Marine Casualty Investigation Board

REPORT OF THE INVESTIGATION INTO THE FAILURE OF THE PILOT LADDER FROM THE M.S "SYBILLE"

The Marine Casualty Investigation Board was established on the 25th March, 2003 under The Merchant Shipping (Investigation of Marine Casualties) Act 2000

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CONTENTS

1. SYNOPSIS

1.1 The M.S "Sybille" arrived at the pilot station of the port of Dublin at 05.30 hours on the 18th February 2004.

1.2 Whilst the pilot transfer was in progress the pilot ladder side ropes gave way.

1.3 The pilot and a section of ladder fell back onto the pilot cutter.

1.4 The pilot was uninjured and subsequently boarded the vessel from the port side using the M.S "Sybille" port side pilot ladder.

2. FACTUAL INFORMATION

2.1

Name of Vessel:	M.S. "Sybille"
Call sign:	V2DT
Port of Registry:	WISMAR
Flag:	ANTIGUA
IMO Number:	9002128
Year of Build:	1991
Class GL	
Owner:	Ludtke Germany
Operator:	Christian Jurgensen,Brink & Wolffel, Germany.

2.2 Ship's particulars at Appendix 8.1.

The vessel was of conventional wooden construction, carvel planked on double sawn frames. It was a full-bodied hull cut away back to the sternpost. Built in 1947 trading as a crayfish carrier between Mauritania in North West Africa and France, it was one of the last wooden vessels built for that trade. After extensive refitting in 1987/88 and in 2002 it had a new engine and systems upgrade for chartering in North West Europe area (See Appendices 8.3 and 8.4).

2.3 Master and Crew of M.S "Sybille"

Name	**Rank**	**Nationality**
Kocakaya, Bulent	Master	Turkish
Es, Gurkan	Chief Officer	Turkish
Araci, Murat	Engineer	Turkish
Cil, Cuma	Deck Rating	Turkish
Bozdal, Erdal	Deck Rating	Turkish
Kartal, Latif	Deck Rating	Turkish
Yilmaz, Celal	Deck Rating	Turkish
Aktas, Muzaffer	Deck Rating	Turkish
Aycan, Tahsin	Deck Rating	Turkish
Ceylan, Ahmet	Deck Rating	Turkish

2.4 Ship's Agent in Dublin

Coastal Container Line,
Pigeon House Road, South Bank Quay, Ringsend, Dublin 4.

2.5 Dublin Pilot: Mr Neil Myles

Pilot Cutter Cox: Mr Richard Saunders

Pilot Cutter Man: Mr Paddy Dunne.

3. EVENTS PRIOR TO THE INCIDENT

3.1 The Master of the "M.S Sybille" joined the vessel at Liverpool on the 17th of February 2004 at 19.00 hours.

3.2 The M.S "Sybille" sailed from Liverpool on the 17th of February 2004 at 20.15 hours.

3.3 The Master did not have a PEC (Pilot exception certificate for Dublin).

3.4 The Master ordered a pilot for the morning of the 18th February 2004.

3.5 Vessel arrived at the Dublin pilot boarding grounds at 05.30 hours.

3.6 Port and Starboard pilot ladders were permanently rigged on the open deck.

4. THE INCIDENT

4.1 The pilot cutter arrived alongside the starboard side of M.S "Sybille" at 05.50 hours.

4.2 The M.S "Sybille" starboard pilot ladder was lowered a distance of approx 2 meters by the M.S "Sybille's" crew.

4.3 The Pilot, Mr Neil Myles, placed his foot on the bottom step and began to transfer his weight on to the step.

4.4 At this point the pilot ladder side ropes gave way.

4.5 The ropes parted approx five steps up from the bottom of the ladder.

4.6 The parted section of the pilot ladder landed in the pilot cutter.

4.7 The pilot was uninjured.

4.8 The pilot called the ship's Master on VHF channel 12 and informed him that the pilot ladder had parted.

4.9 The Master of the M/S "Sybille" requested that the pilot board from the port side.

4.10 The pilot boarded the M/S "Sybille" from the port side at approx 05.50 hours using the port side pilot ladder.

5. EVENTS AFTER THE INCIDENT

5.1 The M/S "Sybille" berthed without incident at Berth number 45 at 06.30hours.

5.2 The Master of the M/S "Sybille" inspected the pilot ladders after the vessel berthed and "decided to renew my port side ladder immediately and renew other after port authorities checking"(Quote from master's statement at Appendix 8.2)

5.3 The port side ladder had been chopped and all that remained was the steps. The rope remains were in the same condition as the starboard pilot ladder.

