GOG ROPES

Industry Advice

BTA

UKMPA

wa
The Workboat Association

This information guide has been produced by the British Tugowners Association (BTA), UK Maritime Pilots' Association (UKMPA) and Workboats Association (WA) following the tragic case involving the CMS BITER and HEBREDIAN PRINCESS.

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Table of Contents

Terminology

Angle of deck edge immersion	The heeling angle at which water will enter the main watertight deck
Angle of down flooding	The heeling angle at which water will enter the vessel through large openings
Angle of vanishing stability	The specific angle of heel beyond which a boat will not right itself and will likely capsize. Also known as the limit of positive stability (LPS)
Athwartships	A direction or position at right angle to the vessel's length. (sideways)
Capsize	When a vessel is heeled to any angle from which it cannot recover without assistance in an athwartships direction
Down-flooding	Flooding through openings that are normally above the calm water level
Girting	The action of capsizing a tug caused by high athwartships towline forces (also referred to as girding or tripping)
Gog rope	A rope or wire used to shift the towing point aft on a tug to aid prevention of athwartships towline forces (also referred to as a gob rope)
Gogging down	The act of moving the towing point astern by hardening up on the gog
Gog winch	A winch to heave or pay out the gog line that can be controlled remotely
GZ	A stability arm or righting lever, the force trying to push a heeling vessel back upright
Heeling	The inclination of a vessel by one or more external forces
Heeling Arm	The lever arm that causes the vessel to heel under external force
Intact Stability	Stability of a vessel in normal conditions, contrary to damage stability
Intact Stability Criteria	Criteria that vessels in normal operation adhere to
Minimum Breaking Load (MBL)	The minimum force that must be achieved before risk of failure or breaking
Pilot Exemption Certificate (PEC)	An exemption for a master that removes the requirement for a pilot in a specific port
Righting Moment	The moment tending to return a vessel to the upright, being the product of vessel weight and righting lever
Speed over ground (SOG)	The speed of a vessel relative to the ground/earth
Speed over (through) water (STW)	The speed of a vessel relative to the body of water it is in
Staple	A strong point on a tug used to run the gog line through on a conventional tug (also referred to as a gog eye/ring or bitts)
SWL	Safe working load, the maximum force that can be handled without the risk of failure or breaking
Towing point	The point of application of the towline force
Turning moment	The turning effect produced by a force acting on an object around a pivot point

Foreword

Towage by its very nature is 'high risk', bringing together two or more vessels of differing sizes and power, often whilst under pilotage, within close proximity of each other and ordinarily in restricted areas of navigation that demands the highest levels of skill & co-operation between those involved.

Whilst there has been an increase in the number of large, modern tugs with robust design, advanced propulsion and operating systems - it remains that the largest numbers of tugs in use today are of conventional design and propulsion.

The rapid girting and subsequent sinking of the tug CMS BITER and the loss of life that followed, is a stark reminder of the dangers of towage. Sadly, this was not an isolated incident, and following MAIB recommendations, industry stakeholders have jointly collaborated to review (conventional) towage operations such that all of those involved, be it masters, crew, pilots and port authorities are best informed of the capabilities and limitations of tugs, particularly when utilising conventional towage methods.

Monitoring tow speed and understanding the correct use of a gog rope is an essential means of managing towline angles and preventing girting. The valuable input of the Workboat Association, British Tugowners Association and UK Maritime Pilots' Association should be recognised for their collaboration and continual drive to improve maritime safety.

To all those involved in towage operations, I commend you to read and distribute this guidance, for **we owe it to all those who have been lost, injured or affected through towage incidents.**

Richard Brooks FICS FNI
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Chair, Workboat Association
Executive Committee member, BTA
Tug Operator

Introduction

> Girting is the most prevalent reason for tugs to capsize and in most cases leads directly to fatalities… Rarely does girting happen slowly enough to allow all the crew to leave the tug before it capsizes (Shipowners, 2015).

The aim of this guidance is to raise awareness on the safe and effective use of gog rope systems to reduce the occurrence of girting incidents experienced during conventional towage.

