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Effect of mooring on inland vessel in port region

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Abstract

In the present study, the effect of the passing ship on moored vessel is analysed considering various range of vessel sizes. Dynamic mooring analysis is studied in support of fixing the orientation of marine facilities by considering various options based on the site specific wind/wave/current data. The comparison on the variations of ship movements is performed by changing the wave period, wave direction, current speed, wind speed and checking the status of the mooring lines of the moored ship and Fenders. The wave forcing on a vessel are considered in the mooring analysis.

Keywords: Bulk Carrier; Environmental conditions; Mooring lines; Vessel displacements; Wave force.

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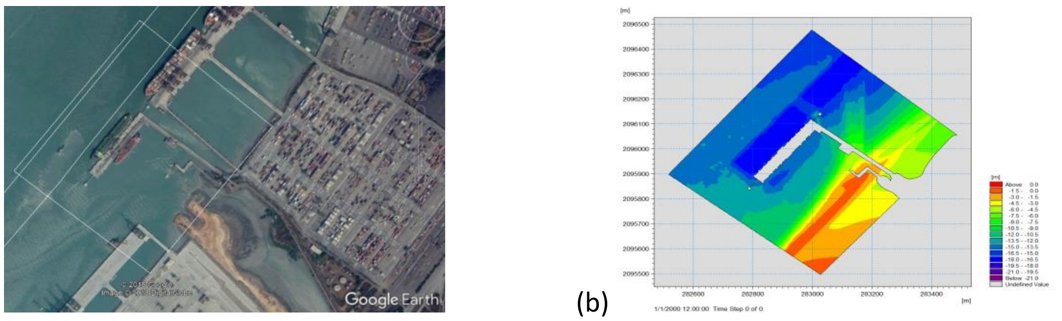
I. INTRODUCTION

The term "Mooring" refers to the system for securing a ship to a terminal often known a berth structure. The mooring of the ship must resist the forces due to the severe combination of wind, current, waves, wides and surges from passing vessels. Mooring arrangements consist of two primary components: mooring lines and fenders. The vessel typically provides mooring lines that extend from mooring points on the vessel to mooring points on the berth. The lines provide restraint in tension. The fenders are attached to the berth at the berth's contact locations with the vessel and provide restraint through compression of the fenders. It is the dynamic mooring analysis software, which uses the vessel hull shape and associated gyrostatic data to derive the frequency response characteristics in the frequency domain and uses them to calculate the motions of the floating vessel under specific environmental conditions and in dependence of the mooring arrangement.

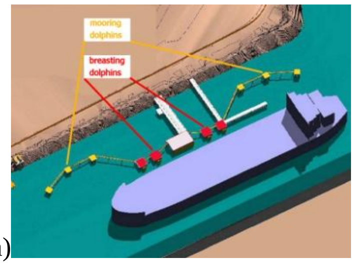
(a) 

(b)

Figure 1: (a) Case study location and (b) Bathymetry

1.1.1 Methodology

The moored vessel considered as the bulk carrier in the MIKE21 mooring analysis. Bulk carriers are a type of ship which transports cargoes in bulk quantities. The cargo transported in such ships is loose cargo i.e. without any specific packaging to it and generally contains items like food grains, ores and coals and even cement. The study is performed on the effect of berthed ship vessel displacements, line forces and status of the mooring lines and fendersdue to the moving of the passing vessel. The moored vessels may be subjected to substantial dynamic forces due to the nearby passage of other vessels especially in narrow restricted waterways with large vessel traffic and the passing vessel forces have caused many mooring incidents, including some tragic breakaways.

(a) 

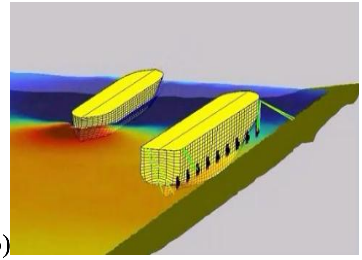
(b) 

Figure 2: (a) Moored vessel and (b) passing vessel effect on moored vessel

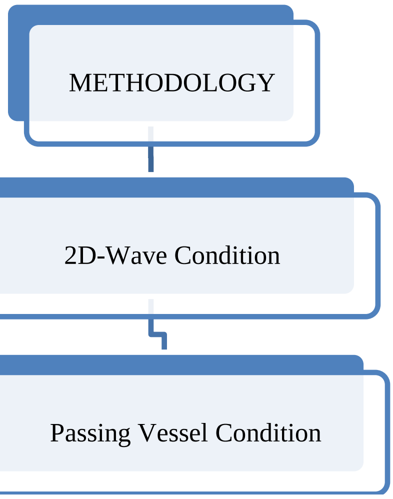


Figure 3: Methodology of the study

1.1.2 Numerical results

The environmental conditions that represent physical conditions and forcing that applies in the domain where the vessel is located is considered. The anchored vessel is kept in a steady position, having swung at anchor in the direction of the dominant environmental force or has reached an equilibrium position. Environmental conditions cover natural phenomena which may contribute to structural damages, operation disturbances or navigation failures. The following different conditions of Environment are considered in MIKE21 Mooring Analysis such as physical parameters, wind, currents and drift forces.

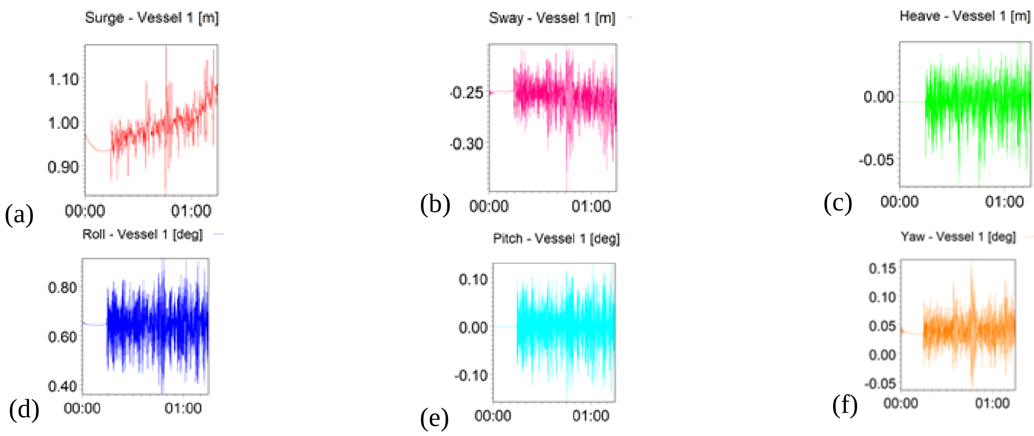


Figure 3: Wave forcing on vessel motion

II. CONCLUSION

The purpose of the analysis is to determine movements of the moored vessel. The allowable motion criteria depend on the type of operation to be performed. For loading of bulk carriers with a conveyor belt, the allowable maximum peak-to-peak surge motion is 2m. From this study, the vessel is affected due to surge motion and negligible effect in heave motion. In addition to motion criteria, it is a requirement that the mooring line and fender forces are not exceeding the allowable limits at any time. The simulation matrix has been adjusted in the course of the analysis work in order to determine the wave conditions resulting in vessel motions and mooring line and fender forces around the maximum permissible limits.

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