

Accident Report

Collision with Bridge

Spirit of Resolution

8 October 2005

Class B



REPORT NO.: 05 3860

SPIRIT OF RESOLUTION – COLLISION WITH BRIDGE

Whilst departing Onehunga, Auckland, on 8 October 2005, the Master of *Spirit of Resolution* was unable to manoeuvre the vessel as intended due to the combination of strong wind conditions and a flooding tide. As a result, the vessel collided with the Old Mangere Bridge. Both the vessel and bridge sustained damage.



Photograph 1
Spirit of Resolution – Taken at the time of the incident.

Details of Vessel, Owner, Manning & Crew:

Name of Vessel:	<i>Spirit of Resolution</i>
Vessel Type:	Container vessel
Port of Registry:	Lyttelton
Flag:	New Zealand
IMO No.:	9139127
Built:	1996
Construction Material:	Steel
Length Overall (m):	100.72
Maximum Breadth (m):	16.53
Gross Tonnage:	3 850
Net Tonnage:	1 980
Propulsion:	Krupp MaK diesel engine developing 3520Kw
Accident Investigator:	Andrew Hayton

Owner Details

Harren & Partner, Germany

Operator Details

Pacifica Shipping (1985) Ltd.

ISM Certificate

The vessel holds a valid ISM Certificate.

Master Details

The Master is the holder of a valid New Zealand Foreign Going Master's Certificate of Competency issued in 1995.

Crew Details

The Chief Officer is the holder of a valid New Zealand Foreign Going Master's Certificate of Competency issued in 1979.

Manning Details

The vessel was correctly manned with a crew of 11.

NARRATIVE

At approximately 1000 hours on 8 October 2005, the Master of ***Spirit of Resolution*** discussed the vessel's sailing with the Chief Officer. The vessel's planned departure from Onehunga wharf, where the vessel was berthed port side to, was set for 1300 hours. Due to the prevailing weather conditions combined with the fact that the vessel was required to swing through an arc of 180 degrees upon departure in order to navigate the navigable channel, the Master ordered a tug. The Master was informed that the Manukau Bar was closed due to rough sea conditions. Because of this, the Master planned to sail from Onehunga and proceed to an anchorage near Big Bay in Manukau Harbour until the sea conditions improved.

The Master completed the pre departure checklist at approximately 1240 hours, at which time he noted the wind speed and direction from the anemometer to be between 18 and 20 knots from the south-southwest.

At approximately 1253 hours, the tug ***Tika*** made fast on the starboard side aft of ***Spirit of Resolution***. At this time, the Chief Officer commenced duty as part of the bridge team.

At 1255 hours, the engine room was placed on standby. The bridge engine and thrusters controls were tested and control passed to the port bridge wing.

The intention of the Master was to bring the vessel off the face of the berth using the main engine, bow thruster and tug.

Once clear of the Ro/Ro ramp, he intended to move astern towards the first set of channel beacons. When approaching the beacons, the tug was to be let go from the after end of the vessel and move to the starboard bow before making fast once more. The vessel would then be swung bow to starboard with the assistance of the tug pulling on the starboard bow.

At 1258 hours, the order was given to let go forward and aft, after which the mooring lines were recovered on board. The Master, who had the con of the vessel, then adjusted the engine controls to give 50% pitch astern. This was only sufficient to hold the position of the vessel against the wind. ***Tika*** was pulling at full power but even with the bow thruster at full thrust to starboard, the Master was only able to bring the vessel approximately 8 metres off the face of the berth.

At approximately 1303 hours, the Master decided that as the wind speed had increased significantly, he would abort the departure and bring the vessel back alongside the berth. However, the strength of the wind precluded him from carrying out this manoeuvre. The strength of the wind caused the stern to pass through the wind onto the port side of the vessel and this, combined with the incoming flood tide, was too strong for ***Tika*** to counteract and ***Spirit of Resolution*** was set rapidly towards the Old Mangere Bridge. The forecastle crew managed to get two headlines ashore but two attempts at landing a heaving line from the poop deck failed. ***Tika*** was let go at this stage.