It also highlights the key elements of conventional towing and sets some questions to prompt direct thought when towing and utilising a gog rope system.

Throughout the guidance there are links to relevant information, videos and reading, all of which supplement the topic. A full list of further reading and direct web address for the links is located at the end.

Girting

Girting (often referred to as 'Girding') occurs when a tug is pulled sideways by a towline force. It can develop rapidly, often leaving insufficient time or capacity to introduce slack into the towline or release the tow before the heeling force becomes excessive and surpasses the vessel's righting ability.

Such circumstances can, more often than not, result in the tug capsizing, frequently with fatal outcomes. These short videos explain more:

Tug Girting - Marine Transport Safety Board of Canada

FIGURE 1. Tug in trouble

Gog Ropes, a Brief Explanation

Gog ropes are ropes, lines, or wires used on tugs to control the towline's movement during ship assist and deep-sea towing. On conventional tugs, the gog rope holds the towline near the stern, shifting the towing point aft and reducing the risk of the towline crossing the beam—which can create dangerous heeling forces and potentially girting (capsizing) the tug.

FIGURE 2. Stern tug with gog

FIGURE 3. Bow tug with gog

Conventional Towage

Conventional towage is a term used to describe the use of tugs with traditional propellers, rudder(s) and either a towing hook or towing bollard. They are numerically the most common tug form in existence, although they are far less manoeuvrable than specifically designed modern alternatives (e.g. ASDs, ATDs). Often less wide in design than modern ship-assist and escort tugs, which causes them to have less inherent transverse (athwartships) stability.

Towing Point

The towing point is where the towline runs in a straight line from the tug to the ship and is crucial for tug safety and stability. Its position significantly influences girting and capsize risks.

On conventional tugs, the towing point is usually near midships with propulsion aft, a setup that increases the risk of girting.

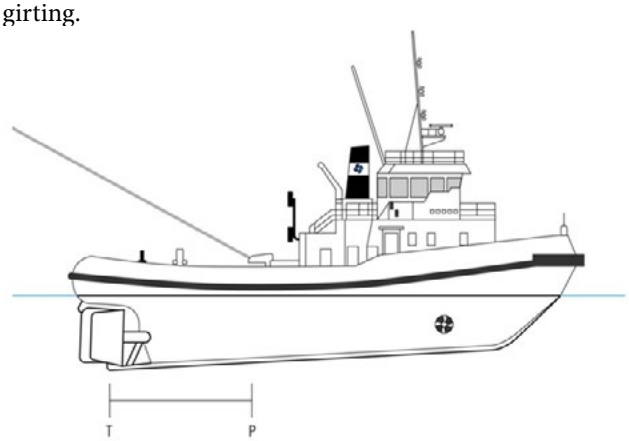

FIGURE 4. Pivot point - no gog

The height of the towing point influences vessel heel during towing. A higher towing point increases heel, so positioning the towing point lower can reduce this effect. Many towing hooks on conventional tugs are designed to move freely in both azimuth (from port midships, through the centreline astern, to starboard midships) and vertically, which can amplify heeling forces if towing is performed directly from the hook without using a gog line.

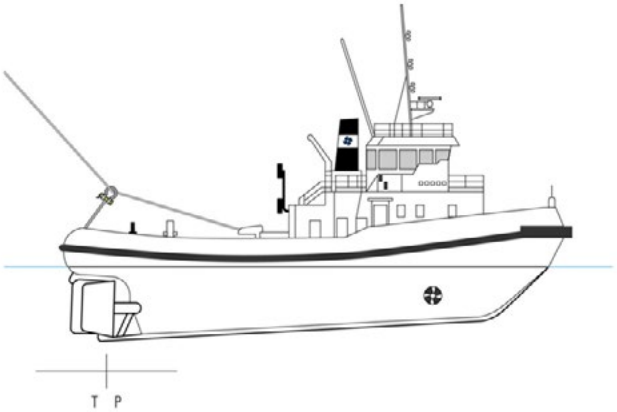

FIGURE 5. Pivot point - gog line in use

Small conventional tugs typically possess less power and manoeuvrability compared to larger harbour tugs, increasing the risk of capsizing if the tow cannot be adequately controlled.