5.4 The remains of the starboard pilot ladder, which landed in the pilot cutter, were sent to Tension Technology International Ltd for testing (See Appendix 8.3)

5.5 The Master ordered a new pilot ladder and this was delivered before the M/S "Sybille" sailed from Dublin.

5.6 The new pilot ladder was supplied with a certificate of warranty (See Appendix 8.5).

5.7 M/S "Sybille" sailed for Liverpool at 21.00 hours on the 18th February 2004.

6. CONCLUSIONS

6.1 Port and Starboard pilot ladders were both in the same condition and both ladders were not fit for use as per SOLAS Chapter V Regulation 23 (Pilot transfer arrangements).

6.2 Port and Starboard pilot ladders were permanently rigged and open to damage from the weather, the action of the seas and the sun. This is a contraventation of SOLAS Chapter V Regulation 23 2(2.1)

6.3 There is no evidence of pilot ladders from M.S "Sybille" having been regularly inspected as per SOLAS Chapter V Regulation 23 2(2.1)g

6.4 The report from Tension Technology International came to the following conclusions:

- The failure is caused by a significant loss of strength in the ropes used in the ladder construction, caused by external abrasion. Added to this, the position of the failures in each leg suggest that flex fatigue has also contributed to loss of strength.

- The general appearance of the ladder suggests that it has been in service for a considerable period of time.

- It would appear that the ladder has not been subjected to regular inspection within existing guidelines and recommendations for safe working with fibre ropes (Ref 2, 3, 4, 5, 6)

- Appendix 8.2 is an extract from ' The Admiralty Manual of Seamanship' 1983, regarding the subject of Care and Maintenance of natural fibre ropes.

7. RECOMMENDATIONS

7.1 It is recommended that a report of the incident be sent to the Antigua and Barbuda Government Marine Administration where the ship is registered.

7.2 A Marine Notice should be issued reminding owners and shipmasters of the requirement to provide safe means of pilot transfer, the proper stowage and regular inspection of pilot ladders as per SOLAS Chapter V, Regulation 23 2(2.1)

7.3 Pilot transfer arrangements and pilot ladders should be inspected during Port State Control inspections.

7.4 Pilot ladders should have a certificate stating their year of manufacture and compliance in line with IMO Resolution A.889 (21)

8. LIST OF APPENDICES

8.1 M/S "Sybille" Ship Particulars.

8.2 M/S "Sybille" Master’s Statement.

8.3 Executive Summary and Report of examination, sampling and testing by realisation method to determine rope residual strength and likely cause of failure of pilot’s ladder from M/S "Sybille".

8.4 Photographs from M/S "Sybille".

8.5 Certificate of warranty for new pilot ladder supplied.

Appendix 8.1

Ship Particulars

SHIP PARTICULARS — M/S "SYBILLE"

STCW 95

CALL SIGN	: V2DT	IMO NO	:	900 21 28
FLAG	: ANTIGUA	PORT OF REGISTRY	:	WISMAR
SHIP YARD	: Kröger Werft Rendsburg	YEAR OF BUILT	:	1991
GL-Register-No.	: 33205	Offical-no	:	2073
Ship - Class	: GL+100A5M	MMSI-No.	:	304 489 000

OWNER : Lüdtke KG
Feldstrasse 41
D – 24768 Rendsburg GERMANY

OPERATOR : CHRISTIAN JÜRGENSEN, BRINK & WÖLFFEL GmbH & CO.
SCHIFFBRÜCKE 24
D – 24939 FLENSBURG GERMANY
PHONE + 49 461 807 824 FAX : + 49 461 807 888

ENGINE	: MAN Burmeister + Wain / ALPHA DIESEL		Type	:12V 28 / 32 A
Maker's No.	: 1751 9	E-Class : GL+MC AUT	GL-Reg.:	GL 77 812 K
Total Rate Power	: 2640 kW / 3590 hp		PRM :	750 ¹/min
BUNKER IFO 80	: 261 mt	MGO : 88 mt	FW :	55 mt