The Master utilised the rudder and engine so as to best reduce the force of the impact with the bridge.

At 1312 hours, the starboard quarter of ***Spirit of Resolution*** made contact with the bridge, the vessel's bulbous bow contacting the western side of the mooring dolphin. ***Tika*** was positioned in safe but confined water between the vessel, bridge and the berth, and was unable to assist other than to push against the vessel's starboard bow.

The Second Officer sounded the forepeak for possible water ingress but none was found. The after peak tank was already half full of water when the vessel sailed.

At approximately 1528 hours, the change of tide set ***Spirit of Resolution*** off the bridge sufficiently for ***Tika*** to manoeuvre clear.

The Master spent the following two hours manoeuvring the vessel to the best of his ability in an attempt to bring the vessel back alongside the wharf. Eventually, the Master was able to bring the vessel head to wind and it was then possible for him to proceed to a position off the western extremity of Onehunga wharf where at 1653 hours the port anchor was let go. The vessel was then manoeuvred astern.

At 1738 hours, the vessel was safely berthed starboard side alongside the cement berth.

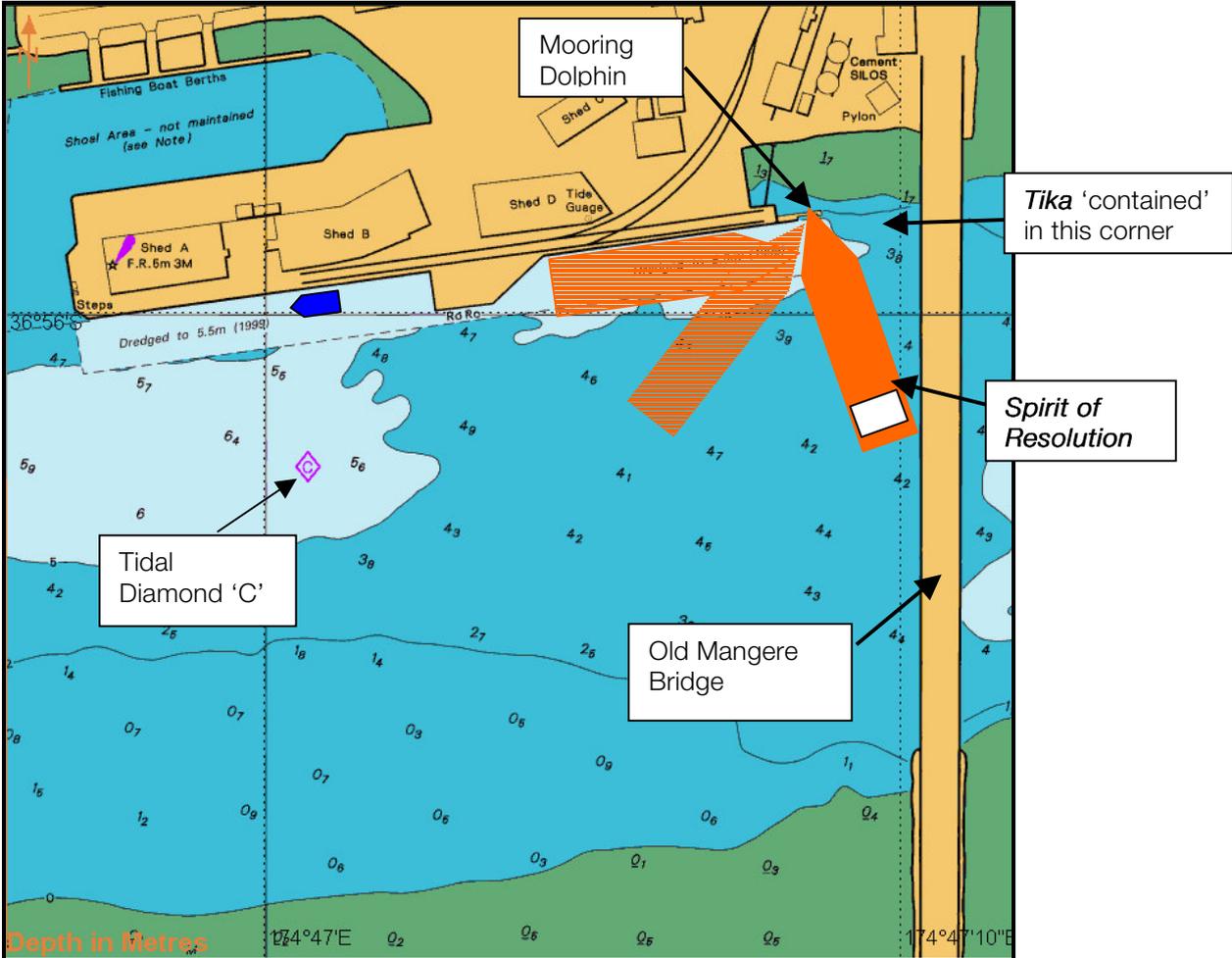


Figure 1
Approximate position of vessel when it contacted bridge

FINDINGS

Weather and Tidal Conditions

High water at Onehunga was predicted at 1430 hours with a height of 3.9 metres above chart datum.

The charted tidal information for tidal diamond 'C' (See Figure 1) was as follows:

Time	Direction	Rate
1230	120° (T)	1.7 knots
1330	126° (T)	0.6 knots
1430	230° (T)	0.5 knots
1530	235° (T)	1.4 knots

The Master stated that wind speed at 1245 hours was 18-20 knots and that the wind speed increased significantly as the vessel left the berth.

The Chief Officer stated that the wind speed upon departure was approximately 30 knots, with stronger gusts.

The MetService Marine Forecast that was issued at 0438 hours on 8 October and valid until midnight, gave a gale warning for all sea areas. The forecast for the Manukau and Waitemata Harbours was for westerly winds at 35 knots, gusting 45 knots and then easing to 25 knots, gusting 35 knots in the evening.