To mitigate the risk of girting, a gog line is used to shift the towing point from the midships—where the winch or towing hook is usually located—to the aft end of the tug. This adjustment creates a longitudinal movement, transforming the towline's influence from a heeling moment to a turning moment.

Gog Rope Systems

A gog rope is essential for tug safety during towage operations. As such, the gog rope must be considered as a gog system and not just a line or rope. All the components of that system must be arranged so that any potential point of failure are fully understood and managed.

A gog rope should be treated like a towing rope and should be a specific rope, used only for the purpose of providing a gog.

To help reduce the risk of conventional towage, regularly inspect, test, and maintain the gog rope, winch or towing hook, gog eye, bollards, emergency release, gog winch, and shackles, replacing any deficient components of the system as needed.

Key Element	Description
Inspection routines	Inspect for damage and wear before and after operations.
Track and record the use	Maintain a towing log to accurately document the frequency and purpose of the gog's usage.
Retirement schedule	Limit the number of operations before retirement and replacement.
Certification	Know the ropes SWL/MBL and general characteristics of all parts of the gog system.
Testing of towing hooks	Test and document the quick release mechanisms for the towing hook—both local and remote—to ensure they operate smoothly before starting towage operations.
Maintenance of towing hooks	Planned and recorded
Testing of gog winch	Test and document the gog winch quick release mechanisms locally and remotely; ensure all are operating properly before starting towage operations.
Maintenance of gog winch	Planned and recorded

The BTA has a guide to the selection and maintenance of towing gear.

Rope Selection, Procurement & Usage - BTA Guidance

A gog line managed with a winch that can be operated from inside the wheelhouse, reduces direct handling of tow gear that could be under tension and at risk of parting, including potential snap back, and will help maintain watertight integrity.

The gog arrangement must be secured in such a way that it is able to withstand the extreme forces that could be exerted on it, and it must ensure that the towing point remains close to the stern of the tug. Towing staples or bitts are used to run the gog rope through and keep the towing point aft, they are most effective at lower deck level, close but remaining above the waterline.

The figure below illustrates a tug rigged with a gog rope, though the gog rope is not pulled tight to the staple (gogged-down), it may have been eased to allow the vessel to turn whilst loaded as necessary for a certain manoeuvre.

In this instance, the gog rope length can be controlled using the gog winch from the wheelhouse. The tug master is balancing a little more manoeuvrability whilst keeping the towline force as far away from midships as possible - but not to the very aft of the tug, which would inhibit turning ability.

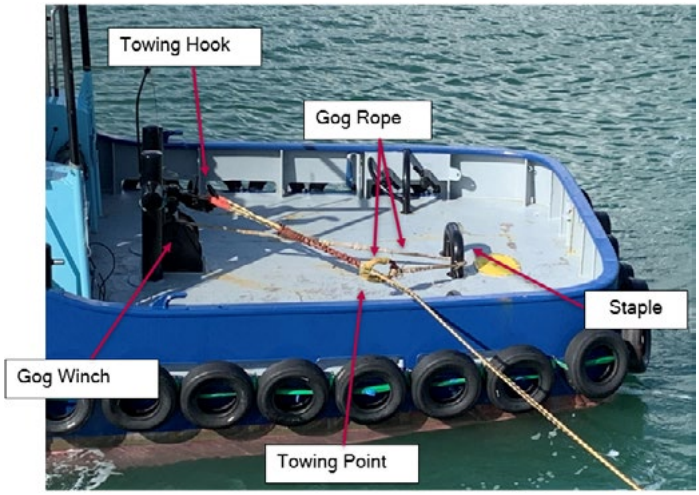

FIGURE 6. Gog rope rigged with all key elements

Safe Speed

Towage should always be performed at a safe speed. Conventional tugs have narrower safety margins in towage operations compared to modern omnidirectional tugs.

Conventional tugs are at increased risk of girting when serving as stern tugs or brakes at speeds over 3 knots (STW) during towing. Stern towage should ideally be carried out at around 2 knots, including the connecting phase that initiates the tow operation.

