

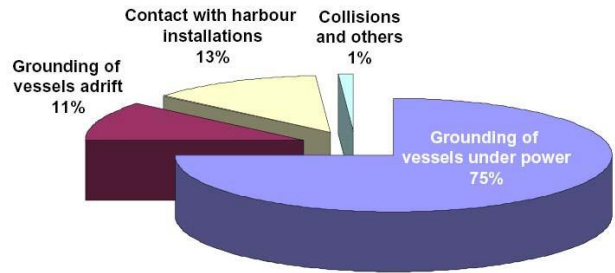
TUG ESCORT

for emergency steering and braking



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Reducing the risk of grounding

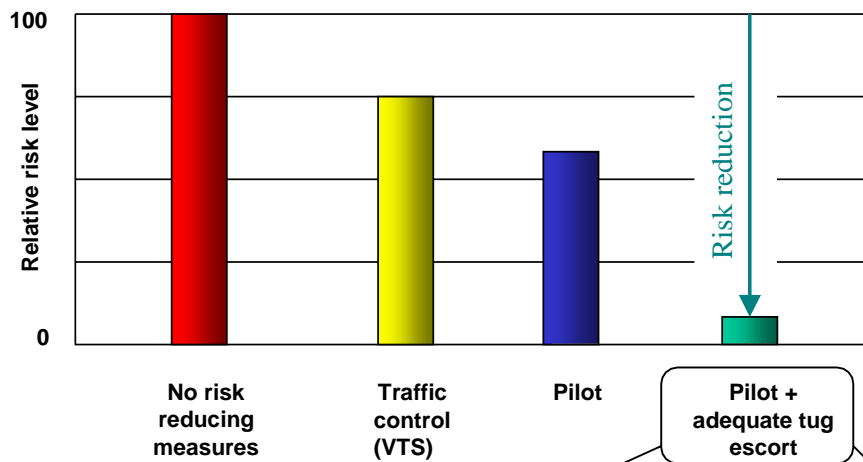


Causes of ship accidents in approaches

Grounding represents the predominant risk of ship accidents in approaches and narrow fairways. Hence prime focus should be placed on means for reducing the risk of grounding.

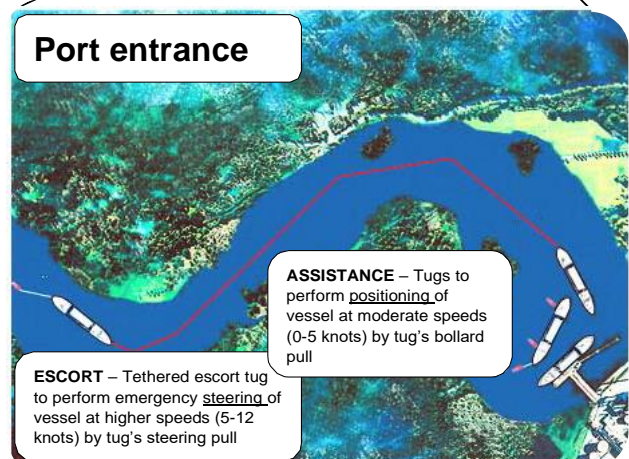
Comprehensive risk assessments have been made by Det Norske Veritas focusing on grounding. Specific risk reducing measures have been studied. Based on objective navigational facts and statistical data, fault tree analyses indicate the potential risk reduction by various measures, as shown below:

Representative effects of risk reducing measures



A certified escort tug is proven to be the single most effective tool for reduced risk of grounding.

Such tug will also be designed for excellent performance in push/pull mode.



Actual and required tug steering pull

The certified steering pull of "Boxer" is a good example of the considerable tow line pull generated mainly by the hydrodynamic forces derived from the water flow around the forward fin of BB's escort tugs:

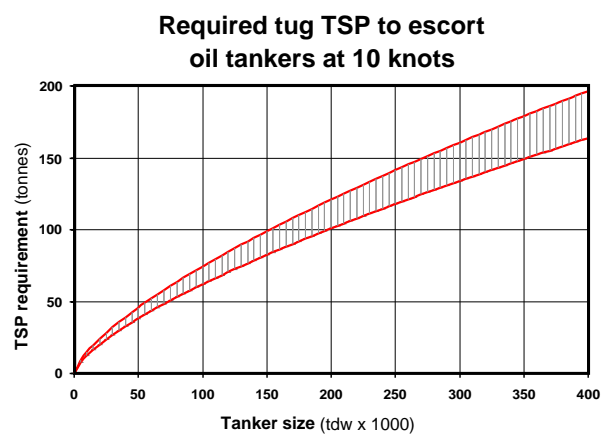
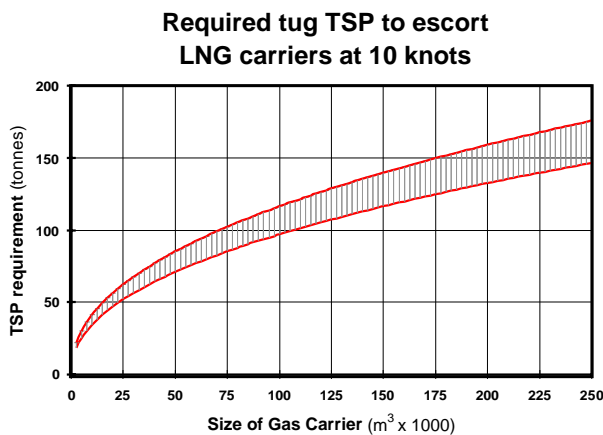


Certified tonnes steering pull (TSP) exerted by 68 TBP Fin First escort tug "Boxer"	
Tug speed	TSP
6 knots	90 t
8	125
10	148
12	160
15	170

Each ship has unique steering characteristics. The below table illustrates the rudder forces generated by two typical oil tankers (reference "Tug use in port" by Capt. Henk Hansen and study at Sture Crude Oil Terminal, Norway):

Tanker speed	100,000 dwt oil tanker Rudder angle:		200,000 dwt oil tanker Rudder angle:	
	15°	25°	15°	25°
6 knots	30 t	45 t	50 t	60 t
8	55	75	85	115
10	85	120	130	185
12	120	175	190	260

IMO has issued rules for ships' maneuverability (IMO 751 – 10/10 zigzag maneuver criterion). To provide maneuverability corresponding to these rules, the escort tug requires minimum steering pull (TSP) as indicated below:



Tug design for emergency ship steering and braking

A large ship navigating in confined waters is faced with many hazards, including the risk of collision or grounding which may have severe environmental consequences.

A major oil spill may be very expensive to clean up and it may take many years for nature to restore the environmental balance.

Adequate tug escort has proven to be a highly effective risk-reducing measure for ships entering and leaving port.

For decades Buksér og Berging (BB) has focused on preserving the environment and property through the provision of superior tug design and continuous crew training.

The Fin First escort tug developed by BB is an example of this commitment to marine safety. The foil-shaped fin is mounted under the bow. Two Voith propellers with a damping nozzle plate and struts are positioned abaft midship.



DNV classification ensures adequate tug escort

The definition of **adequate tug escort** is the ability to perform emergency steering of the escorted ship by a tethered escort tug able to exert steering force to counteract the rudder force of the escorted ship. Tug steering force together with operational procedures for pilots and tug masters is a well proven risk reducing measure.

Det Norske Veritas (DNV) has issued rules for escort tug classification, which include special requirements for:

- Full-scale measurements of steering pull, maneuver time and speed
- Static and dynamic stability
- Tension winch

All BB's Fin First escort tugs comply with DNV escort class, stating TSP at given escort speeds.

