



# Further wave-induced motions and loads on a LNG carrier at a terminal berth.

## Master of subsea engineering project findings



By,  
Thejus Prakash  
Post Graduate (Subsea Engineering)  
Curtin University

**Project Supervisor:**  
Dr. Tim Gourlay (PERTH HYDRO)

## Project objective

*The objective of the project is to conduct a time-domain mooring analysis of a LNG carrier at a generic terminal in North-West Australia, to assess the wave-induced motions, mooring line loads and fender reactions in comparison with recognized operability limits (OCIMF & PIANC) and determine the limiting sea states for safe berthing operations, by including the nonlinearities of fender and mooring lines stiffness characteristics.*

## Key outcomes

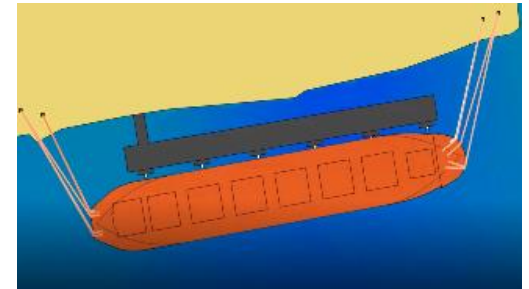
- Determine natural period (surge, sway, and yaw) of the moored vessel.
- Predict the wave-induced motion and loads.
- Determine limiting wave condition for the safe berthing operation.

## Softwares

**NEMOH** (Radiation & Diffraction)

**MoorMotions** (Perth Hydro)

- Fully-nonlinear time domain software.
- Wave induced motions and loads.



Source: Perth Hydro

# Inputs for the analysis

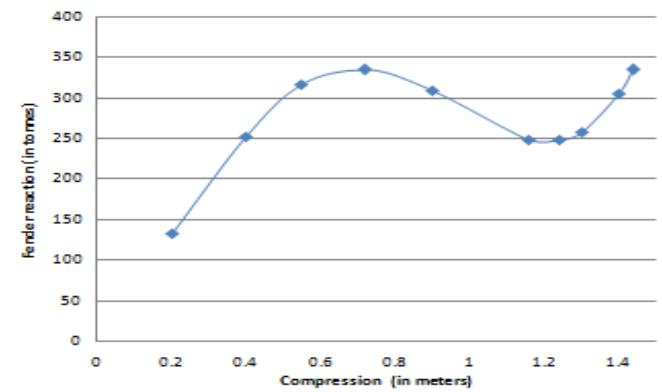
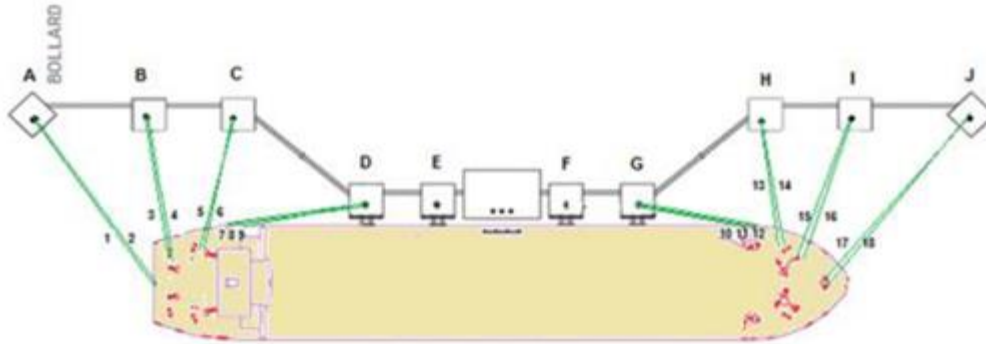


Figure : Nonlinear fender reaction/compression curves.

## ELONGATION:

Figure : Terminal geometry and mooring arrangement

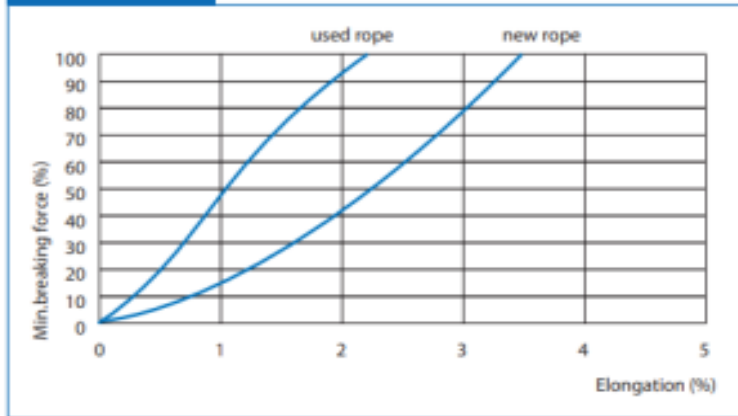
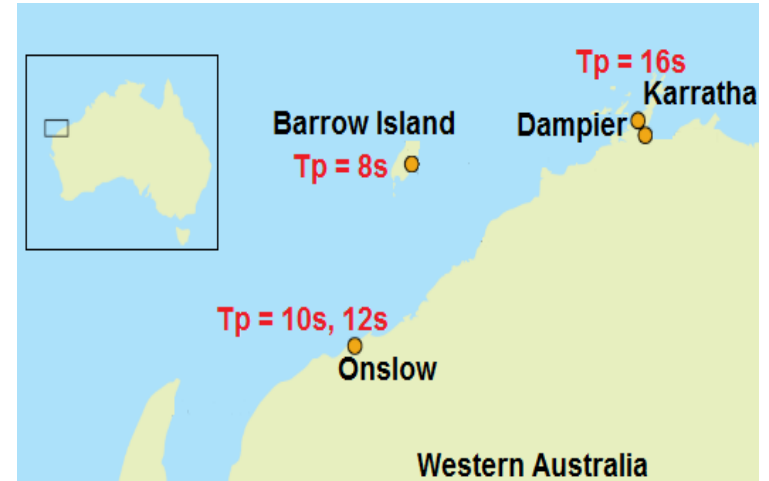


Figure : Nonlinear mooring line tension/extension curves .

Source: Figure reproduced from Lankoforce catalogue



WAVE PERIOD (in seconds)	WAVE HEIGHT (in meters)	MANUFACTURER FENDER REACTION LIMIT	OCIMF MOORING LINE LOAD OPERABILITY LIMIT	SURGE-PIANC RECOMMENDED MOTION CRITERIA	SWAY-PIANC RECOMMENDED MOTION CRITERIA	YAW-PIANC RECOMMENDED MOTION CRITERIA
8	1	✓	✓	✓	✓	✓
8	2	✓	✓	✓	✓	✓
8	3	✗ *4 to 15 t	✗ *2 to 15 t	✓	✓	✓
10	1	✓	✓	✓	✓	✓
10	2	✗ *8 to 15 t	✗ *8 to 15 t	✓	✓	✓
10	3	✗ *4 to 15 t	✗ *4 to 15 t	✓	✓	✓
12	1	✓	✓	✓	✓	✓
12	2	✗ *4 to 15 t	✗ *2 to 15 t	✓	✓	✓
12	3	✗ *2 & 6 to 15 t	✗ *2 to 15 t	✓	✗ *2 t	✓
16	1	✗ *2 to 15 t	✗ *2 to 15 t	✓	✓	✓
16	2	✗ 2 to 15 t	✗ *2 to 15 t	✓	✗ *2 to 4 t	✓
16	3	✗ *2 to 15 t	✗ *2 to 15 t	✓	✗ *2 to 15 t	✓

Table : Limiting sea states for beam seas condition

\* - Pretension value in tonnes.