

ShoreTension: secured to shore at all times

The affordable solution for safe mooring in severe conditions

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The birth of ShoreTension Mooring System

Together with the Rotterdam Port Authority, the Royal Boatmen Association Eendracht (KRVE) has developed the ShoreTension System.

ShoreTension is a mooring system used for mooring of sea-going vessels. The basis for the development was dramatic environmental and economic losses in a number of ports caused by drifting ULCVs. Therefore, the Rotterdam Port Authority required proper action and innovations. Ports have to deal with larger vessels with bigger lateral surfaces, i.e. ULCVs and cruise liners. Also due to climate change, the world faces more extreme weather conditions. The problem of safety is the so-called "mixed mooring", which means the ropes paid out do not always equal the same tension as the ropes that are paid out by the tension winches on deck of the vessel concerned. In other words: the safest way to moor a vessel is making sure that all ropes which are paid out are at the same tension so they work together as one.

How does ShoreTension work?

ShoreTension is a hydraulic mooring system that automatically keeps mooring cables tense in severe conditions such as suction caused by passing ships, severe weather conditions and swell. It also prevents mooring cables from breaking in the case of on-/offloading and tidal differences.

The system is placed on the quay side in between two bollards. One end is fixated to the quay bollard while the ship's line is connected to the moveable part of the system. A second quay bollard is used for guiding the ship's line.

It only has to be activated once via a hydraulic system. After that it functions stand-alone without the need for external energy. This feature makes it easy to place the ShoreTension system anywhere on the quayside.

The ShoreTension system provides a high tension and pays out the line coping with the peak loads without exceeding the Minimum Breaking Load of the line (MBL). By doing this the system dampens the ship's motion and absorbs the energy of the ship. When the peak loads are over, the ShoreTension heaves in the line with the energy stored returning to its initial position.

Because the system doesn't require any external energy it is CO₂ neutral.

Advantages of the ShoreTension system:

- It prevents lines from breaking (fewer personal injuries)
- Fewer mooring accidents could theoretically result in lower insurance premiums
- It improves the stability of the ship while being moored
- It increases the safety and speed of on- and offloading
- It is versatile and can be installed on almost every quay or jetty
- It is able to provide a constant (high) tension up to 60 metric tons of force (600kN);
- It has a safe working load of up to 150 metric tons (1,500kN)
- It has sensors that register the loads in the ropes.
 - This data will be available for the ship's master, port and terminal operators
 - Data will be logged for review of berth



One end of the ShoreTension system is fixated to the quay bollard while the ship's line is connected to the moveable part of the system.

- A warning system can be set for when exceeding limits in force as well as displacement
 - GPS data provides an overview of where warnings are issued across the globe
- The system is certified by Lloyd's Register to operate under the conditions mentioned above, as well as in ATEX conditions.



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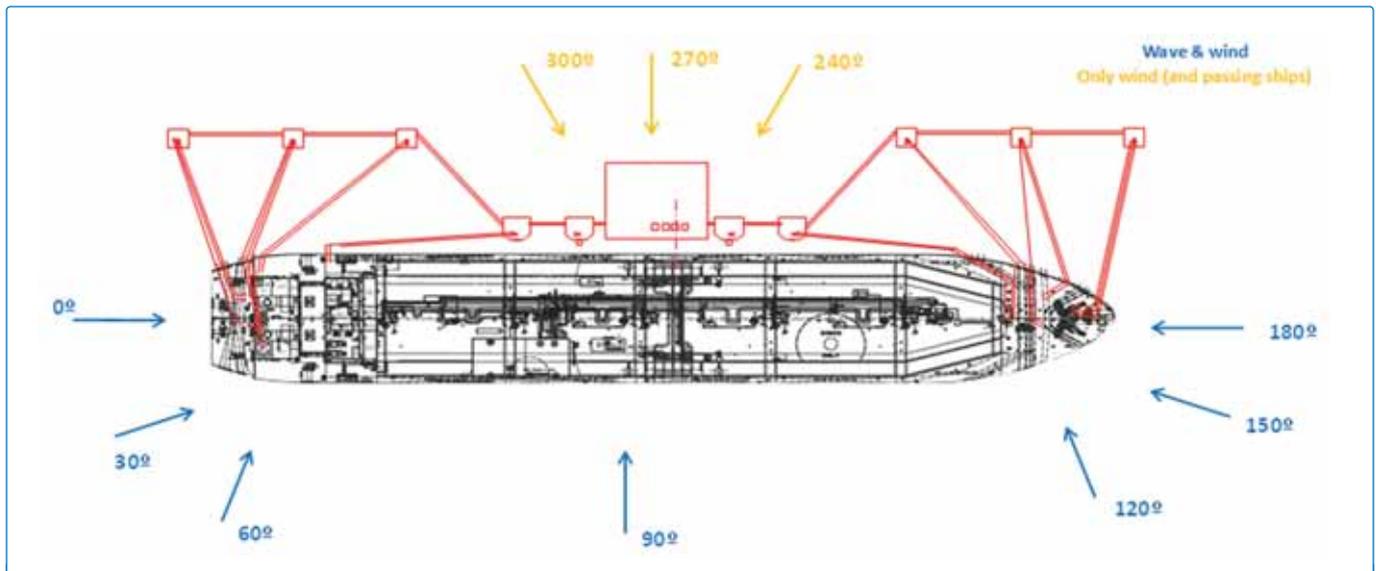


Figure 1. The direction conventions of the wave and wind conditions on a vessel at berth.

