Report on the investigation of

the shift of an articulated road tanker on board the

roll-on roll-off high-speed sea service cargo ferry

Stena Voyager

in Loch Ryan

on 28 January 2009

Marine Accident Investigation Branch
Mountbatten House
Grosvenor Square
Southampton
United Kingdom
SO15 2JU

Report No 21/2009
October 2009

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

Further printed copies can be obtained via our postal address, or alternatively by:
Email: maib@dft.gsi.gov.uk
Tel: 023 8039 5500
Fax: 023 8023 2459

All reports can also be found on our website:
www.maib.gov.uk

CONTENTS

Figures and Annexes

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

BBC	-	British Broadcasting Corporation
cm	-	centimetre
DfT	-	Department for Transport
EMPROC	-	Emergency Response Procedure
EU	-	European Union
HSS	-	High-speed service
IMO	-	International Maritime Organization
ISO	-	International Organization for Standardization
kg	-	kilogram
kN	-	kilo Newton
knots	-	Nautical miles per hour
kW	-	kilowatt
m	-	metre
MCA	-	Maritime and Coastguard Agency
mm	-	millimetre
MSL	-	Maximum securing load
RAIB	-	Rail Accident Investigation Branch
ro-ro	-	roll-on roll-off
SMSO	-	Senior master’s standing orders
SOLAS	-	International Convention for the Safety of Life at Sea
t	-	Tonne (1,000kg)
UK	-	United Kingdom
UTC	-	Universal Co-ordinated Time
VHF	-	Very high frequency
VOSA	-	Vehicle and Operator Services Agency

Times: All times used in this report are UTC unless otherwise stated

SYNOPSIS

On 28 January 2009, an articulated road tanker crashed through a stern door of the High Speed Service vessel *Stena Voyager* shortly after the ferry had commenced a scheduled crossing from Stranraer, Scotland, to Belfast, Northern Ireland. The vehicle's semi-trailer came to rest on the vessel's port water jet units; its tractor unit remained on the vehicle deck. The ferry was quickly stopped and her crew were able to make the vehicle secure. *Stena Voyager* then returned to Stranraer but her passengers had to remain on board overnight because the position of the road vehicle prevented her berthing stern to the linkspan. The passengers were disembarked by the fire service the following day using a telescopic rescue platform. The semi-trailer was removed by crane later the same evening. There were no injuries but the ferry's stern door was lost overboard.

The driver of the road tanker had not applied the vehicle's parking brakes and had left it out of gear. Although the vehicle had been lashed to the deck and its rear wheels chocked, the securing arrangements were not in accordance with the vessel's securing manual, and they failed to stop the vehicle from rolling backwards when *Stena Voyager* became trimmed by her stern as she accelerated. Neither the ferry's deck securing points nor the vehicle's ferry securing points, to which the lashings were attached, accorded with the applicable international and national codes of practice. The lashing straps were also of insufficient strength, and tests have shown that the chocks could not have been correctly positioned.

A recommendation has been made to the Maritime and Coastguard Agency (MCA) and the Vehicle and Operator Services Agency (VOSA), intended to ensure that road hauliers are made aware of the need to make their vehicles safe to transport by sea. Further recommendations have been made to the MCA aimed at ensuring that the securing arrangements and practices on board all high speed craft carrying freight vehicles comply with their cargo securing manuals and the applicable codes of practice, and confirming that procedures include robust measures to ensure that the parking brakes of all vehicles have been applied. Recommendations have also been made to Stena Line and Turner (Soham) Ltd to improve the ability of these companies to meet the guidelines of the codes of practice relating to the secure stowage of freight vehicles at sea.

Stena Voyager

SECTION 1 - FACTUAL INFORMATION

1.1 Particulars of *Stena Voyager* and accident

Vessel details

Registered owner	:	Stena Line Ltd
Port of registry	:	London
Flag	:	UK
Type	:	High-speed sea service 1500 ro-ro cargo ferry. Category B high speed passenger craft
Built	:	1996, Finland
Classification society	:	Det Norske Veritas
Construction	:	Aluminium hulled catamaran
Length overall	:	107.81m
Gross tonnage	:	19,638
Engine power and type	:	80,905kW / 4 x General Electric gas turbines
Service speed	:	40 knots
Other relevant info	:	4 x gas turbine driven water jets

Accident details

Time and date	:	2034 on 28 January 2009
Location of incident	:	54° 59.4N 005° 03.6W, Loch Ryan, Scotland
Persons on board	:	156 passengers and 33 crew
Injuries/fatalities	:	Nil
Damage	:	Number one stern door lost overboard, wet deck holed and damage to the vehicle deck's structural fire protection cladding

1.2 NARRATIVE

An articulated road tanker **(Figure 1)** carrying 21 tonnes (t) of ferrous sulphate powder left its Castleford depot at 0825 on 28 January 2009 and headed for Stranraer, Scotland, to catch the 1440 sailing of the high-speed sea service (HSS) ferry, *Stena Voyager*, to Belfast, Northern Ireland. The vehicle was delayed by traffic and arrived at the ferry terminal at 1445, shortly after the ferry had sailed. The next scheduled departure was at 1950, but this service was fully booked. The road tanker was put onto a reserve list for the crossing and the driver was instructed to park it in the standby lane.

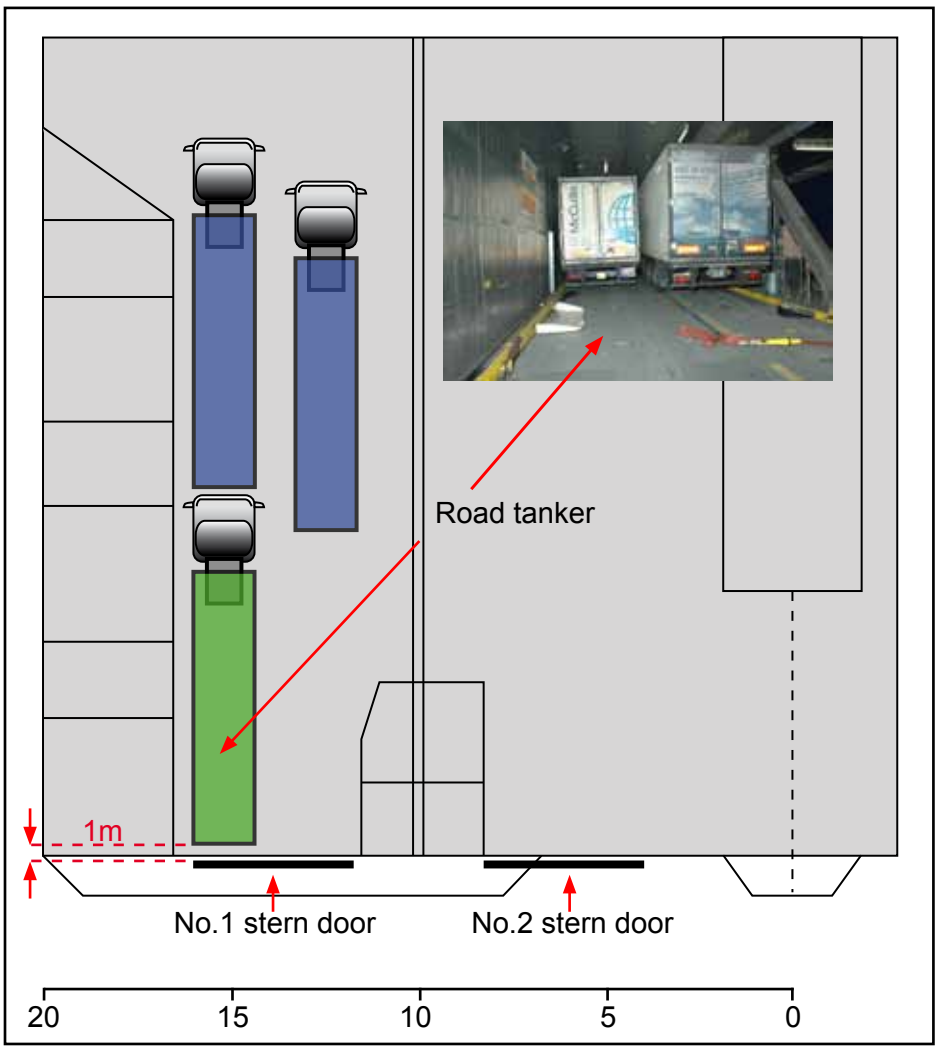
Figure 1

Turners (Soham) Ltd bulk powder articulated road tanker

Stena Voyager returned to Stranraer at 1935, 9 minutes behind schedule, and changed crew. At 1950, the road tanker was called forward for boarding. It was the last vehicle to be loaded and was parked at the aft end of lane number one. The first officer monitored the vessel's stability from a control console on the bridge and saw the fully loaded ferry was trimmed by the head. As this condition was outside the vessel's operating parameters, he asked the deck supervisor to move vehicles aft in order to level the trim. The deck supervisor instructed the road tanker driver to reverse his vehicle back off the ship. This allowed several other freight vehicles to be moved towards the stern. The deck supervisor was assisted on the vehicle deck by a senior deck assistant and a deck assistant.

At approximately 2005, the road tanker was marshalled back on board *Stena Voyager* and parked at the aft end of lane number one. The rear end of its semi-trailer[1] was approximately 1m from number one stern door **(Figure 2)**. The vessel was now trimmed 20cm by the stern, with a slight port list and a mean draught of 4.8m.