GROSS TONNAGE	: 3125	NET TONNAGE	: 1619
DRAFT, MAX. (S)	: 6,142 m		
DISPL. MAX (S)	: 5976 tn	DWGT; MAX (S)	: 4500 tn
Calm sea speed	: 14,6 kn		

LENGTH OVERALL	: 89,10 m	BREADTH	: 16,00 m
DEPTH	: 7,80 m	HIGH MAINDECK	: 7,80 m
AIR DRAUGHT MAX Mast up with draft 3,50 m	: 27,00 m	FREEBOARD (min)	: 1,66 m

ANCHOR CHAIN	: PORT	8 shackels
(1 shackel = 27,7 m = 15 ftms)	STARBOARD	9 shackels
BULBOUS	: YES	

STEERING PARTICULARS

TYPE OF RUDDER	: Becker	MAX: ANGEL :	45°
HARD-OVER TO HARD-OVER	: 27 sec / 1 power unit 14 sec / 2 power units		
BOWTHRUSTER	: 294 kW = 401 hp		

HOLD DIMENSION : L: 51,4 m W: 13,3 m H: 8,8 m

CONTAINER CAPACITY :	20ft	30ft	40ft	24,5ft	49ft
HOLD :	110	57	53	60	30
DECK :	150		60		
TOTAL:	260	57	113	60	30

REEFER PLUGS : 34

HOLD CAPACITY : Grain 5851,5 m³ 206616 cbft

Appendix 8.2

Statement of Pilot Ladder

M/V SYBILLE 18.02.2004

STATEMENT OF PILOT LADDER

I, Master of m/v SYBILLE hereby inform that I joined to the my vessel at liverpool on 17.02.2004 at 19.00 and sailed from Liverpool to Dublin on 17.02.2004 at 20.15 and arrived to Dublin TST 'C' point on 18.02.2004 at 05.30 and arrived Dublin Bay buoy at 05.50. Pilot boat alongside to my vessels starboard side for embark to the ship. After alongside to starboard side; my boatswain let down pilot ledder. When pilot start to upstairs to first step of the ladder; it has been broken. Pilot informed me that pilot ladder has been broken and I said that please come on board port side ladder. Pilot boat alongside to my vessel port side and pilot embarked to my ship. After that my vessel berthed safely with pilot. After berthing operation I checked 2 both side pilot ladders and I decided to renew my port side pilot ladder immediately and renew other after port authprities checking. I communicated with ship owner and decided to supply approved new pilot ladder will be on board before sailing.

Best Regards.

KOCAKAYA BÜLENT
MASTER OF M/V SYBILLE

M/S "SYBILLE"

Appendix 8.3

Report by Tension Technology International

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REPORT

EXAMINATION,SAMPLING AND TESTING BY REALISATION METHOD TO DETERMINE ROPE RESIDUAL STRENGTH AND LIKELY CAUSE OF FAILURE of PILOT'S LADDER from 'MV SYBILLE'

Date	Rev.	Description	Prepared by	Authorised by
20 April 2004	01	Draft	JN	SJB

Distribution:

Client:	Department of Communications Marine and Natural Resources	Attention:	Paul Miley
Internal:	TTI Ltd	Attention:	Steve Banfield

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TERMS AND ABBREVIATIONS

TTI	Tension Technology International
DepCMNR	Department of Communications, Marine and Natural Resources
Rope	Rope is made up of four **strands** twisted together around a core.
Strand	Strand is made up of a number of **rope yarns** twisted together
Rope Yarn	Rope Yarn is made up of **manila fibres** twisted together
Tensile Test	Method of determining the response of materials to a load or tensile [pulling] force
Breaking load	Maximum force recorded during a tensile test.
Breaking strain	The extension of the material under test, at breaking load, expressed as a % of the original length of the sample.
Fatigue	Term covering several different mechanisms by which rope strength can be adversely affected. In particular, loss of performance due to **flex fatigue** is caused by repeated bending of a rope at a localised position.
Stress raising	A very localised elevation of force within a rope, usually caused by discontinuities in the rope structure, such as a splice.
Abrasion	In ropes, can be either external abrasion to the surface of the rope, or internal abrasion caused by relative movement of the rope elements
Dry Rope Strength	Depending on the fibre used in rope construction, some ropes may have a reduced tensile performance when wet. All assessment of rope performance is done on the basis of the rope being dry.
Realisation	Method by which an estimate of rope strength can be made, from knowledge of the strength of its individual components
Residual Strength	Ratio of the estimated breaking strength [by realisation] of the rope to its minimum specified breaking strength. Expressed as a %
KiloNewton kN	Unit of force, 10 kN is approximately 1 Tonnef

