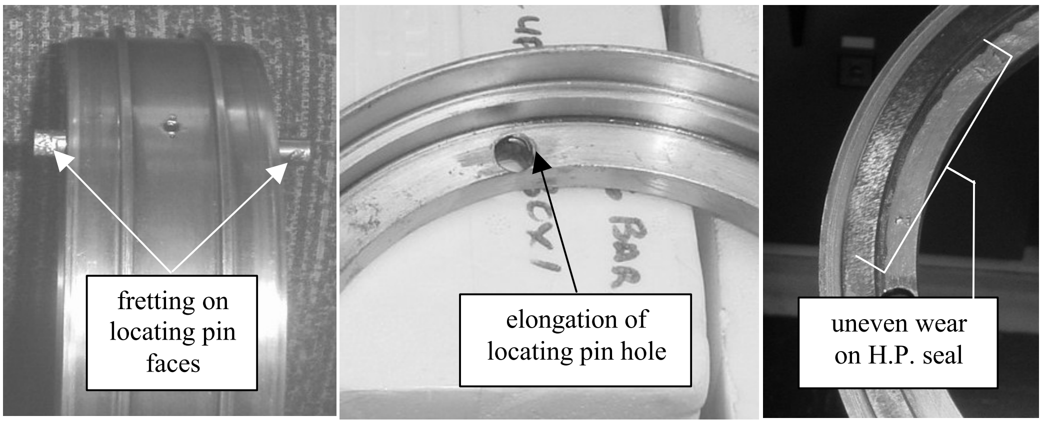

Figure 5
Examples of damage to seals and carrier ring

1.7 Climatic and tidal conditions

1.7.1 The weather at the time of the accident was fair with a south westerly breeze of 20 kts.

1.7.2 The mean spring range for the tide was 3.42 m, and the mean neap range of the tide was 1.99 m. On the morning of 21 November 2002, the range of tide was 3.2 m, indicating near spring tides.

1.7.3 The accident occurred about 2½ hours before high water on a near spring tide at a calculated height of about 2.7 m above chart datum. At this state of the tide the tidal current was running at near maximum flow. Tidal information contained on chart NZ 4315 indicated a current flow of about 1.8 kts in a direction of about 119° (T) directly towards the bridge.

1.8 Personnel and training

1.8.1 The master went to sea in 1957 as a deck hand. After many years serving on ships of both British and New Zealand registry, he took up shore-based employment for 12 years. When he returned to sea he started studying for his certificates of competency and gained his masters foreign going certificate in 1993. He had worked for Holcim (formerly Milburn Cement) since 1982 and had sailed as master for about the last 5 years. The master had attended a Bridge Resource Management course in Auckland during 1998.

1.8.2 The chief engineer went to sea as a time-served engineer in 1968, and gained his chief engineers certificate in 1983. Since then he had sailed as chief engineer and had been employed by Holcim for the previous 20 years.

1.8.3 The chief officer went to sea in 1966, and after working on ships of mainly British and New Zealand registry, he obtained a New Zealand foreign going masters certificate in 1978. He had sailed as master for over 12 years before taking up employment with Holcim, initially as second officer about 18 months before the accident.

1.8.4 The second engineer went to sea in 1977, as a leading hand and gradually worked his way through the system gaining his first class motor certificate in about 1994. He commenced employment with Holcim in about 1994.

1.8.5 The helmsman had been at sea since the late 1950's and had served on ships of varying nationalities. He had been employed by Holcim for 17 years, sailing as boatswain or chief integrated rating for the last 12.

Figure 6
External damage to stern of *Westport*

1.9 Damage

1.9.1 The damage to the *Westport* was extensive but mainly restricted to the stern of the ship (see Figure 6).

- The shell plating in way of the port and starboard fresh water tanks, situated at the stern below the steering flat, was ruptured and the internal frames were buckled and torn.

- The after store steering space deck, shell plating and supports were buckled and torn. The aft upper deck and bulwarks were set up and buckled.
- The port after winch motor was torn off and the steering gear motors were displaced.
- The hydraulic motors for the steering gear were displaced.

Figure 7
Damage to the old Mangere Bridge in the area of the second pier

1.9.2 The damage to the old Mangere bridge was extensive (see Figure 7):

- The second pier from the north abutment was pushed sideways by 500 mm and was badly cracked at both ends.
- The third pier from the north abutment suffered only minor damage, as did the north abutment.
- The outer beams on both sides of the bridge were damaged
- The decks and footpath of the bridge were cracked over a distance of 20 m.
- The safety handrail was also extensively damaged at the point of impact.

2 Analysis

2.1 The master's unberthing manoeuvre was well practised and appropriate for the conditions. On this occasion the manoeuvre was not successful because the controllable pitch propeller failed to full astern pitch at a crucial time.

2.2 The master could have used the emergency stops for the main engines and the force of the impact might have been reduced. However, because the electrical power was being supplied by a shaft alternator the ship would have lost electrical power until the auxiliary alternator automatically started to provide essential services.

2.3 Stopping the engines would have removed any possibility that the engineers may have been able to rectify the problem before the collision.

2.4 Once the master had turned the ship off the berth, the stern was about 100 m from the bridge. Assuming that the ship attained an average speed of 3 kts astern allowing for the assistance of the tidal current and the wind, it would only have taken about one minute to reach the collision point.

2.5 The chief officer's action letting go the starboard anchor was intuitively correct. However, there was insufficient time for the anchor to have any effect in slowing the astern movement of the ship and avoiding the collision.