It is vital that the speed of the tug and assisted vessel are low as any failure of the tug's engines, steering or other equipment could contribute to the tug girting if the tug is manoeuvring at higher speeds.

The United States Coastguard's **Navigation and Vessel Inspection Circular (NVIC) No. 12-83** published the results of research on intact stability criteria for towing and fishing vessels.

This research showed that the heeling force exerted on a tug was proportional to the square of the towing speed.

The heeling moment generated at 4.6kts was more than twice that generated at 3kts and five times that generated at 2kts.

Towing speed (tug velocity)	Factor affecting resultant heeling force: drag = *velocity*^{2}
2	4
3	9
4	16
4.6	21.2

FIGURE 7. Towing speed vs factor affecting resultant heeling force

Communication

Even when a gog system is properly rigged, it is essential to establish and maintain clear, open, and professional communication between the tug master and the pilot or vessel's master throughout the towage operation.

A comprehensive exchange between the tug master and the pilot or pilot exemption certificate holder is crucial. This process ensures that both parties clearly understand the operational plan, as well as the capabilities and limitations of both the tug and tow.

If no tug master/pilot or PEC holder exchange occurs as you near the tow, speak to the pilot and ensure it happens before connecting. Abort the operation if the exchange does not take place.

Action	Completed	Verified
Confirm tug name(s), type and Bollard Pull (BP)		
Agree rendezvous time, position to make fast and safe speed		
Agree safe position for passing heaving line forward.		
Check SWL of bollards and leads are sufficient for expected towline forces.		
Identify location of tugger winches / drum ends to assist heaving of towlines (particularly important when assisting vessels with high freeboards)		
Advise tug of the SWL of Assisted Vessel's bollards		
Agree communication method between tug and pilot for determining requested level of thrust		
Confirm safe heaving line will be used		
Discuss back up communication arrangements		

FIGURE 8. Pilot - Tug Master exchange checklist

The pilot will also conduct a master – pilot exchange onboard the tow as per the below table.

Confirm:	Completed	
Tug(s) names, type, BP, securing intention and assess any positioning risks		
VHF Ch, Rendezvous Position, Environmental limits, STW limits and order of Securing		
SWL of fittings, ship limitations/deficiencies, means of securing & verify not DWHL		
Planned manoeuvre & agree safe STW for all stages and any change of tug role/position		
Disconnection process and agreed safe STW		
	MPX	PTX

FIGURE 9. Master - Pilot exchange checklist

Conventional Towing

Conventional (single or twin propeller) tugs require the most skills when it comes to manoeuvrability, i.e. the ability to turn around on its own axis quickly, which means that the tug master must anticipate the dynamics of an operation. (ETA, 2015)

MANOEUVRING WITH A GOG ROPE RIGGED

The tug remains gogged-down throughout the towage operation, unless the tug master needs to manoeuvre the tug and the gog is preventing this.

While running with the vessel to secure prior to berthing the tow, the gog line can be slacked to provide steerage while the tug is alongside.

The gog is only slackened if the manoeuvre is happening at a very low speed (i.e. 1.5 - 2 knots STW) and communication between tug and tow is maintained.

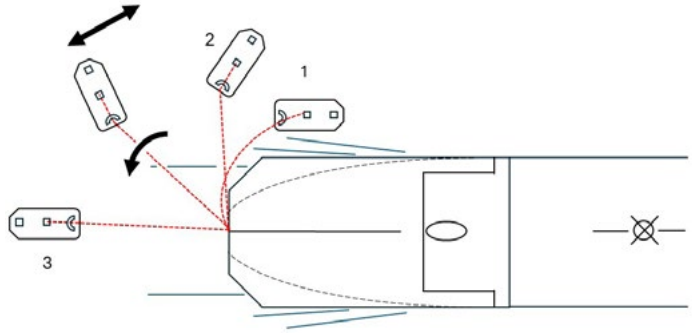

FIGURE 10. Making fast aft

This is repeated in reverse for a sailing, making fast when stationary and gogging down before slackening of the gog to provide steerage and manoeuvrer into a position to let go of the tow.