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EXECUTIVE SUMMARY

The Pilot's Ladder was delivered by hand to the premises of Tension Technology International, Arbroath, courtesy of Mr J Carolan, Dublin Port Co.

The ladder had failed between the third and fourth bottom spans and only this lower part was delivered to TTI.

The ladder was visually inspected by TTI and then its various components were tested for their tensile properties. From this tensile information, an estimate of residual dry rope strength was calculated.

The rope, from which the ladder was made, was a four strand shroud laid construction [Type B], of approximate diameter 22 mm.

It was found, on visual inspection, that there was significant external abrasion damage to the rope components. Untwisting the rope and its component strands [to reveal the component rope yarns] confirmed the presence of severe abrasion damage.

Tensile testing of the rope strands revealed the extent to which the abrasion had affected the general strength of the rope within the ladder part. It was not possible to test individual rope yarns, as the damage was too severe.

The table below shows the estimated dry rope breaking load and its residual strength from one position within the ladder. The result was so low that further testing was considered unnecessary.

Minimum Dry Rope Breaking Load [EN 698:1995] Type B, Ref No. 22 **32.3 kN, 3.29 Tonnef**	**Br Load Tonnef**	**Residual Strength %**
	0.053	1.6

The estimated dry breaking strength is 0.053 tonnef, whilst the minimum breaking strength of new rope is 3.29 tonnef. The residual strength is 1.6%.

Thus, substantial deterioration has occurred in the rope performance.

The degree of visible abrasion damage found suggests that the rope had been in use for a considerable period of time [or had experienced a very high number of deployments].

No evidence of chemical or microbial attack was seen, but their absence can only be confirmed by further investigation by optical microscopy.

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It does not appear that the ladder had been subjected to regular inspection in line with the recommendations for inspecting ropes and rope structures.

Inspection to CMI/OCIMF guidelines would have shown that this rope had deteriorated and should have beed rejected well before this failure.

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1. INTRODUCTION

1.1 Preamble

This report is submitted to the Marine Survey Office [MSO] of the Department of Communications, Marine and Natural Resources in response to their request to conduct a technical investigation into the failure of the Pilot's Rope Ladder from the 'MV Sybille'

2. DETAILED REPORT

2.1 Visual examination of ladder.

Visual examination of the ladder was in accordance with OCIMF, ACI and CMI guidelines.

Photograph 1 shows a general view of the ladder part, with the legs identified. The fail zones are to the foreground [bottom of photograph]

Photo 1 General view of ladder part

left-hand fail zone   right-hand fail zone

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Photographs 2 and 3 show close-ups of the fail zones of each leg of the ladder

Photo 2 Close-up of left-hand fail zone

Photo 3 Close-up of right-hand fail zone

wooden spreader

It can be seen that both legs failed where they emerge from the wooden spreaders. It is assumed there is a short free length of rope, before the rope pairs are threaded through the next ladder span.

Localized flex fatigue will have occurred at these positions.

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As well as the general external abrasion damage seen, there was also rope-on-rope abrasion, between the pairs of ropes in each leg.

Photographs 4 and 5 show examples of external abrasion damage seen, these being from the left-hand leg of the ladder.