2.6 The tidal current was running towards the bridge at about 1.8 kts and, together with the south westerly breeze, would have increased the astern movement of the ship.

2.7 The controllable pitch propeller and associated operating system was a critical component of the ship's propulsion system; its failure disabled the ship.

2.8 The failure was probably caused by a loss of pressure in the hydraulic system after the failure of the high-pressure seal. The controllable pitch propeller blades defaulted to the full astern position indicative of low oil pressure.

2.9 The failure was unlikely to have been caused by a blockage in the hydraulic system, because it would have failed to respond when tested prior to departure. Regular testing of the hydraulic oil for contaminants was carried out and the most recent test showed no evidence of contamination.

2.10 The failure was unlikely to have been caused by air in the hydraulic system. During testing the engineers would have been alerted to this by the slow and erratic movement of the propeller blades. Also an air-purging device was fitted in the hydraulic system.

2.11 The failure was unlikely to have been caused by a failure in the control air system because the controllable pitch propeller would have defaulted to the full ahead position.

2.12 The cant of the high-pressure seal introduced by the locating pin lodging on the small step and the uneven wear on the bronze seal faces were indicative of a probable small gap or incorrect seal contact between the components. Even a very small anomaly would have been enough to allow a loss of high-pressure oil through the seal, effectively bypassing the hub servomotor.

2.13 The incident in May 2002, and the shock of the severe fluctuations in oil pressure and associated pounding that occurred afterwards might have caused the low-pressure seals to move in their housings allowing hydraulic oil to leak past them.

2.14 Although the high-pressure seal components had been installed in the wrong order in 1997, the design was such that its performance would not have been affected. However, being fitted in such a way indicated a less than desirable degree of care.

2.15 The small step in the locating pin recess was possibly formed at the time of re-assembly in 1997. For such damage to occur it is likely that the components of the seal were assembled with undue force. The step probably contributed to the failure sequence.

2.16 Since the high-pressure seal had been replaced in 1997, the hydraulic oil pressure for actuating the propeller blade pitch had been considerably lower than the manufacturer's recommendation but that information was not available to the engineers on board the ship.

2.17 The lower pressures obtained since 1997 could indicate that the seal was losing high-pressure oil from the time it was fitted, finally failing 5 years into its recommended 10-year lifespan.

3 Findings

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

3.1 The *Westport* collided with the Old Mangere Bridge because the controllable pitch propeller system, a critical component of the ship's propulsion system, failed at a crucial time during the un-berthing manoeuvre.

3.2 The master's un-berthing manoeuvre was appropriate for the conditions and would have been successful had the controllable pitch propeller not failed at a critical time.

3.3 The failure of the controllable pitch propeller system was probably caused by a loss of high-pressure hydraulic oil in the oil distribution box because it was able to bypass the high-pressure seals.

3.4 Oil was able to bypass the seals, probably because a seal had become canted in its housing as a result of a step in its locating pin recess.

3.5 The step in the recess was probably formed when undue force was used when the seal was last reassembled.

3.6 The seal had not been inspected in the past 5 years.

3.7 Once the master realised that the ship was moving astern, rather than ahead, there was insufficient time remaining to rectify the problem and avoid collision with the bridge.

3.8 There was insufficient time for the anchor to have had any effect on the ship's progress.

3.9 Had the master stopped the engines as soon as he noted that the pitch was indicating full astern, the impact with the bridge may have been reduced but would not have been avoided completely. Stopping the engines would have left the ship without electrical power until the auxiliary alternator had started automatically, a delay of about one minute. Stopping the engines would also have removed any chance of correcting the fault and reducing the impact speed.

4 Safety Actions

4.1 Subsequent to the accident, Holcim (New Zealand) Limited implemented changes to their procedures in that:

- testing of the controllable pitch propeller system from the navigating bridge control was carried out with the propeller under load prior to arrival and departure at each port
- testing of the controllable pitch propeller system with the propeller not under load was carried out from both the navigating bridge and the engine control room prior to departure from each port
- when the ship was manoeuvring in port, 2 hydraulic oil pumps for the controllable pitch propeller system were run at all times.

5 Safety Recommendations

5.1 On 14 May 2003 the Commission recommended to the General Manager of Holcim (New Zealand) Limited that he:

5.1.1 Instigate regular monitoring and logging of the critical operating oil pressures and flows of the controllable pitch propeller system under repeatable standardised operating conditions. Ensure that data collected is understood by the engineers and is sufficient to give warning of a possible failure in the unit. The maintenance system of the vessel should include the action to be taken if the values obtained deviate from those specified by the manufacturer. (010/03)

5.1.2 Ensure that all the crew of the *Westport* who are responsible for the operation, maintenance and monitoring of the controllable pitch propeller system are made aware of the way the system defaults under differing failure conditions and the necessary corrective action to take in case of a failure (011/03).

5.2 The General Manager of Holcim (New Zealand) Limited. responded to the preliminary safety recommendation, which was subsequently adopted unchanged as the Commission's final safety recommendation. That response dated 23 April 2003, was:

> Holcim (New Zealand) Ltd. accepts the preliminary report and will agree and comply with the two safety recommendations contained in clause 4.
>
> We wish to comment further as follows:
>
> Since the "Westport" incident at Onehunga on 21 November 2002, parts of the two safety recommendations from the TAIC preliminary report have already been put into place. The two safety recommendations will be implemented in full.

Approved for publication 26 May 2003

Hon W P Jeffries
Chief Commissioner

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