The wind conditions recorded at Auckland International Airport, at the time of the incident were as shown in the table below. This weather station is located approximately 4.5 miles south of Onehunga and is in an equally exposed position. The winds near the Old Mangere bridge are, however, considered to be slightly higher than at the airport as Onehunga is situated directly downstream of the river of wind that funnels through the Manukau Heads.

Time	Wind Direction/Speed (kts)	Max Gust last hour (kts)
0700	NW 9.0	21.0
0800	W 22	31.0
0900	W 23	34.0
1000	WNW 26.1	38.0
1100	W 28.1	47.0
1200	W 31.0	43.0
1300	W 34.1	48.0
1400	W 29.0	54.0
1500	W 34.1	54.0
1600	W 28.1	46.0
1700	W 31.0	46.0
1800	W 29.0	43.0
1900	W 28.0	41.0

The logbook entry for 1200 hours, completed by the Chief Officer, records the wind conditions as 30-40 knots from the west-southwest. The Chief Officer stated that this entry was made after the vessel was back alongside the wharf.

Ports of Auckland Limited (POAL), has a wind anemometer located on the Port administrative building at Onehunga Wharf. However, wind speeds from this equipment have in the past been unreliable and POAL state that it is scheduled for relocation.

The Port of Onehunga

The operators of ***Spirit of Resolution*** had no documented procedures or guidelines at the time of the incident regarding the departure of their vessels in strong winds or marginal weather conditions at the Port. The decision to depart or remain alongside was left to the discretion of the Master.

The Auckland Regional Council Harbourmaster (ARCH) in conjunction with POAL, had set a number of limits on vessels using Manukau Harbour. In respect of the Port of Onehunga, vessels whose length overall exceeded 80 metres, were required to use a tug for all departure movements when the wind was in excess of 25 knots and the vessel had to turn off the berth to depart. No limits had been set by either the ARCH or by POAL at the time of this incident, which prohibited the movements of vessels at the port when wind speeds above a certain level had been reached.

A Risk Assessment of Manukau Harbour, arising from the introduction of the New Zealand Port and Harbour Marine Safety Code (the Code) by Maritime New Zealand in 2004, has recently been conducted by ARC and by POAL, who administer the Harbour through a Port Co-ordinator based at Onehunga. ARC, under Local Government and maritime legislation has, through the ARCH, overall responsibility for safety and navigation aids on the harbour. POAL is responsible for managing marine operations within the port of Onehunga. The Risk Assessment was conducted after this accident occurred.