Photo 4 External abrasion

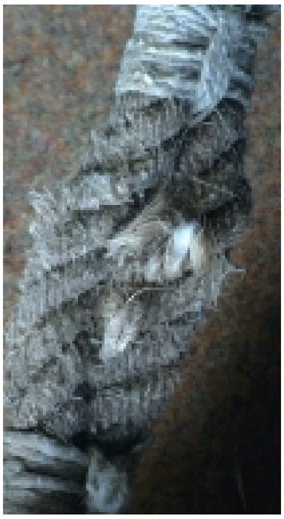

Photo 5 External abrasion

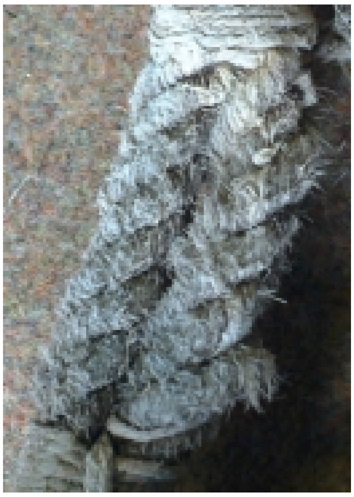

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Table 1 shows the construction of the rope

Table 1

Rope Type	**Type B, 4 strand shroud laid**
Rope diameter	**22 mm [see note below table]**
Material	**Manila**
Breaking Force [EN 698:1995]	**32.3 kN [3230daN]**
4 strands Yarns/strand	**10 outer and 2 inner yarns**
Core Yarns/strand	**2 yarns**

Photograph 6 shows one of the constituent strands from the left-hand rope pair.

Photo 6 View of 3 of the four strands, and core

break of core yarns damage

The damage can be clearly seen. Above the lower two strands, the inner core is laid out. This was found to be broken in two places along the one metre length sampled for testing, and therefore was not tensile tested.

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Photograph 7 shows the fourth strand, untwisted to show its constituent rope yarns.

Photo 7
View of untwisted fourth strand, to show constituent rope yarns

inner rope yarns

Considerable damage is seen to the outer rope yarns, with several completely broken

NB The mean diameter of the rope was found to vary between 20.5 and 23.5 mm. It was judged that the original rope was likely to be that of a No 22 specification.

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2.2 Tensile results and dry rope residual strength by realisation

2.2.1 Tables of results

The rope yarns were found to be in such poor condition that tensile testing would be meaningless. Three strands were tested, however, the results being showed in Table 2

Table 2 Summary of Rope Yarn Tensile Results

	Outer rope yarn	
	Br Load N	Br Ext %
Strand	227	4.6

The results confirm the findings of the visual examination, that the rope had suffered considerable abrasion damage.

2.2.2 Estimate or rope strength by realisation

Table 4 shows the estimated dry rope strength and % residual strength. The core assembly of two yarns was found to be broken in two places over the short distance sampled [1000 mm] and was not tested for tensile strength. Thus, no extra contribution to rope strength from the core yarns is included in the calculation.

Table 4 Calculation for estimate of dry rope strength by realisation

	Strands	Ave BL kN	Total BL kN
Strand	4	0.227	0.904
realization factor			0.58
dry rope calculated break load, kN			0.524
[dry rope calculated break load, tonnef]			[0.053]
minimum new dry break load			32.3
% residual strength			**1.6**

The average breaking strength of the rope is 0.053 Tonnef, whilst the minimum breaking strength of new rope is 3.29 Tonnef.

The average residual strength is 1.6%.

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3. DISCUSSION AND CONCLUSIONS

3.1 Discussion

The failure was located just above the wooden spacers in each of the two legs used to construct the ladder, between spans 3 and 4, as counted from the lowest span.

The visual inspection of the ladder revealed damage due to external abrasion throughout the whole assembly. The position of the failures, just above wooden spacers, indicates that localized flex fatigue has also contributed to loss of strength.

Unravelling of rope samples, to reveal the strands and then their component rope yarns confirmed the extent of the abrasion damage.

Tensile testing revealed the degree to which the rope tensile performance had deteriorated when compared to its minimum 'as-new' breaking force. The rope was estimated to have a residual strength of just 1.6%

A final point is that the general condition of the ladder suggests that it had been in use for a considerable period of time. With natural fibre ropes, there can be a deterioration in performance due to microbial and chemical attack, and repeated wetting [see Appendix 3]. Whilst there was no visual evidence of chemical degradation or microbial attack, it is entirely possible that degradation due to repeated wetting would have played its part in a general reduction of the rope performance.