The figure below shows a tug with the towline under tension working as stern boat. The towline is low, due to the use of a deck level staple helping reduce heeling forces. The gog rope is set to allow the towline to move to either quarter, increasing manoeuvrability of the tug without allowing free movement of the towline towards midships.

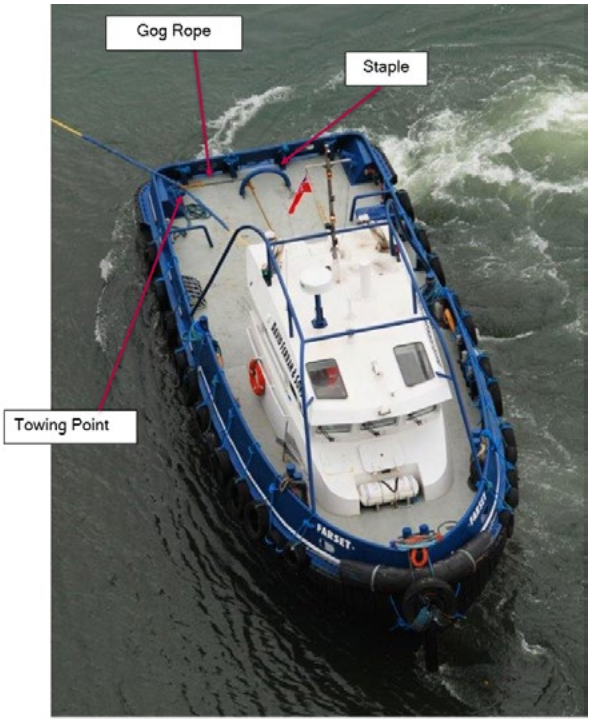

FIGURE 11. Aerial view of tugs gog arrangement

MANOEUVRING WITH A GOG ROPE SLACKED

FIGURE 12. Tug with gog slack

The figure above shows a tug's towing line connected directly to the towing hook with gog rope completely slacked. The force of the tow line acts at bulwark level directly abeam of the tug. An angle of heel will develop quickly should a force be applied (such as the tow increasing speed) when towing directly from the hook. The intact stability of the tug will rapidly reduce.

When a gog rope is not rigged or is rigged but slackened off the manoeuvrability of the tug is increased. However, it is essential that both tug master and pilot are aware the gog has been slackened off and that speed is of the tow is suitably low to minimise any angle of heel.

Effect on Stability

A vessel is designed to be stable in its designated area of operation. Whether it is designed to go to sea, or sail within sheltered waters, inland rivers etc. it accounts for the forces applied manoeuvring in a longitudinal 'fore-aft' direction. In these situations, the vessel should adhere to its general 'operational' stability calculations.

We can be confident that our vessel is safe to proceed with towage if we can prove by calculation or other method that the vessel will remain in a stable condition (intact stability) when adverse forces are applied in non-conventional directions – such as the perceived angles of towing force, and how much those forces will be.

The **International Code on Intact Stability** (IMO, 2025) began with the first non-mandatory Code issued in 1993 (resolution A. 749(18)), which was updated and made mandatory by the **2008 IS Code**, entering into force in 2010.

The following figure shows a standard stability curve as well as the GZ force (GZ = the force wanting to push the tug back upright) and its effect on a tug through progressive angles of heel.