The summary of the risk assessment for Manukau Harbour and Onehunga by POAL and the ARC states as follows:

“The Manukau Harbour is a unique situation as most movements are conducted by pilotage exempt masters. To ensure the continued safe and efficient operation of Manukau Harbour, while at the same time protecting the public, environment and business community, it is important that POAL maintains a pro-active stance with regard to pilotage training requirements, operating procedures and legislative requirements.

Injury to the public, damage to assets such as wharves and floating plant or environmental damage could have long-term effects on the harbour. Loss of business would result from negative media coverage and customers may be forced to trade elsewhere.

Whilst mechanical failure is always a possibility, it is widely accepted that human error is the main cause of accidents and this study identifies areas where human error may be a factor.”

This incident represents the fourth reported case since 1998, where vessels have collided with the Old Mangere bridge whilst manoeuvring off Onehunga wharf. Three of these incidents occurred during high wind events and the other was as a result of a mechanical failure of the ship's propulsion system. There were two other cases where vessels had collided with the ro-ro ramp or the wharf at Onehunga while manoeuvring in strong wind conditions.

Hazards that were identified at the Port of Onehunga during the risk assessment included ships contacting the Old Mangere bridge. The risk factors in this scenario included contact due to Bridge Resource Management (BRM) failure, navigational error, weather, ineffective tug operation and equipment or mechanical failure. In this incident, three of these risk factors were present namely, BRM failure, weather and an ineffective tug for size of vessel in the prevailing weather conditions.

The risk rating for contact with the bridge, where 1 is considered to be low risk and 10 as high risk was found to be respectively, 6.25 (people), 8.75 (property), 6.25 (environment) and 7.5 (stakeholder). Risks rated as 4,5 & 6 were considered to be ‘tolerable’ being in the area of ‘As Low As Reasonably Practicable’ (ALARP), requiring procedures and controls to be reviewed. Risks rated as 7 & 8 were considered to be ‘significant’ where the risk is not acceptable except in unusual circumstances; procedures and controls to be reviewed to reduce risk to the ALARP area. A risk rating of 9 & 10 were considered to be ‘high’ requiring immediate action or activity to be discontinued; damage to the bridge/vessel came very close to this level.

The risk controls that were identified in the risk assessment of contact with the bridge included reviewing POAL procedures and guidelines for pilotage operations, weather forecasting and local knowledge of pilots and pilotage exempted ships masters.

The risk assessment also identified other scenarios, including a vessel contacting the wharf/ro-ro ramp/tug/berthed vessel, which are all potentially outcomes of 'loss of control' while manoeuvring. The risk assessment also had 'tidal effects in the berthing area' as an additional hazard. With the exception of 'ship contact with berthed vessel', all of these scenarios were scored as 'significant' in one or more risk categories (people, property, environment or stakeholders). The risk factors and controls for all scenarios are similar.

Pilotage Exemption

The operators of the vessel have employed the Master for a total of ten years, of which six years were on ***Spirit of Resolution*** plying the Onehunga/Lyttelton route, primarily as Chief Officer. The Master had spent most of the last three years on ***Spirit of Competition*** plying the Wellington/Lyttelton route. At the time of the incident, the Master had been on board the vessel for two weeks of a three-week tour of duty. It was his first swing since being transferred to ***Spirit of Resolution*** as Master. He had previously sailed as Master of this vessel for a short period of time.

The Master was issued with a Master's Pilotage Exemption Certificate by the Maritime Safety Authority on 2nd March 2004. This exemption was for the pilotage areas of Wellington, Manukau, Nelson and Lyttelton.

The conditions of currency and exercise of privilege on this Certificate are:

It is a condition of this document that during any continuous period of one year (from the date of issue) the holder must on at least six occasions (one in and one out during the hours of darkness) exercise their authority to pilot the above vessels.