Developing the design

Currently we are developing an alternative ShoreTension system. A number of terminals have requested the option of a vertical ShoreTension system, so less space is required. The line will be connected via pulleys with the moving ‘head’. It also enables easier placement on bollards or mooring dolphins.

Simulations carried out by Arcadis NV

ShoreTension BV asked Arcadis Nederland NV (Arcadis) to carry out a dynamic mooring simulation study. One of the simulations

was carried out for a generalized LNG terminal. The ship concerned is a membrane 266,000m³ LNG carrier (LNGC).

In the project the LNGC is subject to passing ships and to severe wind and wave conditions. The direction conventions of the wave and wind conditions are summarized in Figure 1.

The regular mooring pattern of present day common practice has been compared to a mooring pattern with ShoreTension. The mooring patterns have been compared against internationally accepted guidelines. The results show that the ShoreTension significantly decreases the motions of the moored vessel and the

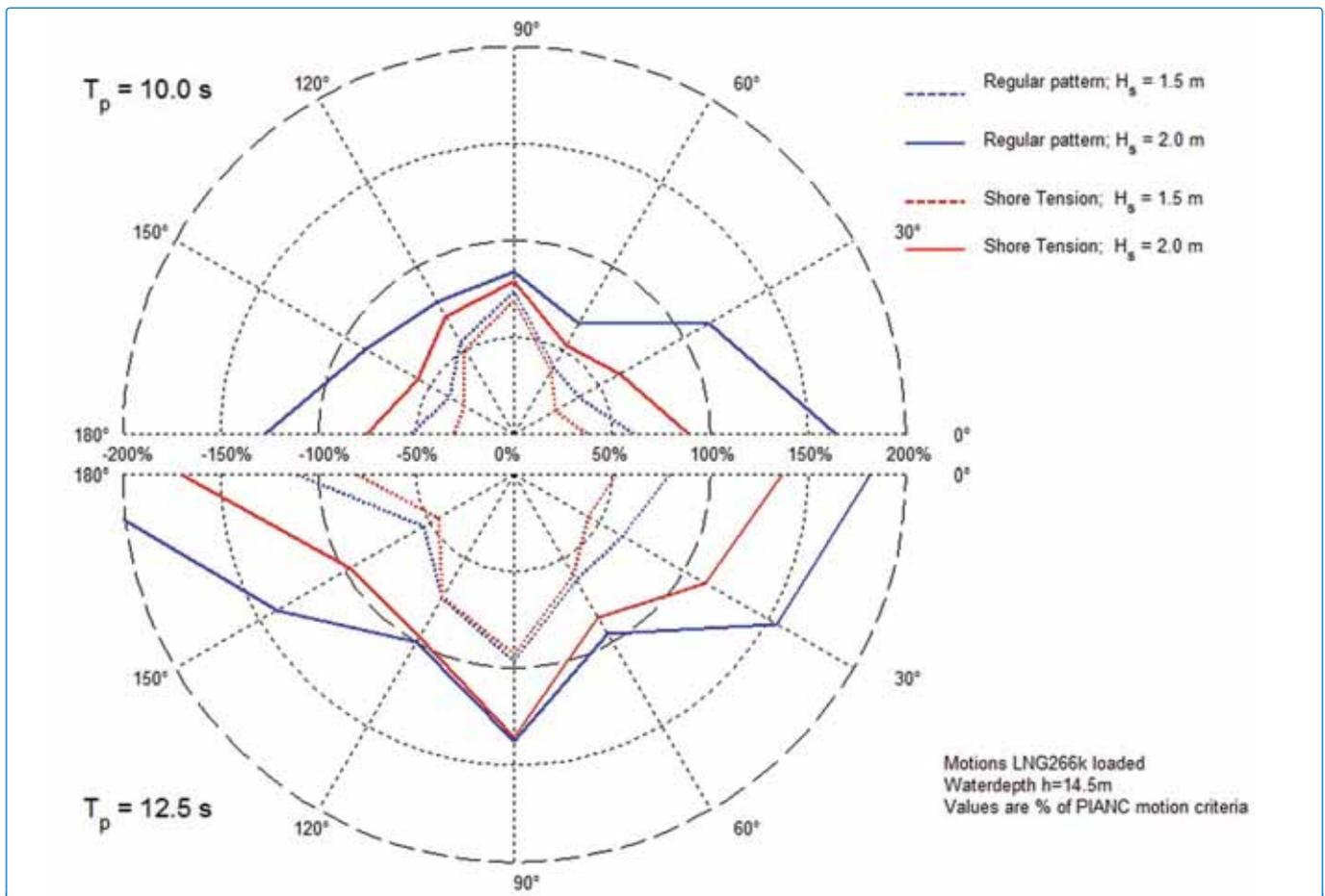
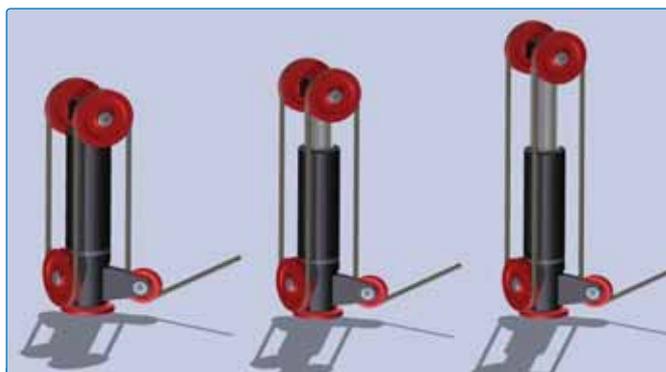