Figure 2



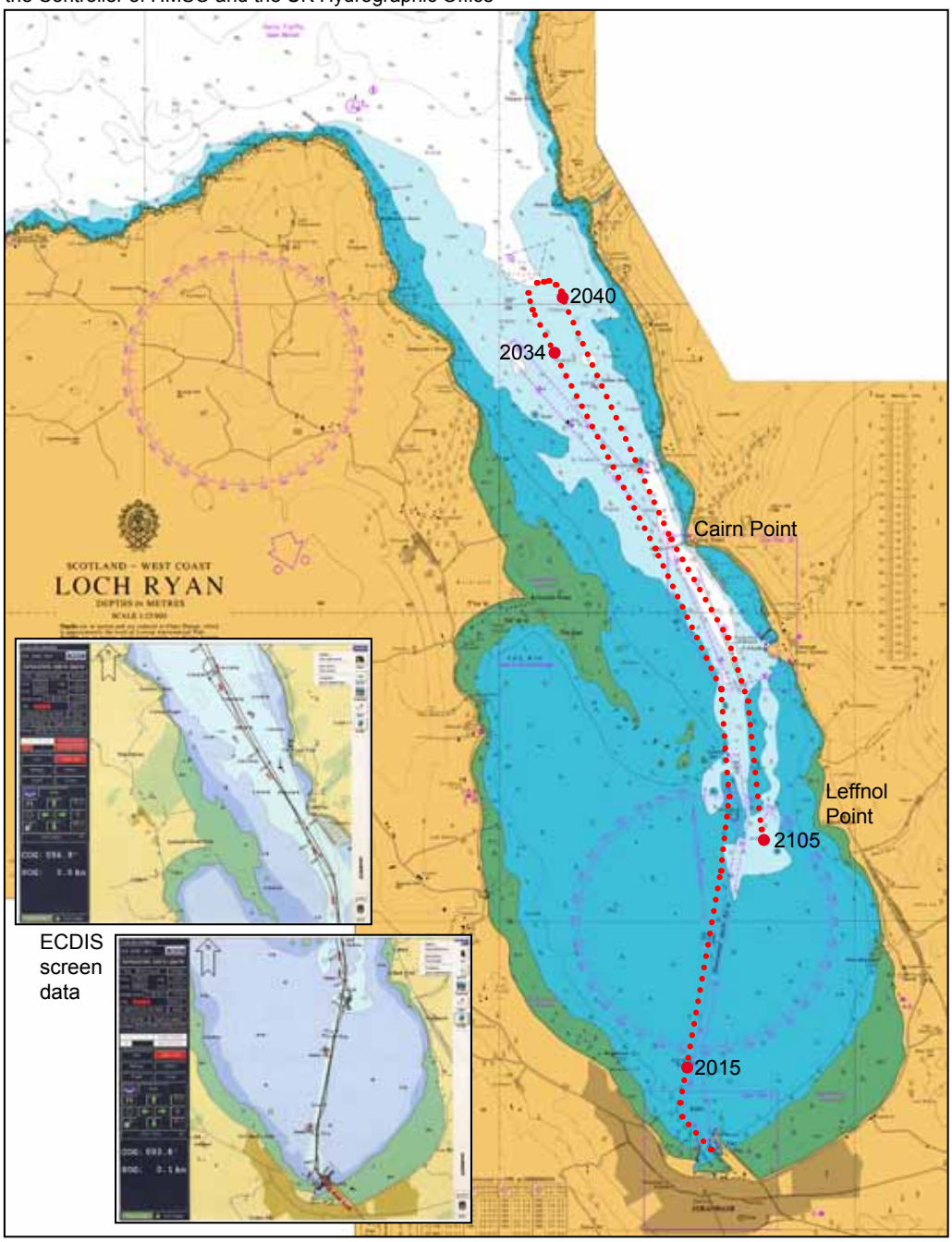
The position of the road tanker at the time of departure

The tanker driver got out of his vehicle and spoke briefly to the deck supervisor before locking the cab doors and proceeding to the freight driver's lounge. The deck supervisor shut the stern door and, with the help of his deck assistant, secured the road tanker to the deck of the ship. At 2012 the deck supervisor advised the bridge that the vehicle decks were secure and, approximately 22 minutes later than scheduled, the ferry sailed. The deck supervisor and deck assistant went for a cup of tea, leaving the senior deck assistant to patrol the vehicle decks.

[1] Semi-trailer – a trailer which is designed to be coupled to a semi-trailer towing vehicle (tractor unit) and to impose a substantial part of its weight on the towing vehicle.

The crossing was scheduled to take 2 hours and 20 minutes, but the master decided to make up the lost time by increasing to full speed. At 2031, as *Stena Voyager* passed Cairn Point **(Figure 3)**, the master put all four engines to full ahead. The vessel's trim increased by the stern as she began to accelerate from 17.5 to 40 knots. At 2034, with the vessel travelling at 27 knots and still accelerating, an alarm sounded on the chief engineer's console, which indicated one of the stern doors had opened. The alarm was accepted and silenced by the chief engineer. Simultaneously, a loud crashing sound was heard on the vehicle decks and a shudder was felt in the after part of the vessel.

Figure 3



Loch Ryan chart and recorded passage

The senior deck assistant and deck assistant immediately went to the aft end of lane number one, where they saw the road tanker's tractor unit raised off the deck and wedged into the top outboard corner of the stern door opening **(Figure 4)**. The aluminium door had been lost overboard and the vehicle's semi-trailer was hanging off the back of the ferry directly above the two port water jets. The senior deck assistant used his hand-held VHF radio to alert the bridge of the situation, and the chief engineer confirmed that a *'doors open at sea'* alarm had activated. The master immediately stopped the vessel.

Figure 4

Photograph of road tanker tractor unit taken immediately after the accident

The deck supervisor, having just arrived on the bridge for his watch, returned immediately to the vehicle deck to assess the situation and take charge of the crew. The master advised the passengers and Stranraer port that there had been a problem on the vehicle deck and that the vessel would be returning to the terminal. Concerned that the vehicle might fall off the stern at any moment and block the ferry channel, he then slowly manoeuvred *Stena Voyager* out of the fairway as he turned back towards Stranraer. The master called the vessel's senior master ashore to apprise him of the situation, and then initiated the company's emergency response procedure (EMPROC).

Prompted by the first officer, the deck crew confirmed they could not see anyone in the vehicle's cab and also advised that it was too dangerous to attempt to make it secure. At 2105, *Stena Voyager* was stopped off Leffnol Point **(Figure 3)** to allow the master an opportunity to fully assess the situation and for the vehicle to be stabilised. At 2107, the tractor unit dropped steadily to the deck and the semi-trailer rested on top of number two water jet. The deck crew immediately lashed the cab to the deck **(Figure 5)**.

Figure 5

Road tanker tractor unit secured to the deck

A passenger, watching from the stern of the vessel, contacted the BBC in Northern Ireland. It then contacted the coastguard. The coastguard was not aware of the incident and called the ship via VHF radio to find out what was going on. The master explained the situation and the coastguard tasked a lifeboat to escort the ferry back to port.

At 2116, the second engineer declutched and isolated number two water jet. At 2136, the vehicle was reported to be secure and the master made the decision to proceed back to the berth.

Because the semi-trailer was hanging over the stern of the vessel **(Figure 6)**, it was not possible to use the linkspan, so at 2241 the vessel berthed alongside the quay, port side to. It was only then that the master realised the stern door had been lost overboard and alerted the coastguard, which immediately issued a navigation warning.

Figure 6

Road tanker semi-trailer resting on top of number two water jet

Without the linkspan, there was no means of disembarking the passengers, and they had to stay on board the ferry overnight. The following afternoon the fire service arrived at the terminal with a telescopic rescue platform and, at 1650, the passengers disembarked one at a time **(Figure 7)**. A 500 tonne crane also arrived from the north east of England and, at 2245, the semi-trailer was lifted ashore and the tractor unit was recovered in board **(Figure 8)**.

1.3 ENVIRONMENTAL CONDITIONS

It was dark at the time of the accident, the visibility was good, the sea state was calm and the wind was south-easterly force 4. The predicted significant wave height for the planned passage was between 1.4 and 1.9m.

1.4 SECURING OF THE ARTICULATED ROAD TANKER

The road tanker was reported to have been secured to the vehicle deck using four web lashings and four rubber wheel chocks. Two lashings were attached to the side impact rails at the rear end of the semi-trailer, and two lashings were attached to ferry securing rings at the front end. The lashing hooks were secured to the deck of the ferry and tightened using their ratchet mechanisms. On the inboard side of the vehicle the forward lashing was attached to a deck securing plate and the aft lashing was attached to a deck rail securing point. On the outboard side, the two lashing hooks were placed on the upper rim of a deck securing rail **(Figure 9)**.

One rubber chock was placed on each side of the two wheels on the semi-trailer's rear axle. Four rubber chocks were photographed close to number one stern door shortly after the accident **(Figure 4)**.

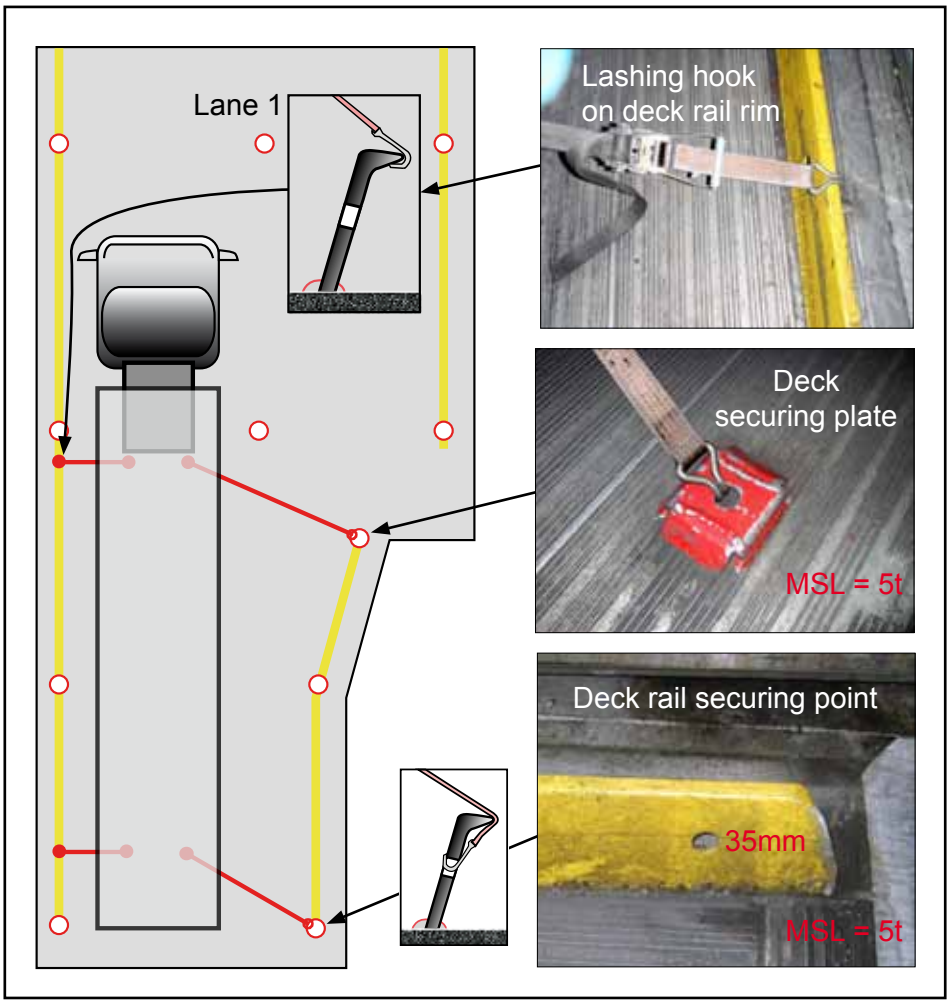
Figure 7

Removal of passengers by the Fire Service

Figure 8

Road tanker recovery

Figure 9



Road tanker semi-trailer lashing positions

1.5 CREW

1.5.1 Bridge team

The bridge team comprised the master, the first officer and the chief engineer, who was at the machinery control station. The master came on board at 1420 and completed a return voyage as first officer before taking command of the vessel at 1935. The first officer was both the navigator and the cargo officer, and was responsible for monitoring and controlling the vessel's draught, trim and list during the cargo operations.