In order to maintain Manukau Harbour currency, Ports of Auckland Limited and the Auckland Regional Council require that the following conditions must be met:

*At least 8 exempt pilotage acts conducted per annum (at least 4 should be arrivals)
At least 1 peer review per annum by a Grade A pilot licensed for the area (vessels over 1000GT)
Attend Emergency Simulator Training course at least every four years (vessels over 1000GT)*

Seven months prior to this incident, the Master had sailed on ***Spirit of Resolution*** as Mate/Master in order to gain sufficient transits of the Manukau Harbour to enable him to maintain his Pilotage Exemption Certificate. In February 2005, a Ports of Auckland Pilot accompanied one of his transits of Manukau Harbour in order to witness his performance.

At the time of the incident, the Master had completed ten pilotage acts within Manukau Harbour (five departures and five arrivals) since February 2005, one arrival being conducted during the hours of darkness. During this period, this was the first pilotage act in which a tug was used and, on the day of this incident, the wind conditions were the strongest the Master had encountered.

The Chief Officer holds a valid Pilotage Exemption Certificate for Manukau Harbour having spent the previous 18 months sailing onboard ***Spirit of Resolution***.

Fatigue was not a factor in this incident and the Master claims that he was under no commercial pressure to sail.

For the Manukau Harbour, POAL have a pilot training programme for licensed pilots and an exempt master training programme both of which are approved by Maritime New Zealand. The master exempt training programme has been adopted and used by port users at Onehunga, other than Pacifica Shipping.

Two POAL pilots are licensed for the Manukau Harbour. One of these has completed twenty transits of the Wairopa channel in the last twelve months and the other pilot has completed twelve transits of this channel in the last twelve months. These have been on a variety of vessel types and are in addition to the numerous pilotages that they conduct on the Waitemata Harbour.

Bridge Resource Management (BRM)

The purpose of BRM is to eliminate the potential for one-person error. Good BRM practice should ensure that all available resources, people, equipment and information along with challenge and response namely, establishing an open communication style that encourages challenges and appropriate responses from the whole bridge team when executing a predetermined plan are used to optimum effect. Knowledge and limitations of the available resources and equipment, and their reliability, coupled with the ability and experience of the personnel involved are vital to effective BRM.

In this incident the vessel was berthed port side to the wharf with her bow pointing towards the Old Mangere bridge. Whilst this was not unusual, it was usually the practice to swing the vessel and put her starboard side to the wharf after completion of discharge and before loading so as to facilitate the vessel's departure with her bow facing seawards. Due to the inability to utilise the main engine for this purpose, as a result of maintenance being conducted at Onehunga, the vessel remained port side to the wharf. This necessitated having to swing the vessel off the berth in order to line her up for her passage along the navigable channel. Although this manoeuvre had been conducted before, the Master had not done so. The fact that it had been done, however, may have lulled the Master into thinking that he could do it himself.

Given the prevailing adverse weather and tidal conditions; the vessel's high windage area with containers on deck (*See Photograph 1*); a tug with a low bollard pull; the lack of a fully functional Becker rudder (*see below*); the limited sea room in which to manoeuvre off the berth and the fact that the Manukau bar was closed, the Master should have seriously questioned the need to sail at that time. The proper application of BRM practices would have showed him that by sailing he was taking unnecessary chances and that there were risks of his losing full control of the vessel.

The Chief Officer should have challenged the Master's decision to depart. He was in a senior position with limited high power distance between himself and the Master. However, without an open communication style that clearly establishes and encourages challenges when there is any doubt whatsoever about differences in concepts or actions, the Chief Officer may have thought that it was not his job to do so. What should have been paramount, however, in his mind and that of the Master was the safety of the ship and crew.

Whilst both the Master and Chief Officer had received training in BRM, there was no effective auditing procedures or a system of peer review within Pacifica to ensure that appropriate BRM practices were being followed at all times.

Spirit of Resolution

The vessel is equipped with a Becker rudder. When placed 'hard over', the rudder turns to a maximum of 40 degrees. The Becker flap when fully functional turns to twice the main rudder angle. Approximately six months prior to this incident, the Becker flap was welded into a position aligned to the main section of the rudder due to problems with the Becker flaps' bearings. This work was carried out with the Classification Society's knowledge and is due to be repaired at the next dry-docking. By not having a

fully functional Becker Rudder available to him, the Master was at a definite disadvantage when manoeuvring the vessel.