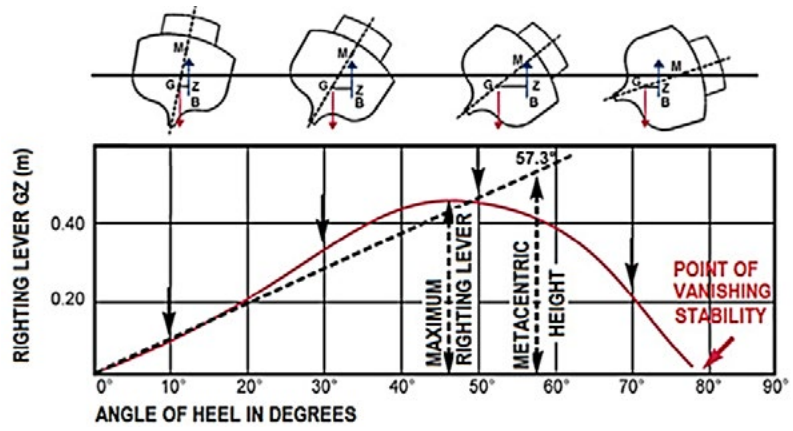

FIGURE 13. Standard Stability Curve

The GZ righting lever (distance between G and Z) rapidly decreases when the angle of down-flooding is reached, as depicted by the tug visuals on the top row of figure below. It is important for the tug master to know the angle at which down-flooding will occur. As the GZ (righting lever) reduces to zero, the vessel has now reached the angle of vanishing stability (AVS) and the vessel will theoretically continue to roll and invert/capsize, in most cases it will not recover.

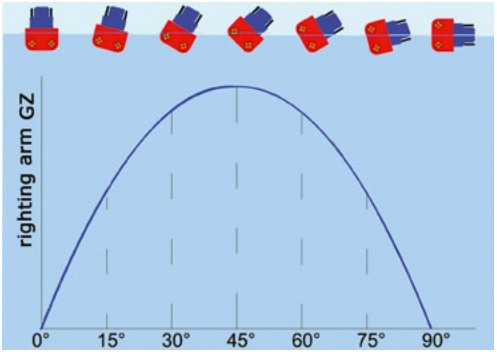

FIGURE 14. GZ and angle of down-flooding

When a heeling force is applied, in the case of this topic a towline, the tug should have enough reserve stability to remain in a stable condition in all assessed force directions, and in all assessed weather, sea state and STW conditions.

A change in heeling moment can be caused by:

1. The tow when the tug begins tripping, being dragged by the towline.
2. The tug due to a combination of its own actions – towing point movement, change in rudders, propellers, winches – all in combination with the hydrodynamic and external forces on the hull.
3. A combination of points 1 & 2.
4. Water ingress via down-flooding, damage or other.
5. External due to Allision, Collision, Fowling or Grounding.

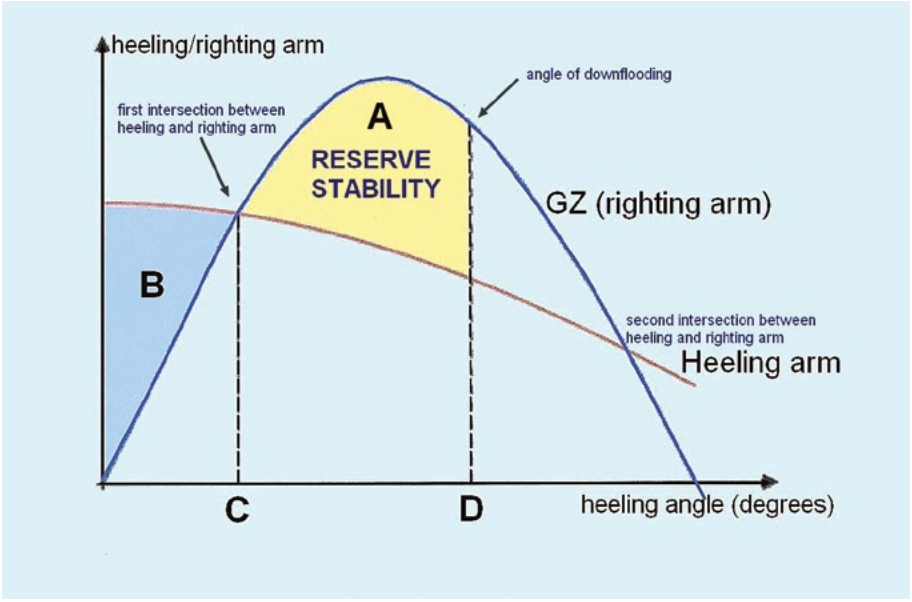

FIGURE 15. Stability curve and heeling arm

Many tugs are fitted with towing hooks that can move both vertically and horizontally. This shift in towing point can influence the heeling arm when the tug is not using a gog.