1.5.2 Deck crew

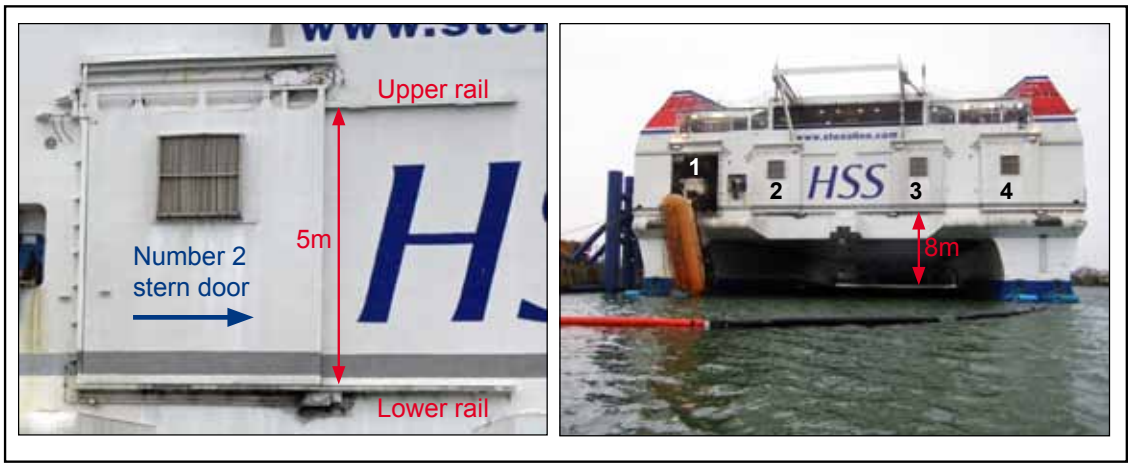
The deck supervisor, senior deck assistant and the deck assistant had worked on board *Stena Voyager* since she entered service. They loaded, secured and discharged vehicles without the oversight of a deck officer and were assisted on the vehicle decks by trained general purpose crew.

1.6 HSS *STENA VOYAGER*

Stena Voyager was one of three HSS 1500 ferries built for, and operated by, Stena Line. Her sister vessels were *Stena Explorer* and *Stena Discovery*. The HSS 1500 is the largest of the high speed craft ferries built to date. It can carry up to 1,500 passengers, 354 cars and freight vehicles weighing up to 44t.

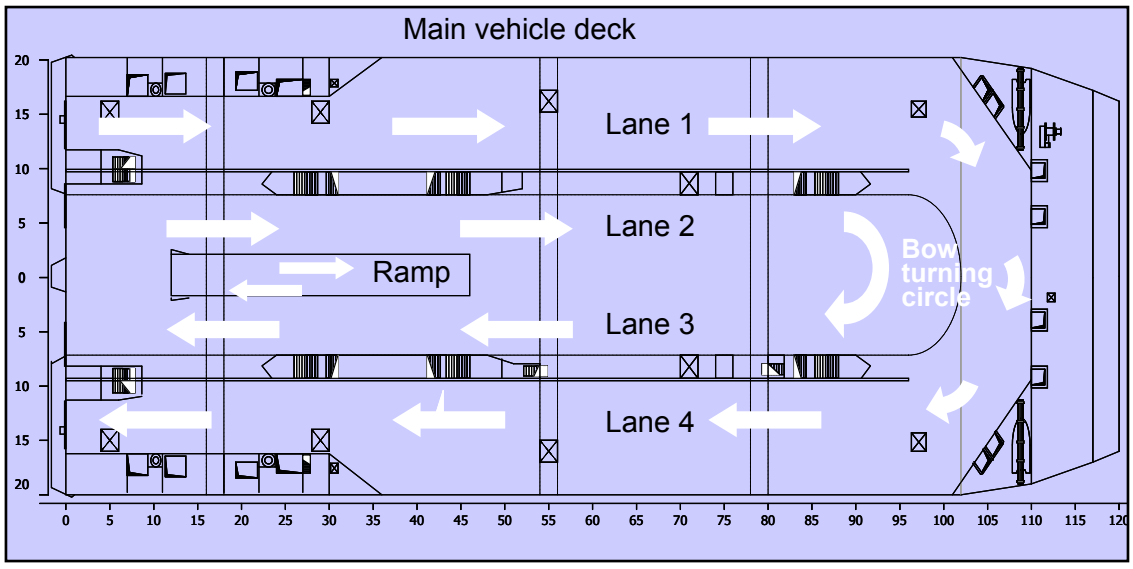
Stena Voyager's main vehicle deck had four lanes, each fitted with a 5m high aluminium sliding stern door at the aft end. The four stern doors were positioned 8m above the waterline and were not classed as watertight **(Figure 10)**. Vehicles were driven on board through doors one and two, and off through doors three and four **(Figure 11)**. The main vehicle deck had longitudinal serrations to reduce the risk of vehicles sliding from side to side. The area of deck adjacent to number one stern door, where the road tanker was parked, had an anti-slip coating.

Figure 10



Stena Voyager's stern doors

Figure 11



Main vehicle deck layout

Stena Voyager's high speed craft *Permit to Operate* detailed Stranraer as her base port. She was approved to operate in seas having significant wave heights of up to 4m while remaining within 40 miles of a place of refuge. The vessel's operational criteria, based on her stability characteristics, were:

- Maximum allowable mean draught of 4.8m
- Maximum allowable trim by the stern of 1.8m
- The vessel must not be trimmed by the head
- Maximum allowable list of 1° (when connected to the linkspan)

The vessel's maximum speed was 40 knots, and during the trans-critical acceleration phase to super-critical speeds she typically trimmed by the stern at an angle of between 2° and 3°. She completed eight crossings between Stranraer and Belfast each day. Four of the crossings took 2 hours 20 minutes and were conducted using two gas turbines. Four gas turbines were used on the remaining crossings, which took 2 hours. The turnaround time in port was 25 minutes.

1.7 VEHICLE STOWAGE AND SECURING

1.7.1 Cargo securing procedure

The operating limits listed on the high speed craft permit to operate, coupled with the inherent stability and sea keeping characteristics of the HSS 1500, were taken into account when the vessel's cargo stowage and securing requirements were determined by Stena Line and agreed by the Maritime and Coastguard Agency (MCA). *Stena Voyager*'s cargo securing manual was approved by the MCA on 27 February 1998, and its last amendment was approved on 20 January 2000; all subsequent changes to onboard cargo stowage and securing practices had been promulgated via Stena Line's senior master's standing orders (SMSO).

The cargo securing manual detailed two levels of securing vehicles, with the level to be used determined by the predicted environmental conditions for each crossing. As a minimum, the manual required *'all freight vehicles at the fore and aft end of each lane to be secured at all times, irrespective of weather conditions'*. SMSO numbers 8 and 23, *Securing of cargo* and *Securing of freight vehicles*, explained the specific securing requirements, and SMSO number 23 was added as an annex in the cargo securing manual **(Annex A)**.

Stena Line's minimum cargo stowage and securing requirements for significant wave heights of up to 2.5m are illustrated in **Figure 12** and included:

- All freight vehicles should be block stowed facing in a fore and aft direction
- Articulated freight vehicles must not be parked in the bow turning circle
- Road tankers should be secured within a block stow

- All vehicles should be parked with their hand brakes on and engines in gear
- All freight vehicles at the forward end of each lane must be lashed
- All freight vehicles parked next to the stern doors must be lashed
- All vehicles at the fore and aft end of each stow must be chocked

Figure 12

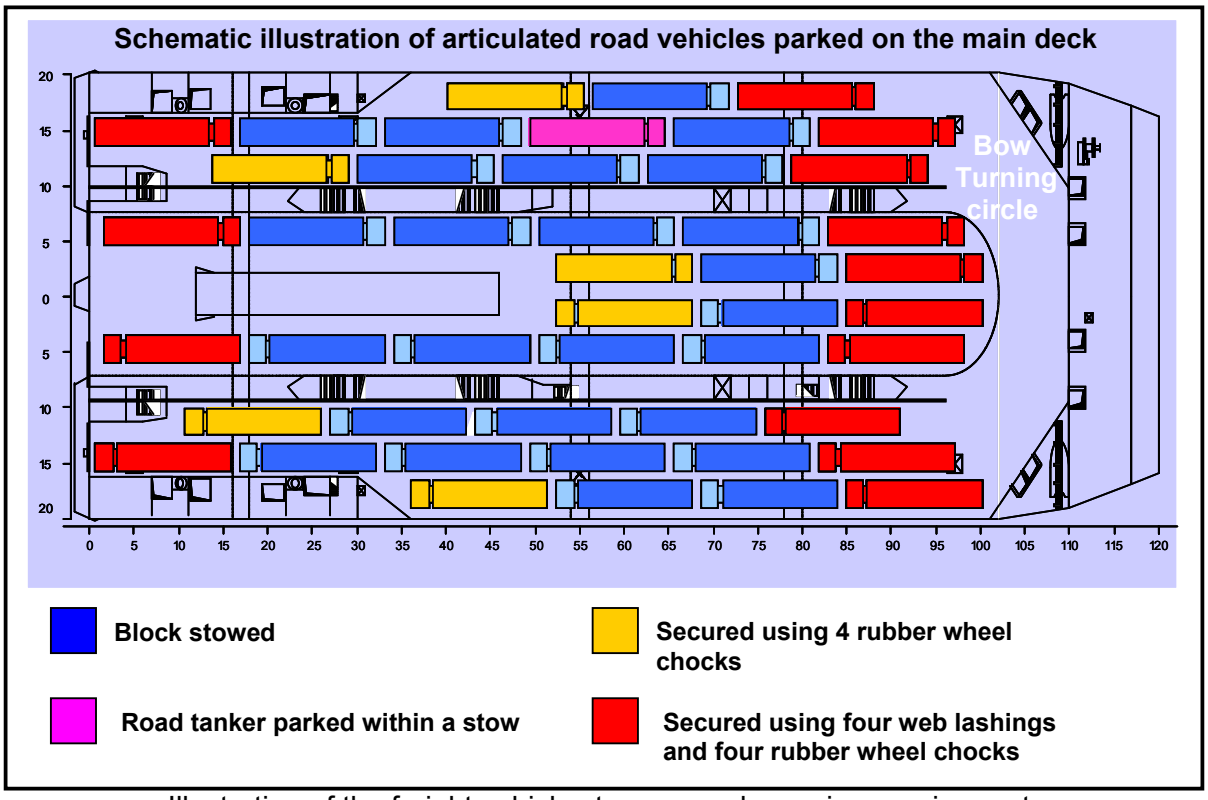


Illustration of the freight vehicle stowage and securing requirements on board *Stena Voyager*

The crew did not verbally instruct drivers to apply parking brakes or seek confirmation that they had done so during the loading operations, but warning posters on the vehicle decks provided a visual prompt for drivers. Hand-held instruction boards were held on board, but were not used **(Figure 13)**.

The cargo securing manual required the first officer to conduct rounds of the vehicle decks and verify the load integrity at the first available opportunity after the craft had cleared pilotage waters. However, this was not routinely undertaken on board the HSS 1500 ferries.

Figure 13

Vehicle deck warning signs and hand-held instruction boards

1.7.2 Lashings and deck securing points

Conventional ro-ro[2] ferries traditionally use steel chain lashings to secure freight vehicles to the deck. Stena Line used polyester web lashing straps on its HSS 1500 vessels to help protect their aluminium decks. According to the cargo securing manual, the maximum securing load (MSL)[3] for the freight vehicle web lashings was 5t. The freight vehicle lashings used on board *Stena Voyager* were 3.5m long and had a minimum breaking strength of 5t. They had a stainless steel securing hook at each end and were tensioned by a manual ratchet mechanism. The lashings were not individually marked and were not given a maximum working life. The onboard maintenance regime was limited to periodic visual inspections. *Stena Voyager*'s cargo securing manual required the road tanker's semi-trailer to be secured to the deck using four web lashings **(Figure 14)**.