3.2 Conclusions

- The failure is caused by a significant loss of strength in the ropes used in the ladder construction, caused by external abrasion. Added to this, the position of the failures in each leg suggest that flex fatigue has also contributed to loss of strength.

- The general appearance of the ladder suggests that it has been in service for a considerable period of time.

- It would appear that the ladder has not been subjected to regular inspection within existing guidelines and recommendations for safe working with fibre ropes (Ref 2, 3, 4, 5, 6)

- Appendix 2 is an extract from ' The Admiralty Manual of Seamanship' 1983, regarding the subject of Care and Maintenance of natural fibre ropes.

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References

1. The Durability of Polyester Ropes, JIP co-promoted and managed by NEL and TTI, 1999-2002.

2. "The selection, use, care, inspection and maintenance of non-metallic ropes and cords" United Kingdom Defence Standard DEF STAN 40-7/1.

3. "Mooring Equipment Guidelines", 2nd Edition, Oil Companies International Marine Forum 1997.

4. "Admiralty Manual of Seamanship' III 1983

5. "The selection, use and care of man-made-fibre ropes in Marine applications". British Standard BS 4128 1967 : Now lapsed, not replaced.

6. Cordage Manufacturers Institute, Recommendations for Rope Safety, 1984.

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4. APPENDICES

Appendix 1

Testing Apparatus and testing conditions

Photo 8 shows the tensile testing instrument used to perform the tests. Bollard grips were used to clamp the samples.

The machine is a Testometric Micro 500, Serial No 500-123

Calibration performed by Denison Mayes Group, 10 June 2003, Certificate No. 64800

Photograph 1 Bollard grips used for tensile testing

Testing conditions were:

Gauge Length 835 mm

Xhead Speed 200 mm/minute

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Appendix 2 Extract from "Admiralty Manual of Seamanship' I 1983

its left-hand lay makes it suitable for use with the marline hitch. It may be rot-proofed or natural.

Nettlestuff is made from New Zealand and St. Helena hemp. It consists of two or three yarns, reverse-spun (left-handed), and laid up together right-handed. It was once used for making hammock clews.

Care and maintenance

Natural fibre used in ropemaking has not a permanent elastic limit within which it can be worked indefinitely. Therefore no attempt should be made to put a heavy strain on a rope which has been well used or on a rope which has once been loaded to near breaking-point. The life of a rope depends on the amount it is used under strain, because the fibres tend to slip a small amount under each load in spite of the twist given during manufacture.

Ropes contract when wet, and a belayed rope must be slackened off before it is dangerously strained. On the other hand, advantage may be taken of this contraction for tightening lashings by wetting the rope. Never stow rope away while it is wet; if this is unavoidable the rope should be brought out and dried at the first opportunity. Boats' falls, which are stowed on reels, often have to be reeled up wet and are then very liable to rot. They should not be turned end-for-end without first being carefully inspected throughout their whole length.

Although any rope in good condition can be confidently expected to bear its full working load with ease, allowance for wear must be made in assessing the strength of used rope, particularly when it has been subjected to hard conditions. Before estimating the strength of such a rope it should be examined for damage, rot and fatigue. Serious damage can be seen when the strands are distorted and bear unequal strains, or when the rope becomes *opened*. Slack-jawed or opened rope usually results from hauling by hand, when there is a tendency to unlay it near the end. Examples of opened rope are often found in the last few fathoms of boats' falls, and those affected portions must always be cut off before the falls are turned end-for-end; failure to do so has been the frequent cause of accidents.

Loss of strength caused by external chafe can be estimated from the proportion of damaged yarns in a strand. To assist in this estimation it should be accepted that Admiralty manila and sisal have, very approximately, $C^2 \times 3$ yarns per strand, C being the circumference of the rope.

Rot can be detected by opening out the strands and examining their inner surfaces. Should the exposed fibres be healthy and strong, all is well; if they are powdery, discoloured, weak, or can be plucked out, rot exists and the rope should be condemned.

Fatigue will most probably show itself in a reduction of the circumference of the rope below its specified size. This indicates that the rope has stretched under a heavy load and has failed to return to its normal condition. A rope which has been so stretched has lost a considerable proportion of its initial tensile strength and should therefore be used with great caution.