As the tow hook turns with the tow to one side or the other, the towing point equally moves away from the centre line of the tug horizontally. As the vessel then heels, the horizontal movement of the hook is then countered by the vertical movement of the hook which tries to bring the towing point back towards the centre line of the tug.

In summary, the benefits to stability created by the towing hook moving horizontally are effectively removed by the vertical shift of the towing hook. This can be seen in the figure below.

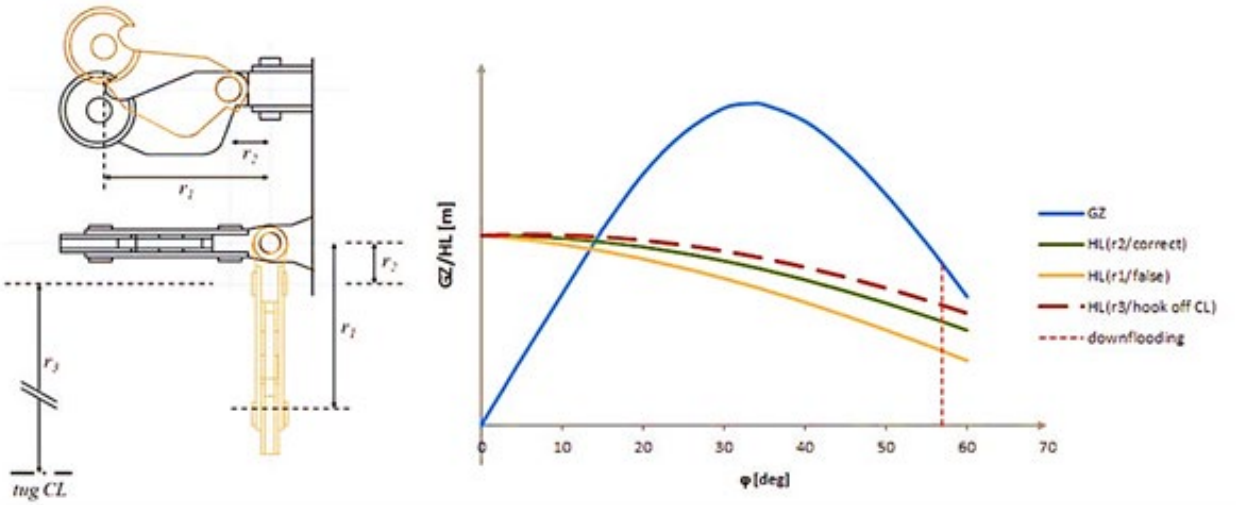

FIGURE 16. Effect of vertical movement of towing hook-on stability

Effect on Stability – Gog or No Gog

The difference between the effective tow point and load on the tug's hull over time can be shown below. When a gog rope is rigged the load on the tug decreases positions from A to D and the stern falls into the line of the tow.

The load increases from positions A to D when no gog line is present. This typically occurs in a matter of seconds leading to potentially fatal consequences.

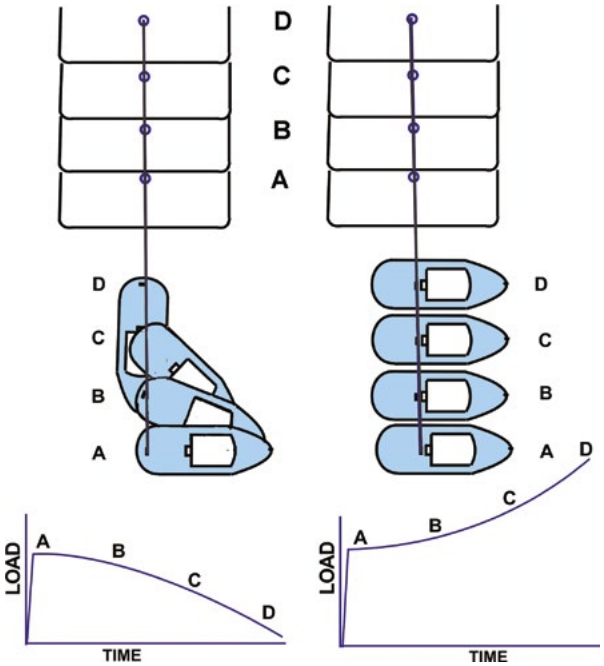

FIGURE 17. Difference in load on the towing point. Left with gog and right without gog