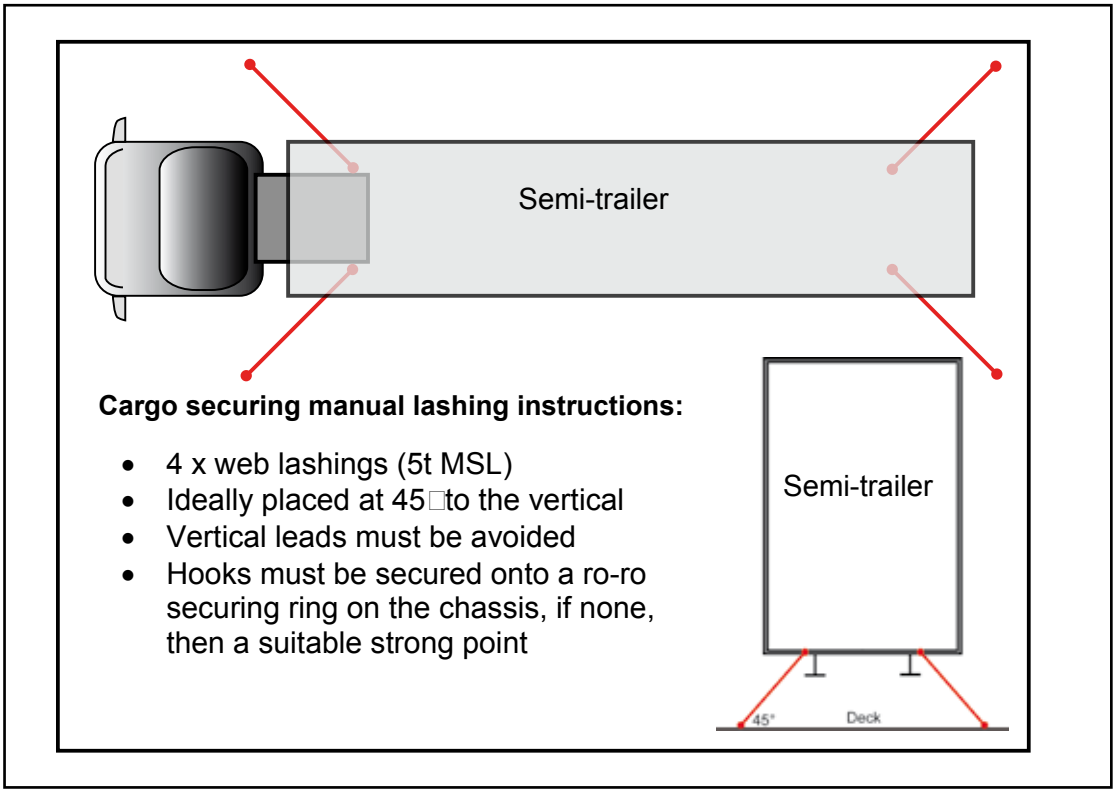
The normal operation of the vessel was based on short turnaround times, and the original cargo securing philosophy for the Stena HSS 1500 **(Annex B)** was based on an assumption that under normal operating conditions vehicles would not require to be secured. *Stena Voyager* was therefore designed and built without deck securing points. This was unacceptable to the MCA and to the Irish and Swedish administrations. Consequently, S*tena Voyager* was retro-fitted with two types of deck securing points to allow for the lashing of freight vehicles.

---

2 Roll-on roll-off (ro-ro) ship – a ship which has one or more decks either closed or open, not normally subdivided in any way and generally running the entire length of the ship, carrying goods which are loaded and unloaded normally in a horizontal manner

3 Maximum Securing Load (MSL) – is a term used to define the load capacity for a device to be used to secure cargo to a ship. For web lashings the MSL is equal to 50% of the breaking strength.

Figure 14



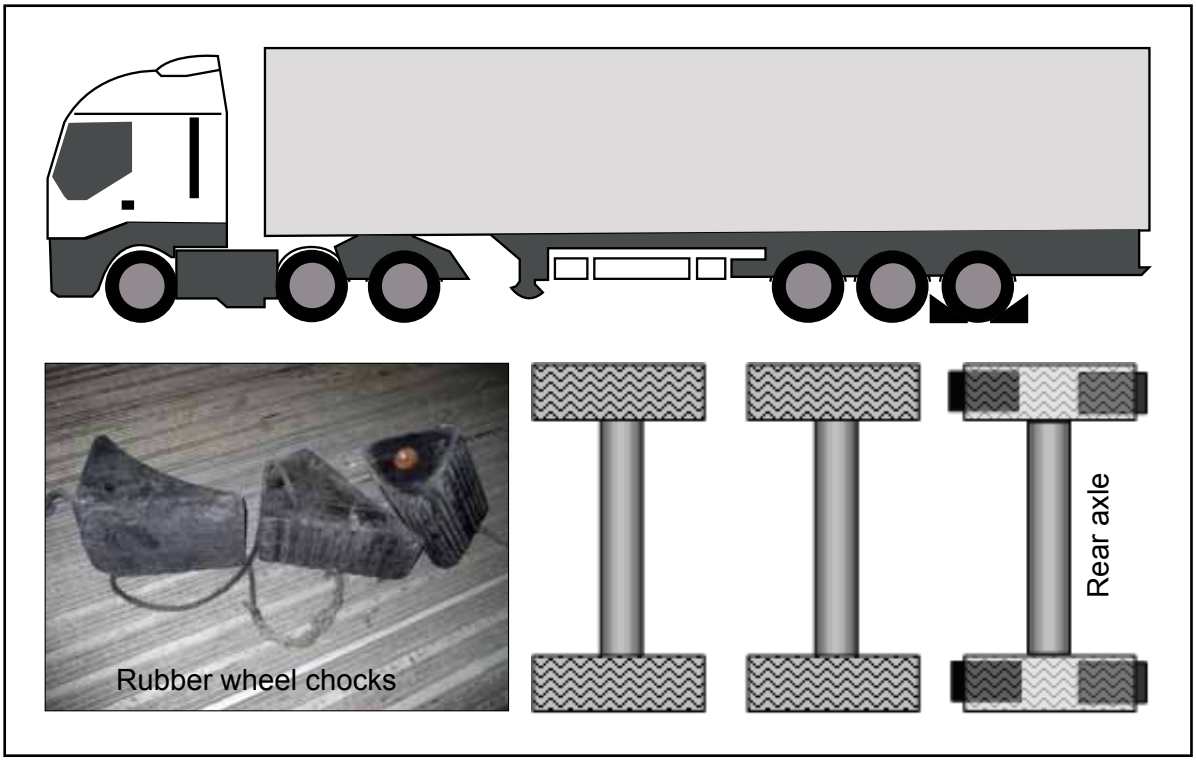
Lashing arrangement prescribed in *Stena Voyager*'s cargo securing manual

Several rows of securing plates were welded to the vehicle deck within each lane. In addition, a series of 35mm diameter holes, intended to accept lashing hooks, were drilled at 6m intervals through the 150mm high deck securing rails located on the outboard edge of each lane **(Figure 9)**. The spacing of the deck securing points on board *Stena Voyager* in the area of number one stern door was 6m in the fore and aft direction and approximately 4m in the athwartships direction. The MSL of the deck securing points was 5t, and only one lashing was allowed to be attached to each point.

1.7.3 Chocks

Stena Line used rubber wheel chocks to supplement the freight vehicle lashings on board the HSS 1500 vessels. Three different types were used on board *Stena Voyager*. The approved procedure was to place four chocks around the freight vehicle's rear wheels, two facing forward and two facing aft **(Figure 15)**.

Figure 15



Stena Voyager chocking arrangements

1.8 THE ROAD TANKER

1.8.1 Vehicle details

The articulated road tanker was owned by Turners (Soham) Ltd. It weighed 34.3t and was 14.1m long, 2.6m wide and 3.96m high. The 7-year old tractor unit was manufactured by ERF; it had a manual gearbox and was triple axled with six wheels. The semi-trailer was manufactured in 1995 by Spitzer and was designed to carry bulk powders. It was also triple axled with six wheels.

The tractor unit and semi-trailer were fitted with separate parking brake systems. The application of the hand brake in the driver's cab activated the parking brakes on the tractor unit, but not those on the semi-trailer. The tractor unit's hand brake had a safety catch designed to lock it into position once applied. To release the parking brake, a safety catch collar needed to be lifted before the lever could be moved forward **(Figure 16)**. The semi-trailer parking brake has to be applied manually from outside the cab at a control position on its chassis. The semi-trailer parking brakes were held off by compressed air so that any loss in pressure resulted in their application. Stena Line did not require the parking brakes of semi-trailers to be applied.

The semi-trailer had two ferry securing rings fitted at its forward end, one on each side **(Figure 17)**. The tractor unit had no ferry securing rings. This was the standard configuration on all of Turners' road tankers which were intended to travel by ferry.

Figure 16

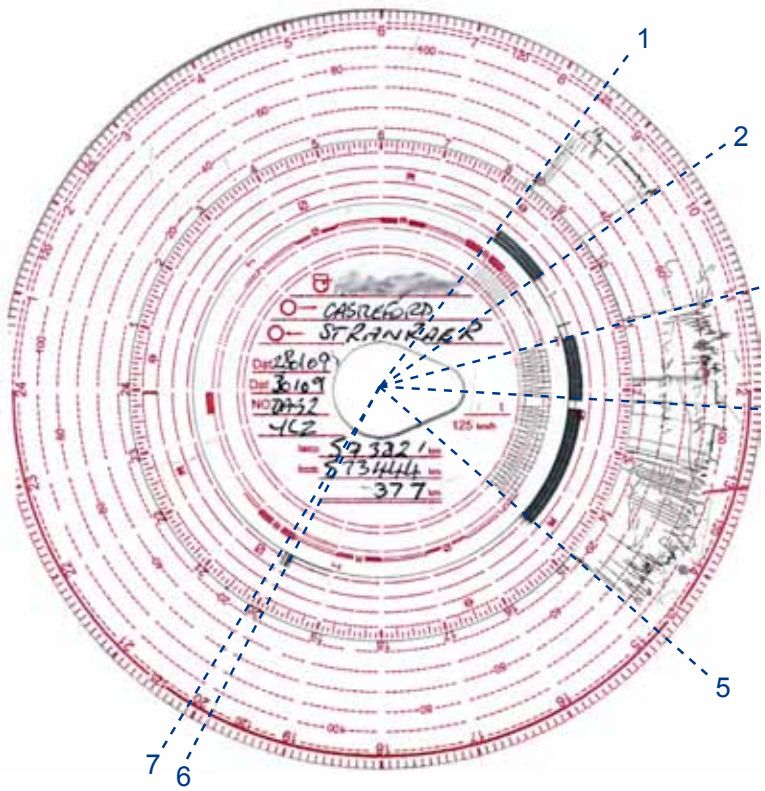
Road tanker tractor unit brake and gearstick

Figure 17

Road tanker ferry securing rings

The tractor unit was fitted with a Siemens VDO 1324 analogue type tachograph. The tachograph is a precision instrument which records the speed of the vehicle and the distance travelled, on a circular chart **(Figure 18)**. The circular chart covers a 24 hour period and is renewed daily.