The vessel is fitted with a variable pitch four bladed, right hand turning propeller that rotates at constant revolutions.

The vessel is equipped with a Thies Clima anemometer. The anemometer is reported not to give reliable or accurate readings at wind speeds of around 30 knots, other than from winds emanating from right ahead.

Tug

Tika is the only tug available at Onehunga, and is owned by POAL. The tug has a bollard pull of 8 tonnes and a draft of 2.4 metres. In commenting on the draft report, the Master stated the tug is seriously underpowered. POAL stated that all ports have operational limits placed on the manoeuvring of ships depending upon the type and size of ship involved, the port's tug power, the manoeuvre, proximity of dangers and the weather. All masters and pilots must therefore take into consideration all these factors before making a decision to proceed or to delay.

Damage

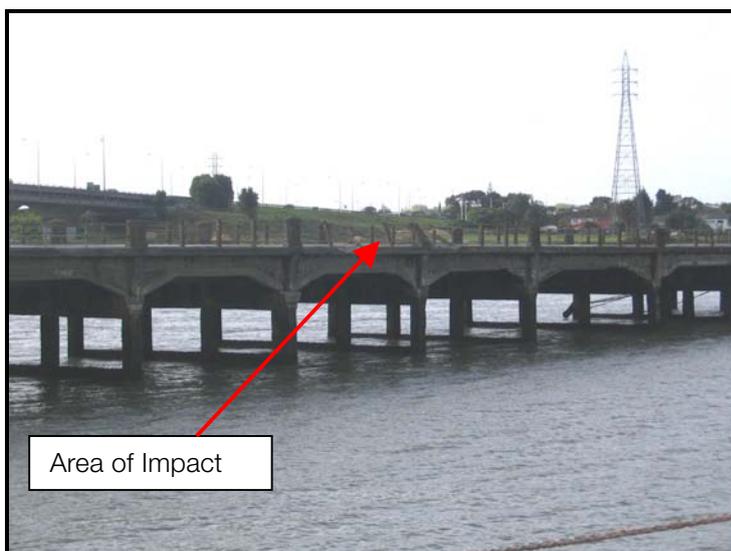
There is no fendering of any description on the Old Mangere Bridge. The bridge is constructed of reinforced concrete. The bridge is closed to vehicular traffic but is still used as a public footpath.

There was damage to the concrete capping of the bridge and to the handrail over a distance of about 20 metres.

The mooring dolphin and supporting piles were damaged and the catwalk connecting the dolphin to the wharf was destroyed. The estimated cost of damage to the wharf and pilings is \$ 670 000.

The damage to **Spirit of Resolution** included a small indentation to the bulbous bow and stove in shell plating with a small hole above the waterline on the vessel's starboard quarter.

There was no damage to the tug **Tika**.



Photograph 2
Old Mangere Bridge



Photograph 3
Damage to starboard quarter of *Spirit of Resolution*



Photograph 4
Damage to the mooring dolphin

CONCLUSIONS

Conducting maintenance work on the main engine prevented the vessel being swung bow to sea before her departure.

The Master should not have sailed in the prevailing weather conditions. This was a knowledge based mistake where the Master made an erroneous judgement due to his lack of sufficient knowledge and/or experience of having to turn the vessel off the berth in adverse weather.

Having sailed as Master for a number of years on *Spirit of Competition* where high winds are frequently encountered when arriving and departing Wellington, may have instilled in the Master a degree of 'normalisation' where the process of 'forgetting to be afraid' can arise. *In commenting on the draft report, the Master disputed this conclusion. He stated that based on some previous occasions when he had been asked by management to leave Onehunga and go to anchor, when the bar was closed, that this was in the back of his mind when he made the decision to depart.*

The BRM practices on the bridge were not of a sufficient standard that would help eliminate the risk of one-person error. Effective auditing procedures and peer reviews of bridge teams to ensure proper BRM techniques were being practised would have helped to ensure that the appropriate standards were being maintained.