Summary

Conventional tug essentials

1. The tug master is in control of the action of his towline at all times.
2. Communication between tug and tow is adequate and constant. Each must understand what the other is doing and intends to do.
3. The whole operation is conducted at a safe speed – which may need to be determined and enforced by the tug master.
4. The tug master must take time to learn and know the limitations and characteristics of their particular tug.
5. Heeling angles can be reduced by moving the towing point aft and as low as possible.
6. All elements of the gog rope system are well maintained and good condition.
7. Means of releasing the gog and towline are in place and tested prior to towage operations
8. A towage plan with safe parameters has been agreed with the pilot
9. Has the appointed pilot suitable level of experience in conducting conventional towage operations
10. Has the port authority ensured that there is a suitable platform for training pilots to use conventional tugs including exercises with pilots.

A correctly rigged gog line in good condition and thorough knowledge of the characteristics and operational capabilities of your tug could well prevent your tug from capsizing and could save your life.

Questions

Here are some questions to ask yourself in relation to your tug, towing gear and port. If you can't answer these questions go and find out the answer, it may save your life.

Your vessel

- What are the characteristics of your tug?
- What are your tugs limitation?
- Do you have a speed indicator within sight and is it working?
- Have you read your stability book?
- What is your angle of deck edge immersion?
- What is your angle of down flooding?
- How and when do you confirm watertight integrity?
- What are the weather constraints for towage operations on your tug?

Your gog rope system

- Do you have a dedicated gog rope, gog eye and tow rope?
- Do you have relevant Certification for all elements of the gog rope system?
- What are the SWL for all elements of the gog rope system?
- Have you considered the relationship between the towline, gog and staple in terms of breaking strain when used together as a system?
- Do you have a record of towage operations onboard including us of the gog rope and tow rope?
- How do you release the gog in cases of emergency or adjusting the length?
- What is the established a safe speed to adjust your gog line?
- Do you log the towage operations conducted by master, mate or trainee?

Your port

- Do you have agreed plans for communications between tug(s) and tow?
- Do you have access to the towage guidelines for the port you are operating?
- Do you have weather parameters for towage operations in the port you are operating?
- Has your company contributed to towage risk assessments for the port?

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Further Reading

A report on the investigation of the capsize and foundering of the workboat/tug Trijnie with the loss of one life in the approach channel to Milford Docks, Milford Haven, on 8 September 1998
Marine Accident Investigation Branch

Report on the investigation into the loss of the tug Ilsselstroom in the port of Peterhead 14 June 2009
Marine Accident Investigation Branch

Report on the investigation of the collision, capsize and foundering of the tug Chiefton with the loss of one crewmember at Greenwich Reach, River Thames on 12 August 2011
Marine Accident Investigation Branch
Annexes to CHIEFTON Report

Report on the investigation into the girting and capsize of the mooring launch Asterix at Fawley Marine Terminal, Southampton, UK 30 March 2015
Marine Accident Investigation Branch

Capsize of tug Domingue while assisting CMA CGM Simba resulting in two fatalities Tulear, Madagascar 20 September 2016
Marine Accident Investigation Branch

GIRDING AND CAPSIZING Tug George H Ledcor North arm of the Fraser River, British Columbia 13 August 2018
Marine Transport Safety Board of Canada

Report on the investigation of the capsize and sinking of the tug Biter with the loss of two lives, while assisting the passenger vessel Hebridean Princess off Greenock, Scotland on 24 February 2023
Marine Accident Investigation Branch

Tug and Tow - A Practical Safety and Operational Guide
The Shipowners Club

Tug Stability: A Basic Guide for Masters, Annex II to the WBA "Use of Workboats for Towage: Good Practice Guide", 2018
Workboat Association