Figure 18



Siemens VDO 1324 analogue type tachograph disc

Tachograph timeline

1. 0825: Depart Castleford
2. 0935: Stopped in traffic
3. 1055: Resumed journey
4. 1210: Stopped for fuel
5. 1445: Arrived Stranraer
6. 1950: Called forward
7. 2005: Road tanker parked prior to departure

Tractor unit tachograph disc

1.8.2 The driver

The road tanker driver was 60 years of age. He had worked for Turners (Soham) Ltd for many years and had taken freight vehicles on board ferries in the past. He was also one of the company's driving instructors.

1.9 TESTS AND INSPECTIONS

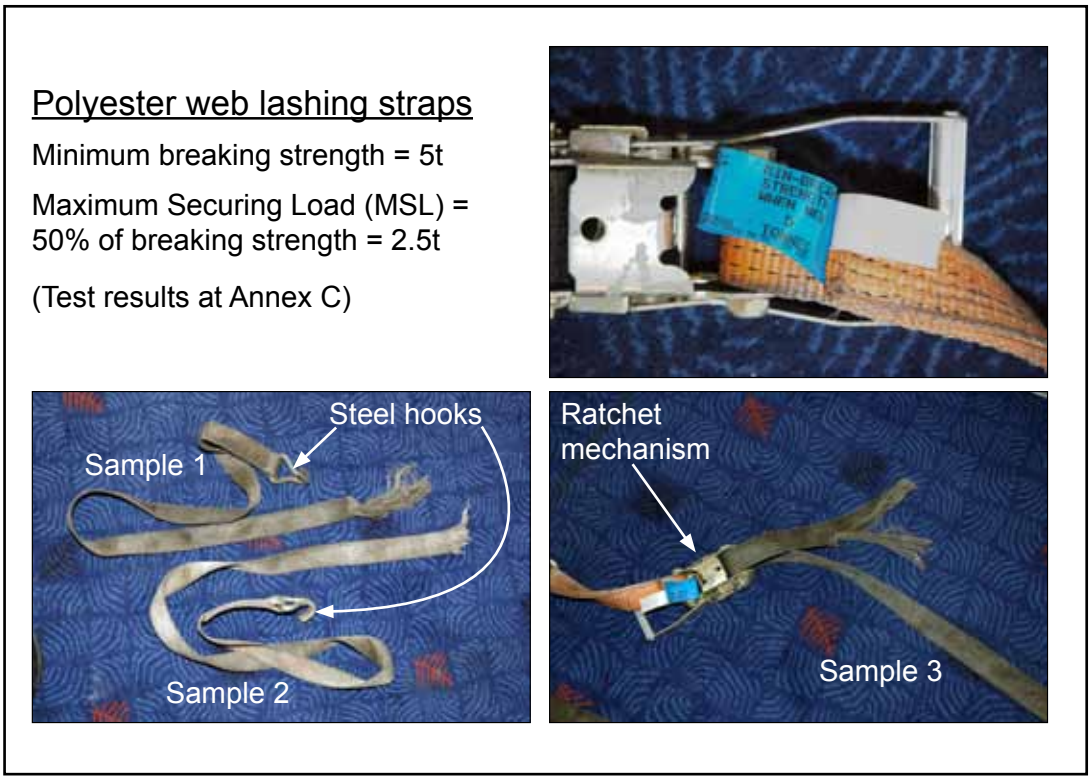
1.9.1 The road tanker

When the road tanker was inspected after the accident its parking brakes were found to be off and its gearstick was in the neutral position **(Figure 16)**. The hand brake safety catch mechanism functioned correctly and no faults were found with the braking systems.

1.9.2 Lashings

The crew recovered three lengths of failed web lashing after the accident **(Figure 19)**. Subsequent analysis **(Annex C)** concluded that two of the failed samples were from the same lashing. One of the lashings had lost 43% of its original strength and the second had lost 65%; the residual breaking strengths were 2.85t and 1.76t. Visually, the lashings appeared as though they had been in service for some time.

Figure 19



Failed lashing straps recovered from the accident scene

1.9.3 Chocks

The rubber chocks used on board *Stena Voyager* were purchased from different manufacturers and no information relating to their anticipated performance was available.

On 13 May 2009, the MAIB, in co-operation with the Vehicle and Operator Services Agency (VOSA) conducted a set of tests to determine the forces required to pull a fully loaded (44t) articulated road tanker, without brakes or lashings, over the three types of rubber chocks most commonly used by Stena Line **(Figure 20)**. The results **(Annex D)** found the best performing chock provided an average restraining force equivalent to 4.28t when two were positioned behind the rear wheels of the semi-trailer on level ground; the worst provided a restraining force of 3.5t. The chocking of one wheel effectively halved the restraining forces provided.

Further tests demonstrated that as the gradient of the road was increased, the force required to pull the vehicle over the chocks was reduced. Calculations indicate that the force acting on a 44t road tanker due to its weight alone would cause it to roll over the best performing chock at an angle of 6º. Measurements were also taken on an inclined section of road to establish the magnitude of shock loads applied by a free rolling vehicle to initially slack lashing straps. The maximum theoretical force acting on the road tanker in the aft direction during the trans-critical phase of *Stena Voyager*'s passage was calculated to be almost 3t.

Figure 20

Wheel chock performance tests

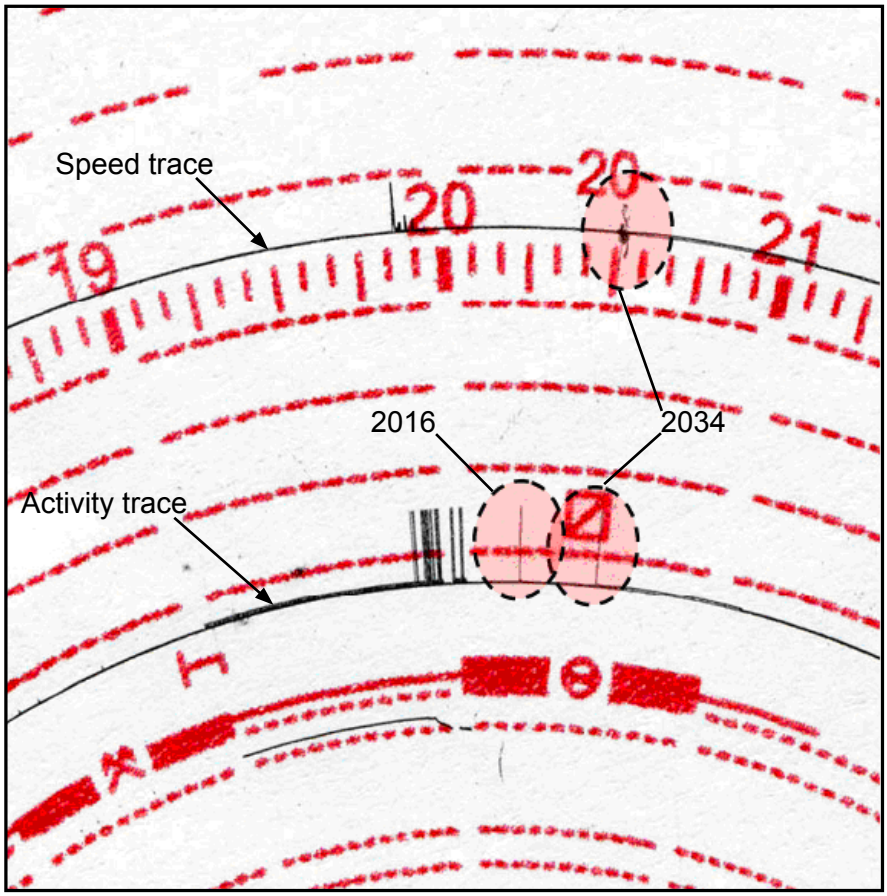
1.9.4 Tachograph

The tractor unit's tachograph disc was inserted by the driver on the morning of the accident and was removed by the MAIB on 30 January 2009 once the vehicle had been recovered inboard. The disc was analysed by the tachograph manufacturer, Continental Automotive Trading UK Limited (formerly Siemens VDO Trading Limited) **(Annex E)**. Comparisons of the timelines show that the tachograph clock was set 3 minutes ahead of *Stena Voyager*'s voyage data recorder.

Despite its engine being stopped, the road tanker's movement at the time of the accident was recorded on the disc **(Figure 21)**. The violence of the impact on the vehicle as it crashed through the stern door was also sufficient to create marks on the vehicle's speed trace. Careful analysis of the disc indicates the road tanker probably moved aft at 2016, shortly after *Stena Voyager* departed the berth. This was 18 minutes before it passed through the stern door.

The tachograph confirmed that the driver had complied with the current UK rules on commercial drivers' hours of work and rest.

Figure 21



Tachograph marks
Note: *Stena Voyager* departed berth at 2012

1.10 CARGO STOWAGE AND SECURING REGULATIONS AND GUIDANCE

1.10.1 International regulation and guidance

The International Convention for the Safety of Life at Sea (SOLAS) chapter 6 Regulation 5.4 states:

> *'Appropriate precautions shall be taken during loading and transport of cargo units*[4] *and cargo transport units*[5] *on board ro-ro ships, especially with regards to the securing arrangements on board such ships and on the cargo units and cargo transport units and with regard to the strength of the securing points and lashings'*

Regulation 5.6 of the same chapter states:

> *'All cargoes, other than solid and liquid bulk cargoes, cargo units and cargo transport units, shall be loaded, stowed and secured throughout the voyage in accordance with the Cargo Securing Manual approved by the Administration*[6]*'*.

For ro-ro ships this must be completed before the ship leaves the berth.

[4] Cargo unit – a vehicle, container, flat, pallet, portable tank, packaged unit or any other entity.