Figure 2. Results illustrating the movement of the vessel at berth for differing wave heights, for the regular pattern and with use of the ShoreTension system.



A new vertical version of the ShoreTension system is currently in development, which will make the design much more compact.

line loads of the mooring system at this generalized terminal for the following conditions (summarized):

- Passing ships
- Wind and wave conditions approaching the vessel head on (0° and 30°) and stern on (150° and 180°) – see Figure 1.

Part of the results is illustrated in Figure 2. The Figure shows two wave heights (dotted line: $H_s = 1.5$ m; solid line: $H_s = 2.0$ m) and two wave periods ($T_p = 10.0$ s in the upper panel; $T_p = 12.5$ s in the lower panel). The radii of the rose refer to the angles of incidence of the wind and waves. The radius (the values along the radii) presents the percentage exceeding the allowed PIANC motion criteria. Only the maximum value exceeding the surge, sway roll and yaw motion is used for the figure.

Conclusions drawn from the simulation

In view of this generalized study, the following conclusions are drawn on application of the ShoreTension on LNG terminals:

- For situations where berthed LNGCs are affected by passing ships, the loads in the lines can be decreased by application of the ShoreTension. For wind blowing from the jetty, the dedicated ShoreTension mooring pattern shows a reduction in both motions and line loads for most conditions analyzed.
- For moored LNGC subjected to head (0° and 30°) and stern (150° and 180°) wind and waves, the motions of the vessel are significantly less in the dedicated ShoreTension layout than in the regular mooring pattern.
- Conventional winches let mooring lines slip when the loads in the lines exceed the maximum holding capacity. In doing so, the conventional winches temporarily drop the tension in the lines and control over the ship is temporarily lost. This undesired behavior of the conventional winches has not been taken into account in the simulations. Another major advantage of the ShoreTension is that it keeps the lines under a constant high tension, providing permanent secure mooring of the ship.

ABOUT THE AUTHOR AND COMPANY

Gerrit van der Burg is the Resource and Development Director within the Royal Boatman's Association in The Netherlands. He has over 25 years of experience in the Port of Rotterdam with mooring all kinds of vessels and has developed the ShoreTension System.

The **ShoreTension System** finds its origin with the Royal Boatmen Association Eendracht (KRVE) in the Port of Rotterdam, an association that has undertaken the mooring and unmooring of all sea-going vessels in the Port of Rotterdam since 1895. ShoreTension BV is a sister organization and works in close cooperation with the Boatmen. We have over 115 years of mooring experience and have deep understanding of the problems that occur in a modern port.



Simulations carried out by Arcadis Nederland NV show that the system significantly decreases loads on the lines, and minimizes vessel movement at the berth.

Efficiency benefits

All parties involved by the call of a vessel benefit from the use of the ShoreTension system.

The ship owner is aware that his ship is safely moored and the turnaround time improves. The terminal cranes do not have to stop loading/unloading because the vessel does not move at all, which also means that the roundtrip in Europe can be done more slowly, which decreases fuel consumption.

The terminal has less downtime: the cranes can do their operations continuously because the vessel is completely fixed to the quayside. It also improves the efficiency of that particular quayside because the vessel only has to pay out breast lines.

The system is equipped with a pre-alert call in case of a possible critical mooring situation and gives real-time mooring information. The Port Authority is able to monitor the actual status of the mooring 24 hours a day. This is a great advantage for the safety of the Port.

REFERENCES

The ShoreTension approach has been recognized by various companies and terminals in the Port of Rotterdam, such as:

- Europe Container Terminals – Delta Terminal
- Ertsoverslag Europort C.V. – EECV Terminal
- Steinweg Handelsveem B.V. – Botlek Terminal
- Combined Cargo Terminals – CCT Terminal Moerdijk.

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