

CASE

# Mooring study at Copenhagen Port

Taking a new quay in use for large container ships require that the mooring lines, bollards and fenders are capable to withstand the resulting forces and movements, when the ship is exposed to wind, waves and current.



Copenhagen Malmo Ports (CMP) chose FORCE Technology to conduct a mooring study for container ships moored to a new quay to find the limiting environmental conditions for safe operation.

It is possible from a mooring study to find the limiting conditions for specific ships and mooring arrangement due to the influence from environment or passing ships and hence give an estimate of downtime based on environmental statistics. In this case a limitation on the longitudinal movement of the ship was of importance due to the land-based cranes' working limitations.

## Mooring study with SimFlex

To set up the mooring study CMP provided detailed information of the bathymetry, expected currents, tide and waves along with mooring line and fender characteristics.

A container ship was chosen from the extensive FORCE Technology database of ships and a mooring arrangement was set up and implemented in the SimFlex Navigator software system based on input from an experienced container ship captain.

A number of different combinations of wind, current and waves were conducted in fast time where each scenario was run for three hours and the results were compared to PIANC recommendation for safe mooring.

## Outcome

- Line forces
- Fender forces
- Time series of forces
- Operational limits
- Ship movements
  - › Heave
  - › Pitch
  - › Roll
  - › Surge
  - › Sway
  - › Yaw
- Time series of movements
- Statistics.

## Software

- SimFlex navigator.

## Scope

- Determine the forces in the lines
- Determine the forces in the fenders
- Determine the movements of the container ship
- Determine environmental limits.

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