The low bollard pull of the tug; the high windage area of the vessel and her deck cargo; the lack of a fully functional Becker rudder and the limited sea room off the berth, were all factors that contributed to this incident.

The provision of documented guidance measures to masters as to the limiting parameters when they could depart Onehunga would have been of assistance.

ACTIONS TAKEN BY MARITIME NEW ZEALAND

On 21 March 2006, following two further incidents when the Master was in command whilst manoeuvring off Onehunga wharf, Maritime New Zealand issued a Notice of Impositions of Conditions on the Maritime Document of the Master. These were as follows:

That the Master was not to exercise the privileges of his Pilotage Exemption Certificate for a ship exceeding 500 gross tons east of Cape Horn (situated about 2.5 nautical miles from the landward end of the main navigable channel in the approaches to the Port of Onehunga), in the Manukau pilotage area until he had:

- A. Undertaken training by a senior Pacifica master who is the holder of a Pilotage Exemption Certificate for the Manukau pilotage area, until he had demonstrated competency to pilot a ship exceeding 500 gross tons safely in or near Onehunga wharf.
- B. Undertaken simulator training for the port of Onehunga.
- C. Undertaken a Bridge Resource Management course offered by an institution approved by the Director of Maritime New Zealand.
- D. Satisfied an approved licensed pilot, following completion of the training referred to in the preceding three paragraphs, that he is competent to pilot a ship exceeding 500 gross tons safely in the area near to Onehunga wharf.

Documented records of the Master's training are required to be kept including the following:

- Date and time the training is conducted.
- Name of training master
- Evidence of training master taking command
- Whether an inward or outward passage
- Prevailing weather conditions to include wind speed and direction and visibility
- Tidal conditions; whether flood , ebb or slack water and whether neaps or springs
- Use/non-use of a tug
- Comments of training master on the outcome of the manoeuvre

Maritime Rule Part 90

Maritime New Zealand is currently reviewing this Rule. This will include resolving the current ambiguity between the regulatory and port requirements regarding the number of transits that are required for the issuance of Pilotage Exemption Certificates.

SAFETY RECOMMENDATIONS

1. It is recommended that in addition to the measures set out in the Notice of Imposition of Conditions Pacifica Shipping :
 - a) Develop and implement documented guidelines to assist masters in determining whether it is safe to sail from the port of Onehunga in marginal weather conditions.
 - b) Develop and implement documented auditing procedures and a system of peer review on board Pacifica vessels to ensure effective BRM practices are being followed at all times.
 - c) Model ***Spirit of Resolution*** on the Devonport simulator of Manukau Harbour so that the Master and other masters/officers of Pacifica Shipping can simulate the manoeuvring of this vessel in emergency situations and inclement weather conditions with the use/non-use of a tug and ship's anchors.
 - d) Initiate BRM refresher training of all Pacifica masters and deck officers at an institution recognised by the Director of Maritime New Zealand.
 - e) Appoint a suitably qualified person to inspect the anemometer on board ***Spirit of Resolution*** for accuracy and reliability.

2. It is recommended that the Auckland Regional Council Harbourmaster, in conjunction with Ports of Auckland Limited develop and implement appropriate procedures/Bylaws that will limit the movements of vessels at the port of Onehunga in marginal weather conditions.

In commenting on the draft report the Master stated that POAL should be required to conduct the following:

1. *Move the anemometer located on the wharf. POAL stated this action is already planned.*
2. *Upgrade the anemometer to record historical trends in wind speed and direction. POAL stated that these are already being recorded.*
3. *Enable masters to receive wind speed and tidal information remotely via a web site. POAL stated that tidal information is already planned to be on the web and that tidal information was available to the Master before his departure.*
4. *Undertake pilot training utilising existing ship movements so pilots become as familiar with this port as other pilots are required to do in other NZ ports. POAL stated that this already being covered.*
5. *Review and upgrade the tug services available at Onehunga. POAL stated that tug size merely sets the limits that masters and pilots must cease operations when weather and other factors deteriorate.*