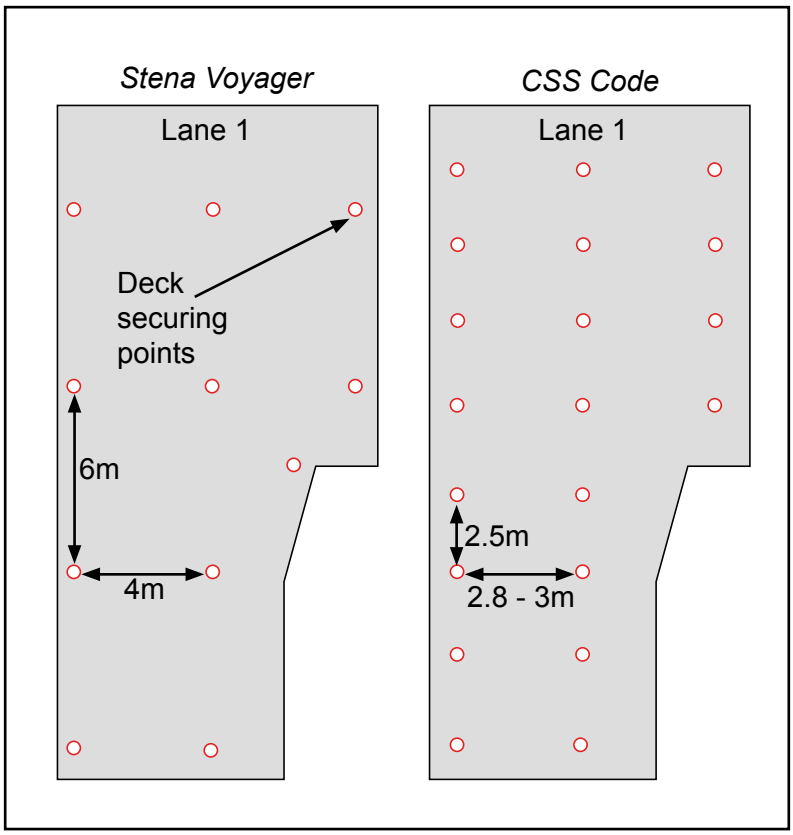
[5] Cargo transport unit – a road freight vehicle, a freight container, a road tank vehicle, a railway tank wagon or a portable tank

[6] The administration for *Stena Voyager* was the UK Maritime and Coastguard Agency (MCA)

The International Maritime Organization's (IMO) *Code of Safe Practice for Cargo Stowage and Securing* (CSS Code) provides generic guidelines on how to meet the SOLAS requirements. The CSS Code was written in 1990 and adopted by the IMO assembly in 1991. Its purpose is to provide an international standard for the safe stowage and securing of cargoes. Included as an appendix to the CSS Code is IMO resolution A.581(14), *Guidelines for the securing arrangements for the transport of road vehicles on ro-ro ships* **(Annex F)**. This resolution details specific guidelines for the provision of securing points on ships' decks, and on road vehicles. It also includes guidelines on lashing equipment, lashing techniques and vehicle stowage procedures.

The resolution states the arrangement of deck securing points should be left to the discretion of the shipowner provided the minimum distance between them in the fore and aft direction does not exceed 2.5m and the athwartships spacing is between 2.8m and 3m **(Figure 22)**. It also states that securing points on road vehicles should be designed for securing the road vehicle to the deck of the ship with no fewer than two, and no more than six securing points on each side of the vehicle. These guidelines apply to road vehicles, with the exception of

Figure 22

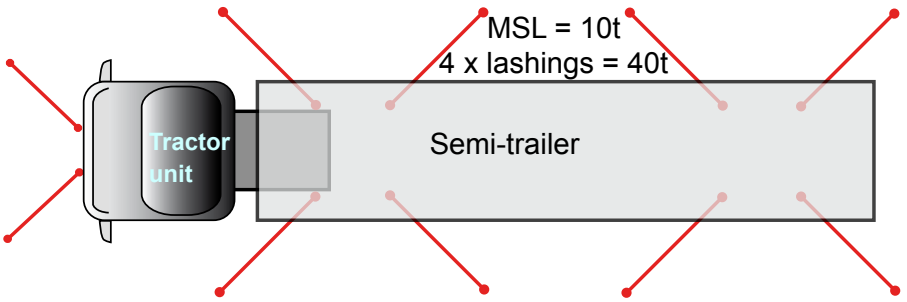


Deck securing point spacing

buses, weighing 3.5t and over. The total number of securing points on each side of a road vehicle is dependent on its weight. As a rule of thumb, the total MSL values of securing devices on each side of a unit of cargo (port and starboard) should equal the weight of the unit **(Figure 23)**. Other guidance given in the resolution includes:

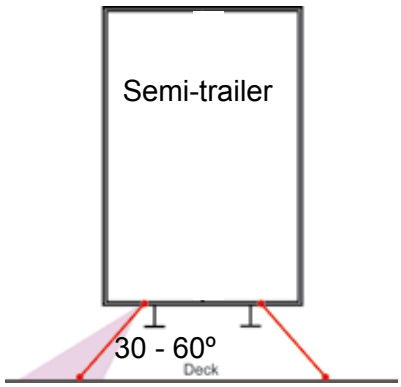
- The parking brakes on each element of a road vehicle should be applied.
- Vehicles with diesel engines should not be left in gear during the voyage.
- Wheel chocks should be used to provide additional security in adverse conditions.

Figure 23



Vehicle weight (Tonne)	Minimum number of securing points on each side of road vehicle
3.5 to 20	2
20 to 30	3
30 to 40	4

Note: Semi-trailer towing vehicles are excluded from the table above. They should be provided with two securing points at the front of the vehicle, the strength of which should be sufficient to prevent lateral movement of the front of the vehicle. A towing coupling at the front may replace the two securing points.



CSS Code ferry securing ring guidance

The CSS Code recommends that all securing devices used to secure vehicles on ro-ro ferries have an MSL of not less than 100kN (10t).

Chapter 4.3.1 of the CSS Code states:

> *'The master should not accept a road vehicle for transport on board his ship unless satisfied that the road vehicle is apparently suitable for the intended voyage and is provided with at least the securing points specified in section 5 of the annex to resolution A.581(14)'*

In 1989 the International Organization for Standardization's *Shipbuilding and marine structures* and *Road vehicles* technical committees jointly prepared the international standards ISO 9367-1[7] and ISO 9367-2[8]. The standards specify the minimum requirements to allow the efficient lashing and securing of road vehicles on board ro-ro ships. They detail the number and position of the securing points required, and a signage and identification protocol **(Annex G)**.

1.10.2 United Kingdom (UK) regulation and guidance

The requirements laid down in SOLAS are enabled within the UK by the *Merchant Shipping (Carriage of Cargoes) Regulations 1999*. The regulations apply to '*sea-going UK ships wherever they may be'* and *'sea-going ships which are not UK ships while they are within UK waters'*, when loaded or intended to be loaded with any cargo. The regulations place a number of requirements on shippers[9], including the need to inform the ship owner or master in advance of loading that the cargo is suitable for the ship and can be safely stowed and secured on board the ship under all expected conditions during the intended voyage.

The MCA's *Roll-on/Roll-off Ships Stowage & Securing of Vehicles* code of practice (MCA Code) includes similar guidance to the CSS Code on the stowage and securing of vehicles. It also incorporates a number of IMO resolutions and circulars, including resolution A.581(14). It repeats the guidance given regarding the application of parking brakes on each element of a road vehicle but does not include the recommendation that vehicles with diesel engines should not be left in gear during the voyage.

Guidance given in Annex 1 of the MCA Code states:

> *'Where there is doubt that a freight vehicle complies with the provisions of paragraph 2.3 of this Annex, the master may exercise discretion whether to load the freight vehicle on board, taking into account the apparent condition of the freight vehicle, the weather and sea conditions expected on the intended voyage and all other circumstances'*

The MCA Code also reminds ship owners, ship managers and masters that before being accepted for shipment, every freight vehicle should be inspected externally by a responsible person appointed by them, to check that it is in a satisfactory condition for shipment.

---

7 ISO 9367-1 Lashing and securing arrangements on road vehicles for sea transportation on Ro/Ro ships – General requirements – Part 1: Commercial vehicles and combination vehicles, semi-trailers excluded.

8 ISO 9367-2 Lashing and securing arrangements on road vehicles for sea transportation on Ro/Ro ships – General requirements – Part 2: Semi-trailers.

9 Shipper – means any person who, whether as principal or agent for another, consigns goods for carriage by sea.

The Department for Transport's (DfT) code of practice, *Safety of Loads on Vehicles* provides guidance to the road haulage industry on vehicle loading and securing techniques, and promotes best practice. Sections 1.17 to 1.20 of the code describe the specific hazards presented by the dynamic movement of a ferry and explain that operators intending to use ferries should ensure vehicles are fitted with ferry securing points. The third edition of the DfT code, published in 2002, refers vehicle operators to early versions of the MCA Code and the ISO 9367 standards.

1.10.3 Stena Line guidance

Stena Line provides instructions and guidance to freight operators via its web site. The web site includes an electronic copy of its publication *'Freight Facts'* and paper copies are sent to its regular customers. The document advises customers that:

- *'A freight unit must be equipped with approved lashing brackets (according to the requirements in IMO "Code of Safe Practice for Cargo Stowage and Securing"). This means that every freight unit must be equipped with at least four (4) approved lashings brackets on each side to ensure loading and lashing in a manner safe for sea transport'. And;*

- *'The master of the vessel has the right and the obligation to refuse shipment of freight units intended for sea transport that do not comply with these requirements. For the same reason, the Maritime Administrations in our areas of operation may forbid Stena Line to take such units on board. In these situations, Stena Line reserves the right to leave such freight units on the wharf.'*

1.11 POST-ACCIDENT OBSERVATIONS

1.11.1 Freight vehicle ferry securing rings

On 5 March 2009, MAIB inspectors visited *Stena Explorer* during a return crossing between Holyhead and Dublin to observe her cargo operations and the securing arrangements provided on freight vehicles. Of the semi-trailers inspected, 95% did not comply with the ISO standards; 52% had fewer securing rings than recommended by the IMO, and 26% had no securing rings at all. None of the tractor units inspected were fitted with securing rings.

Following on from the findings on board *Stena Explorer,* a survey of freight vehicles awaiting shipment from Dover was conducted on 17 March 2009. Over 50% of the articulated freight vehicles inspected in Dover had no securing rings; this figure included 57% of vehicles declared as carrying dangerous goods. Of the vehicles inspected, 70% originated from mainland Europe, of which 60% had no securing rings; 24% were UK vehicles, of which 35% had no securing rings;

and 6% were from Ireland, 33% of which had no securing rings. Many more vehicles had fewer securing rings than those recommended by the IMO and less than 5% complied with the ISO standard.

A similar survey was conducted in Portsmouth on 20 March 2009, where the inspection of freight vehicles on board one ro-ro ferry identified that all of the semi-trailers loaded had been fitted with securing rings. The ferry operator had implemented a strict inspection regime and employed a closed loop reporting system to ensure hauliers/shippers rectified any identified shortcomings. However, only 35% had the number of securing points recommended by the IMO. The ferry had a 2-hour turnaround time, and a large percentage of the vehicles carried on board were presented for shipment by regular customers. In addition, there was no competition from other ferry operators on the route.

1.11.2 Parking brake safety alarms

It was noted that the tractor unit provided for the chock tests by Turners (Soham) Ltd had a parking brake alarm system which sounded if the driver's door was opened while the brakes were off. The tractor unit was less than 2-years old, and the alarm was included as a standard feature by the manufacturer.

There are presently several alarm systems commercially available designed to reduce the occurrence of vehicles running away due to parking brakes not being applied correctly. These safety devices are not mandatory, but manufacturers are starting to include them as standard specification for new vehicles. Some freight operators are also having them fitted as an additional safety measure.

1.11.3 Cargo securing practices and documentation control

During the visit to *Stena Explorer*, a review of her cargo securing manual found that the cargo securing requirements set out in SMSO number 23 differed from those given in the equivalent document on board *Stena Voyager*, and both contradicted the instructions given in SMSO number 8 **(Annex A)**. The crew were observed to chock one wheel on each vehicle, and in some cases chocked only one side of a wheel; not all chocks were placed squarely against the wheels **(Figure 24)**. Several vehicles were found to be secured with fewer than four lashings.