If a rope is showing no signs of damage, rot or fatigue, it is unlikely to be much below its full strength, but some consideration must be given to its age

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and those occasions when its fibres may have been weakened or their grip on each other lessened. Such weakening may have been caused by any or all of the following:

Constant stretching under heavy loads
Stowing away wet
Subjection to extremes of heat and damp, as in the tropics
External friction round bollards or through fairleads
Internal friction due to bending round sheaves of blocks.

If short lengths of yarns can be taken which are representative of the used portion of the rope they may be tested for tensile strength and thus give an indication of the deterioration which has taken place. It is necessary, however, to know the actual or specified breaking strength of the yarns.

The only really reliable method by which the strength of the rope may be determined is to test a sample of the worst part of the rope to destruction. Sample lengths are taken for testing to destruction of all ropes manufactured commercially and at the Admiralty Ropery. Appearance, stretch and reduction in size are all important, but it is not possible to lay down rules which can be applied to determine the degree of deterioration in tensile strength which has occurred by these means. This has always been left to the judgement of experienced seamen or ropemen.

Manufacture

Not only does the twist imparted to a rope during manufacture give it elasticity and enable its fibres to hold together by mutual friction, but it also packs the material firmly, thereby helping to keep out moisture and giving the rope a hard surface against wear and tear. Twisting the fibres, yarns and strands in opposite directions also helps to counter any tendency of the rope to unlay. Rope which is given a hard twist in manufacture (hard-laid rope) loses in flexibility and strength but gains in elasticity and firmness. Soft-laid rope, on the other hand, is very flexible, and stretches less, but is more easily damaged by chafe. Rope used for general purposes is given a medium twist; but for edging sails, awnings and other canvas, where flexibility and minimum stretch are the first considerations, soft-laid boltrope is used.

The distance along the rope between any two points on the same strands is known as the *jaw* of the rope, and gives a measure of the hardness of the lay; the shorter the jaw the harder the lay. A similar result can be obtained from the *angle of the lay*, which is the angle between the line of the strands and that of the rope; the greater the angle the harder the lay. A rope in which the lay has become slack, perhaps even showing a gap between the strands, is known as *slack-jawed* or *opened*.

Twisting the fibres to form the yarn is essential to enable them to hold together, but it reduces the strength of the individual fibres, and, within limits, the lighter the twist the greater is the strength of the yarn. On the other hand, bad material in a rope may be disguised by reducing the angle of lay; so that, although it may pass the necessary test when new, it will probably fail afterwards under normal working conditions.

All vegetable fibre cordage supplied to the Royal Navy is manufactured at the Admiralty Ropery at Chatham, with the exception of log line and the

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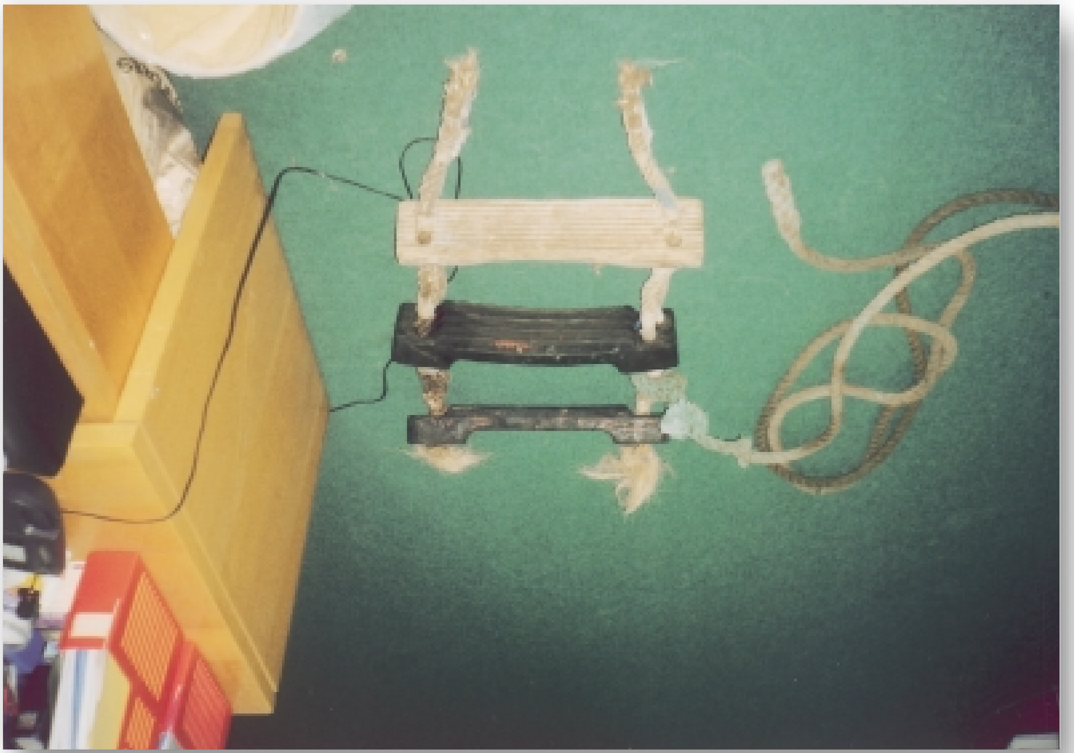
Appendix 8.4

