Increasing Operational Limits of Marine Terminals
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ABSTRACT
Marine terminals are a vital link in the overall hydrocarbon supply chain and optimizing the use of these facilities is of paramount importance. During sudden surge in demand, the capacity of some terminals becomes insufficient to cope with the arriving traffic, and ships start experiencing increasing waiting time in queue before being allowed to moor at a designated berth. This paper investigates key functional and hydrodynamic parameters that must be evaluated for increasing the operational limits of existing berths in a marine terminal, in order to add flexibility, minimize congestion, and reduce demurrage costs.

KEY WORDS: Marine Terminals; Deadweight Tonnage (DWT); Vessels; Hydrodynamic Parameters; Operational Limits; Demurrage Cost.

NOMENCLATURE
BD Breasting Dolphin
CD Charted Datum
CoG Center of Gravity
DOF Degree of Freedom
DWT Deadweight Tonnage
FoS Factor of Safety
HAT High Astronomical Tide
Hs Significant Wave Height
LAT Low Astronomical Tide
LOA Length Overall
MBL Minimum Breaking Load
MD Mooring Dolphin
MSL Mean Sea Level
OCIMF Oil Companies International Maritime Forum
PBL Parallel Body Length
QRH Quick Release Hook
QTF Quadratic Transfer Function
Tp Peak period
UKC Underkeel Clearance
VCG Vertical Center of Gravity
WD Water Depth

INTRODUCTION
Marine terminals are designed and rated for specific tanker sizes and type of cargo (e.g. crude, gas, refined product etc.). During the design life of a marine terminal, Ports & Terminal authorities often receive requests from customers and fleet operators to allow newer and larger energy efficient vessels to call at the berths. Therefore, it is paramount to evaluate the existing marine terminal’s operational limits for safe and optimized operations, to minimize congestion and waiting time, and to reduce demurrage costs (the waiting charges levied by ship-owners if their ships are not loaded or unloaded within a specified time).

Hydrodynamic and structural analyses, using directionally-dependent metocean data, should be undertaken in accordance with international standards to confirm whether the larger vessel can safely moor and operate at the berth. This paper presents the structured road map for conducting a typical Marine Terminal assessment for increased operational limits. A case study involving a marine terminal originally designed for berthing 100,000 DWT tankers is evaluated for accommodating a proposed 120,000 DWT Aframax tanker. The authors assessed all key aspects like berthing, mooring, ship-shore access, and cargo transfer to ensure that the existing infrastructure at the berth can safely provide station-keeping for the vessel under normal environmental conditions.

DESIGN CRITERIA
Under normal operating conditions, berth design components shall withstand the loads associated with a 1-year storm event and shall satisfy the general design criteria presented in Table 1.

- The layout of the existing marine facilities shall accommodate the size of Aframax tankers with respect to navigational approach, stationkeeping, and berth utilization/operation;
- Mooring-line tensions shall maintain an acceptable margin of safety relative to their maximum capacities (OCIMF, 2008);
- Fender compressions shall be within the manufacturer’s specified limits (PIANC, 2002);