The crews of *Stena Voyager* and *Stena Explorer* had adopted different securing practices, and neither was fully compliant with the minimum requirements set out in the cargo securing manuals. This had not been identified by any internal or external audits.

Figure 24

1: Lashing attached to vehicle wheel allowing chassis movement
2&3: Lashing attached to chassis girder rather than ferry securing ring
4: Chocks not placed squarely against wheel
5&6: Chocking of one wheel using only one chock

Securing practices on board *Stena Explorer*

1.12 SIMILAR ACCIDENTS

1.12.1 Stena HSS 1500

In 2001 an articulated freight vehicle and three transit vans shifted and were lost over the stern of *Stena Discovery* as she accelerated on her departure from the Hook of Holland. The 30 tonne articulated vehicle had been parked in lane number one, with its parking brakes off. The trailer was reported to have been secured using four rubber wheel chocks. As the vehicle rolled aft, it picked up sufficient momentum to push three transit vans aft, against the force provided by their parking brakes, and through the aluminium stern door. Following the accident, the Dutch police conducted a set of trials on board the vessel during a return crossing to Harwich, using a similar road vehicle. Two wheels on the vehicle were chocked in accordance with the cargo securing manual, and the parking brake was taken off and the engine left out of gear. During both crossings the forces on the vehicle, caused by the angle of the deck and the acceleration of the vessel, resulted in the chocks sliding a distance of up to 10cm. However, they provided sufficient restraint to prevent the vehicle from running away **(Annex H)**.

In 2003 a semi-trailer, attached to a Stena Line towing vehicle, shifted and hit number one stern door on board *Stena Voyager* as she departed Stranraer at slow speed. The door was damaged and the vessel had to return to the berth. A subsequent investigation conducted by Stena Line concluded that the towing vehicle's brake had accidently been released. It also identified that

Stena Voyager regularly departed the berth before the crew had completed the securing of its cargo. The investigation report recommended that deck crews should check that hand brakes have been applied to the vehicles positioned at the ends of each lane.

A review of the vehicle damage reports held on board *Stena Voyager* and *Stena Explorer* identified 27 instances of vehicles shifting since 2005, where failure to correctly apply parking brakes had been assessed as the causal factor.

1.12.2 MAIB incident reports

There have been 11 accidents reported to the MAIB since 2005 where vehicles have shifted and caused damage to themselves, the ships' structure and/or other vehicles. Parking brake failure, or misapplication, was considered to be a contributory factor in four of these accidents; incorrect securing practices were considered a factor in two. The contributory factors in the remainder included unexpected environmental conditions and poorly stowed cargoes within the freight vehicles.

1.12.3 Other similar accidents

There have also been several similar accidents worldwide where the failure to correctly apply parking brakes to commercial vehicles has resulted in vehicles running away on board ferries and causing damage, injuries and fatalities:

- In 2003 a passenger coach crashed through the stern door of the high speed ferry *Max-Mols* in Scandinavia.
- In 2007 a bus rolled off the back of a ferry on the river Nile in Minya, Egypt, resulting in the loss of 16 lives.
- In 2007, vehicles broke free in rough weather on board the New Zealand ferry *Aratere.* As a consequence, compliance with the requirements set out in ISO 9367-1 was mandated for all road vehicles carried on ferries in New Zealand.

In 2008 a passenger coach being transported on a Eurotunnel passenger shuttle train ran away after its driver had forgotten to apply its parking brake. The runaway coach narrowly missed a group of children who were sitting on the floor of the train carriage behind the coach. Its driver attempted to arrest the coach's motion and was injured after being pinned between it and the wall of the carriage. The Rail Accident Investigation Branch (RAIB) conducted a full investigation[10] and concluded that the coach was not sufficiently restrained against backward movement because its parking brake had not been applied, first gear had not been engaged and a chock had either not been placed, or had been incorrectly positioned, behind the front wheel on the driver's side.

---

[10] Rail accident report No. 08/2009 – Uncontrolled movement of a road vehicle in a Channel Tunnel passenger shuttle train in transit from the UK to France, 4 April 2008 (www.raib.gov.uk)

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 CAUSE OF THE VEHICLE MOVEMENT

The results from the tests and analyses conducted following the accident strongly indicate that the road tanker first moved towards the stern door shortly after *Stena Voyager* left her berth at slow speed. It is likely that it then either rested against the stern door or was held by one or more of its lashings. As the ferry accelerated, her trim angle increased by the stern and the resulting forces acting on the vehicle were sufficient to cause the vehicle to crash through the stern door. The movement of the vehicle was due to several factors, including:

- Neither of the vehicle's parking brakes had been applied, and the vehicle had been left out of gear.
- The vehicle was not lashed in accordance with international or national guidelines, and the strength of the lashing straps was insufficient to withstand the forces experienced.
- The wheel chocks were either not in position or had been positioned incorrectly.
- The vehicle was not within a block stow as required by the vessel's procedures.

2.3 USE OF PARKING BRAKES AND ENGINE GEARS

2.3.1 Use of parking brakes

Parking brakes are the first and most obvious means of preventing a vehicle from moving. There is little doubt that, had the tanker's brakes been applied, it would have remained in the position in which it had been parked. However, as this, and the accidents highlighted in paragraph 1.12 demonstrate, drivers can and do forget to apply parking brakes before leaving their vehicles. Indeed, one of the principal sources of danger listed in the MCA Code is the '*failure to apply brakes correctly'*. Therefore, the risk of this occurring must be reduced as much as possible.

In recent years, the size and vehicle carrying capacity of ro-ro ferries has increased while turnaround times and possibly the number of crew available have reduced. As a consequence, the speed of loading and discharging vehicles has become faster and, as in this case, many operators rely chiefly on warning signs on vehicle decks to remind drivers to apply parking brakes. Such signs are possibly seen by many drivers only after they have left their vehicles, if at

all. Few operators appear to require the parking brakes of all elements of an articulated road vehicle to be applied, as required by the relevant codes of practice.

Notwithstanding time and manning constraints and language difficulties, the most effective ways of ensuring that a parking brake has been applied is to verbally remind each driver, and/or to check their correct application. Had this action been taken on board *Stena* Voyager, as recommended after the similar accident in 2003, this accident would have been prevented.

2.3.2 Engine gears

Despite the guidance given in IMO resolution A581(14), Stena Line required all vehicles to be left in gear during a voyage, a policy which is not adopted by all ferry operators. It is not normal practice to leave a vehicle in gear when it is parked on the road, and therefore it is very unlikely, unless verbally instructed to do so, that drivers will comply with this requirement.

2.4 LASHINGS

2.4.1 Rigging

Lashings are used primarily to prevent the transverse movement of a vehicle chassis, and are considered to be most effective when they are rigged at an angle of between 30º and 60º from the deck. Where practicable, the lashing arrangements on both sides of a vehicle should be identical and angled to provide some fore and aft restraint in the event of a parking brake failure or a change in a vessel's trim.

In this case, the lashings attached to the road tanker were not rigged in accordance with the guidance given in the codes of practice or the instructions contained in *Stena Voyager*'s cargo securing manual. Consequently, the two outboard lashings would have provided minimal resistance in either the fore or aft directions as they had been attached to the top rim of the deck securing rail and would therefore have slid along or fallen off the rail as the vehicle rolled along the deck. The inboard lashings provided no restraint against movement in the aft direction; in fact, once tensioned they would have pulled the vehicle towards the stern **(Figure 9)**.

2.4.2 Strength and maintenance

The strength of the lashing points and lashing equipment should be appropriate for the weight of the vehicles being secured. To effectively secure the road tanker to the deck of a ferry for all expected conditions at sea, the codes of practice recommend four lashings, each with an MSL of 10t, being fitted to each side of the vehicle. Due to the expected environmental conditions and the specific characteristics of the HSS 1500, the MCA and the Swedish and Irish administrations approved Stena Lines' proposals to use only two lashings

on each side of the vehicle. They also approved a minimum MSL of 5t for the lashings and associated securing points. As the MSL for web lashings is 50% of the breaking strength, the lashing straps on board *Stena Voyager* should have had a minimum breaking strength of 10t. If positioned correctly, these should have provided a restraining force of up to 20t in the forward and aft directions. However, the MSL of the lashings used on the road tanker was actually 2.5t, a quarter of that recommended by the IMO and half that approved by the MCA.

Analysis of the failed lashings recovered from the scene of the accident identified that the residual strength of the web lashings used to secure the road tanker was as low as 35% of their design strength. Therefore, the maximum restraining force achievable from the two forward lashings was only 3.5t. Although it was still possible for the lashings to have prevented the vehicle from moving, it would only have required the road tanker to build up momentum over a few centimetres to induce a sufficient shock loading to cause the lashings to fail.

The degree to which the lashings had degraded was attributed mainly to their age, and wear and tear, and was not easily identifiable by visual inspection alone **(Annex C)**. Therefore, the need to introduce procedures enabling web lashings to be identified, and to be renewed after being in service for a maximum specified period, is compelling.

2.5 WHEEL CHOCKS

The analysis of the road tanker's tachograph, coupled with the results obtained from both the MAIB's chock tests and those conducted by the Dutch police on board *Stena Discovery* in 2001 (paragraph 1.9.3 and **Annex D**), strongly suggest that if chocks were used to secure the road tanker on *Stena Voyager*, then they were not correctly positioned.

Had the two rear wheels of the semi-trailer been chocked in accordance with the cargo securing manual, the least effective chocks used on board *Stena Voyager* would probably have prevented the vehicle shifting. However, even the best performing chock positioned on one wheel alone would have been insufficient to restrain the vehicle on a 3º incline. It is unlikely that the wheel chocks slid aft because the deck adjacent to the stern door had a non-slip coating and was dry. Furthermore, had the chocks slid aft, it is likely they would have gone overboard with the semi-trailer; they would not have been found near the stern access **(Figure 4)**.

2.6 BLOCK STOWS

The Turners road tanker was the last vehicle to be loaded on board because it had been put on standby for the 1950 ferry crossing. As a result, it was parked adjacent to number one stern door and was not contained within a block stow as required by the vessel's cargo securing manual. Achieving tight stows in

both the athwartships and the fore and aft directions can help contain a vehicle that has, for what ever reason, shifted or run away. With the exception of those carrying dangerous goods, the only vehicles required to be secured on board the HSS 1500 vessels during normal operating conditions are those at the fore and aft ends of the stows. Therefore the only additional restraint for vehicles within a block stow are the other vehicles parked around them. As demonstrated on board *Stena Discovery* in 2001 (paragraph 1.12.1), the parking brakes of surrounding vehicles cannot always be relied upon to arrest the momentum generated by a heavy freight vehicle.

2.7 FERRY SECURING RINGS

To comply with the guidance provided in IMO resolution A.581(14), the CSS and MCA codes of practice, and the ISO standards, the semi-trailer of the Turner's road tanker should have been fitted with four ferry securing rings on each side. However, it was only fitted with one pair at its forward end. The findings highlighted in paragraph 1.11.1 indicate that the majority of freight vehicles arriving for embarkation on ferries in UK and other European ports do not have the recommended number of ferry securing rings fitted. Moreover, a significant percentage has none at all.