Photograph numbers 1 and 2 showing section of pilot ladder that fell into the pilot vessel.



Appendix 8.4

Photograph numbers 3 and 4 showing section of pilot ladder that fell into the pilot vessel.

Appendix 8.4

Photograph numbers 5 and 6 showing sections of the port side pilot ladder that were removed from the remainder of the ladder on the M/S "Sybille"

Appendix 8.4

Photograph number 7 showing sections of the port side pilot ladder that were removed from the remainder of the ladder on the M/S "Sybille"

Appendix 8.4

Photograph numbers 8 and 9 showing sections of the starboard side pilot ladder (broken one)

Appendix 8.4

Photograph numbers 10 and 11 showing starboard side of the M/S "Sybille"

Appendix 8.4

Photograph numbers 12 and 13 showing starboard ladder. Section that remained on the M/S "Sybille"

Appendix 8.4

Photograph numbers 14 and 15 showing starboard ladder. Section that remained on the M/S "Sybille"

Appendix 8.5

Goodyear & Hick Ltd Certificate of Warranty

GOODYEAR & HICK LTD

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Harlow Street
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L8 4UH
Tel: 0151 708 6520
Fax: 0151 709 3225

CUSTOMER: J C Altham & Sons Limited Anchor Building Penrod Way Heysham LA3 2UZ	**DATE:** 18th February 2004 **CERFITICATE NO.** 1736 **YOUR ORDER NO.** 18/2/Breeze/70

Certificate of Warranty for Fibre Robe / Webbing

We hereby certify that the Goods supplied against your order on leaving our works complies with the requirements of the specification enumerated below.

REFERENCE: 4.5metre pilot ladder	**QUANTITY:**	1
GUARANTEED MINIMUM BREAKING STRENGTH: 2, 44 tonne on a single part	**CONSTRUCTION:**	3 strand
	SIZE:	18mm
DESCRIPTION: 18mm diameter manila rope used as the side ropes Of the ladder		

SAFE WORKING LOAD OF LIFTING GEAR

The maximum safe working load of this lifting gear when supplied new from our factory and used at an angle not exceeding between any of the parts bearing the loads is

FOR GOODYEAR & HICK LIMITED

In the absence of instructions from the user, the safe working load quoted is the maximum allowance for this size, and quality of rope stated used in the defined lifting mode. In adverse operating conditions it is necessary for the user to reduce the safe working load quoted to a value appropriate to those conditions. Reference to the Cordage Manufacturers Institutes booklet/code of practice "Lifting Tackle" to obtain further information in such cases is strongly recommended.

9. LIST OF CORESPONDENCE RECEIVED

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IRELAND
22 NOV

Coastal Container Line Ltd
South Bank Quay, Dublin 4

Mr R Heron
Secretary
Marine Casualty Investigation Board
Leeson Lane
Dublin 2.

Date: 11th November 2004.

Your Reference: MCIB 84.

We are in receipt of your draft report of the investigation into the failure of the Pilot ladder from M.V. Sybille on 18th February 2004.

We have no comments or observations to make on this matter.

J Dent
Safety Manager

MCIB RESPONSE
The MCIB notes the contents of this letter.

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