The *Merchant Shipping (Carriage of Cargoes) Regulations 1999* and the MCA code place a duty on shippers, and ferry owners and masters, to ensure all vehicles can be secured in all expected conditions. It is also the stated policy of many operators, including Stena Line, to transport only vehicles fitted with ferry securing rings. However, it is clearly evident that the requirement for ferry securing rings to be fitted to freight vehicles is not being universally enforced. This is almost certainly due to the competitive nature of this sector, in which unilateral enforcement by one operator would undoubtedly result in customers moving to others operating on the same or a similar route.

In view of the large numbers of freight vehicles originating from the UK and other EU states, which are not fitted with the appropriate number of ferry securing rings, it is almost certain that many road hauliers within the EU are not aware of their responsibilities under the merchant shipping regulations, or of the guidance available. Furthermore, there is no requirement to register vehicles as being suitable for shipment by ferry, or for VOSA to check their compliance in this respect. Turners (Soham) Ltd regularly transported road tankers on several ferry routes, but none of its vehicles had adequate numbers of ferry securing rings. Although reference is made to early versions of the MCA code and ISO 9367 standards in the DfT's code of practice *Safety of loads on vehicles*, this is published primarily as guidance on load safety for UK hauliers, and contains little detail itself on ferry securing arrangements.

2.8 SECURING PRACTICES

To enable freight vehicles to be effectively and quickly secured on board ro-ro ferries, it is essential that a vessel is fitted with frequently spaced securing points and that freight vehicles are fitted with an adequate number of ferry securing rings. On this occasion, neither of these criteria were met, and the crew had to use their initiative, and 'make do' with the arrangements available. It was therefore not surprising that the resulting configuration of the lashings deviated from best practice and fell considerably short of the optimum.

In such circumstances, which were likely to have been repeated on each crossing without adverse consequences, the probability of the crew routinely adopting poor practice was considerably increased. This is supported by the observations on board *Stena Explorer* which demonstrate that her deck crew had adopted practices at variance with the vessel's cargo securing manuals. In particular, deck securing points were not used even though available**,** freight vehicles were secured with fewer than four lashings, and wheel chocks were not correctly positioned **(Figure 24)**. It is highly likely that similar practices had been adopted on board *Stena Voyager*.

The absence of any supervision of the deck crew by the first officers on board *Stena Voyager* and *Stena Explorer*, as required by the vessels' cargo securing manuals, and the failure of both internal and external audits to identify cargo securing non-conformities, meant there was little to prevent poor practice from becoming routine.

2.9 COMPLIANCE WITH THE CARGO SECURING MANUAL

Once a cargo securing manual has been approved, changes to its content by a ship owner must be submitted to the appropriate administration for approval. In the case of *Stena Voyager*, this was last done in 2000. Since then, amendments have been implemented through contradictory SMSOs which diluted a number of the manual's requirements. This, and other factors, including the spacing of the deck securing points and the strength of lashings stipulated, indicates that the cargo securing manuals for the HSS 1500 ferries require re-validation. Furthermore, in view of the evidence of HSS vessels regularly sailing before all vehicles have been secured, it would be prudent for Stena Line to confirm that its HSS crews are able to meet the requirements of the cargo securing manuals within the turnaround times currently scheduled.

2.10 ONBOARD AND COMPANY EMERGENCY PROCEDURES

The master's understanding of the damage caused by the accident and the risks presented by the road tanker, led to his assessment that his ship and its passengers and crew were in no immediate danger. He successfully manoeuvred his vessel out of the ferry channel into deeper water, which allowed his crew the opportunity to secure the vehicle and stabilise the situation before he returned to the berth.

The passengers were kept informed of the situation and the master initiated the company's emergency response procedure. However, the coastguard was not made aware of the vessel's predicament until notified by the BBC. Regardless of whether an emergency appears to be under control, the situation might change quickly and without warning. Therefore, it is always better to alert the coastguard, and have assistance made available if required, than it is to call for assistance when it is possibly too late.

The delay in informing the master that the '*doors open at sea*' alarm had activated, and the master's lack of awareness regarding the status of the stern door until the vessel berthed alongside indicate that the information flow among the bridge team, and between the bridge and the vehicle deck, was not fully effective. Potentially, this could have adversely affected the response to this situation and underlines the need for good communications between members of the bridge team to be maintained at all times.

The lack of a suitable gangway in Stranraer to disembark the vessel's passengers, although inconvenient, is not considered to have seriously impacted on the passengers' safety. In the event of an onboard emergency while alongside, the passengers could have disembarked by the vessel's marine evacuation system or, albeit more slowly, by her fast rescue boat.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENDATIONS

1. The driver of the road tanker did not apply his brakes or leave his vehicle in gear as indicated on signs posted on the vehicle deck. [2.3.1]

2. The road tanker had not been parked or secured in accordance with the guidance in the applicable codes of practice or in the instructions given in the vessel's cargo securing manual. [2.4.2, 2.5, 2.6 and 2.8]

3. The ferry securing rings fitted to the road tanker did not comply with either the applicable international and national codes of practices or meet the relevant international standards. [2.7]

4. The majority of freight vehicles arriving for embarkation on ferries in UK and other European ports do not have the recommended number of ferry securing rings fitted, and a significant percentage has no securing rings. [2.7]

5. Commercial pressures make it difficult for ferry operators to unilaterally enforce a requirement for freight vehicles to be fitted with securing rings. [2.7]

6. The number and interval of the securing points fitted on the deck of the vessel did not meet the guidelines contained within the applicable international and national codes of practice. [2.8]

7. Changes made to onboard procedures for the securing of vehicles, which diluted the requirements contained in the vessel's cargo securing manual, had not been approved by the MCA. [2.9]

3.2 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE NOT RESULTED IN RECOMMENDATIONS BUT HAVE BEEN ADDRESSED

1. Stena Line did not require drivers of articulated vehicles to apply the semi-trailer parking brakes. [2.3.1]

2. The MSL of the lashings used on board *Stena Voyager* was half that approved by the MCA. [2.4.2]

3. The maintenance regime for the lashings was ineffective; the residual strength of the lashings used to secure the road tanker was less than 50% of the design breaking strength. [2.4.2]

4. The cargo securing practices of the deck crews were not subject to routine scrutiny by the officers on board *Stena Voyager*. [2.8]

5. The coastguard was not informed of the incident, and the communication within the bridge team was not fully effective. [2.10]

SECTION 4 - ACTION TAKEN

The **Marine Accident Investigation Branch** has:

1. Published a safety flyer to advise the ferry industry of the circumstances of this accident and promote best practice.

2. In its investigation report into the grounding, and subsequent loss, of the ro-ro cargo vessel *Riverdance*, Shell Flats – Cleveleys Beach, Lancashire, on 31 January 2008 (report No 18/2009, published on 3 September 2009), made the following recommendations to:

   The **Department for Transport** and the **Maritime and Coastguard Agency** to:

   2009/153 *Conduct an urgent study into stability and operational issues which impinge on the safety of ro-ro vessels operating from UK ports. In particular, the study should identify how the stowage plan should be produced and implemented, how masters can establish the stability of their vessel before sailing, and under varying conditions of service, the securing of trailers, and the securing of cargo within trailers to prevent their movement whilst at sea.*

   The **Road Haulage Association** and the **Freight Transport Association** to:

   2009/154 *Provide guidance to shippers on the additional securing of cargo onto trailers intended for shipping by sea to withstand the dynamic forces that may be experienced.*

Stena Line UK has:

- Provided additional deck securing points adjacent to the stern doors.
- Sourced a more robust rubber wheel chock to replace those used on board the HSS 1500 vessels.
- Instructed its deck crews to seek confirmation that the parking brakes have been applied on the vehicles parked at the forward and aft end of each lane.
- Introduced a requirement for parking brakes to be applied to all elements of a road vehicle.
- Designed and fitted vehicle restraint barriers adjacent to the stern doors of its HSS 1500 vessels.
- Reviewed and amended its HSS 1500 cargo securing manuals and submitted them to the MCA for approval.
- Instructed its first officers to conduct at least one random inspection per day of the securing arrangements on the vehicle decks.
- Conducted a survey of all web lashings held on board the HSS 1500 vessels.
- Individually marked its web lashings and stipulated a working life of 5 years.

- Ordered a gangway for use during unconventional berthing operations at Stranraer.
- Conducted a review of its emergency response procedures.
- Programmed bridge team resource management refresher training for its officers.

Since the accident, Stena Line has sold *Stena Discovery*, but continues to operate *Stena Voyager* and *Stena Explorer*.

The **Maritime and Coastguard Agency** has:

- Undertaken to review its current guidance on the securing of vehicles on ro-ro vessels with a view to emphasise or include specific advice on lashing points and chocks if necessary.

The **Department for Transport** has:

- Stated its intent to update the current guidance in its *Safety of Loads on vehicles* code at the earliest opportunity and to propose to the European Commission that similar guidance is included in its *Best Practice Guidelines on Cargo Security*.
- In the meantime, it intends to produce a short information sheet to serve in lieu of a formal revision.

The **Freight Transport Association**, the **Road Haulage Association** and the **Society of Motor Manufacturers and Traders** have:

- Undertaken to inform their members of the safety issues raised in this report and emphasise the need for compliance with the ISO 9367 standards when transporting freight vehicles by ferry.

SECTION 5 - RECOMMENDATIONS

The **Vehicle and Operator Services Agency** and the **Maritime and Coastguard Agency** are recommended to:

2009/164 Conduct a co-ordinated programme of roadside/dockside inspections of freight vehicles presenting for shipment at UK ports, to identify those vehicles that do not comply with the IMO and MCA guidance on ferry securing arrangements, and take any appropriate actions available to increase levels of awareness and compliance.

The **Maritime and Coastguard Agency** is also recommended to:

2009/165 Review the cargo securing manuals of all UK flagged HSC carrying freight vehicles to ensure compliance with the numbers of lashing points required in the UK Code of Practice.

2009/166 At the next SMC audit or EU Ferry Directive (1999/35) survey of all UK-flagged freight-carrying ro-ro ferries and all foreign-flagged freight-carrying ro-ro ferries operating to UK ports, check the cargo securing arrangements to confirm that:

- Onboard practice is in line with the approved cargo securing manual and the procedures detailed in a vessel's safety management system.
- Shipboard procedures include measures to verify that the parking brakes of all vehicles, including semi-trailers, have been applied.

Stena Line Ltd is recommended to:

2009/167 Seek assurance through operational trials/inspections that, following the implementation of its safety manager's recommendations, the crews on board its HSS 1500 vessels are able to stow and secure all vehicles in accordance with the cargo securing manual prior to leaving the berth within the scheduled turnaround times.

Turners (Soham) Ltd is recommended to:

2009/168 Ensure all its freight vehicles intended for shipment by ferry are fitted with ferry securing rings in accordance with the guidance given in the ISO 9367 standards.

Marine Accident Investigation Branch
October 2009