IMDC

International Marine and Dredging Consultants (IMDC) is an engineering and consultancy company specialized in a vast range of water related projects. Our highly qualified staff provide advice based on recent research from leading universities and research institutes, and hands-on experience acquired over the years.

One of IMDC's core activities is to deliver nautical assistance to our clients' projects. The wide range of services we can offer in this domain is presented in this product sheet.

More information can be found on our website: www.imdc.be

Nautical Services

Ports and waterways play a crucial role in global trade and have a significant impact on the quality of life. Worldwide, almost 90 percent of our goods are transported by sea. The success of today's global economy depends on ships and ports to move goods quickly and efficiently from producer to end user. New vessels are being deve-loped using green fuels and to transport new commodities like CO_2 and hydrogen. Furthermore, economies of scale in transportation results in increase of vessel capacity. Growth in vessel capacity and cargo volume comes with challenges for ports in terms of infrastructure and cargo handling equipment. While transport has been growing significantly during the last decades, there is also an increasing urgency to make ports and waterways more sustainable and suitable for co-use.

Oceans and seas are being more extensively used for different purposes. Examples are wind farms, fishing, aquaculture, cables and cargo transport. Due to this increasing co-use of marine areas, the risks of collisions with ships and other impacts have increased significantly over time also endangering marine ecosystems.

IMDC provides a range of integrated services to support clients meeting these challenges and demands. We advise on nautical efficiency and safety in and outside ports by delivering either one dedicated service or the full range of integrated services. In all our studies we challenge ourselves to continuously search for the most sustainable solutions for our clients balancing People, Planet and Profit.

Service

Ship manoeuvring

The design of ports and marine infrastructure requires thorough knowledge of the different processes, regulations and design guidelines involved, as well as practical experience. Simulators are essential when modifying or building new ports.

By carrying out fast-time and/or real-time ship manoeuvring simulations we evaluate different layouts, validate and optimize our designs and ship manoeuvring strategy and determine under which conditions vessels can safely enter or depart the port. We use a probabilistic approach to determine the probability of bottom contact or exceeding the channel limits. For the real-time simulations we work with pilots to account for the human factor. This is done during small sessions, but also in the form of workshops with stakeholders to make decisions with regards to safety, efficiency and other impacts.

Mooring studies

Modelling complex interactions is important to evaluate and improve efficiency and safety of marine operations. To this end IMDC uses guidelines and software models, both static and dynamic, to determine loads in the mooring system and to simulate vessel movements.

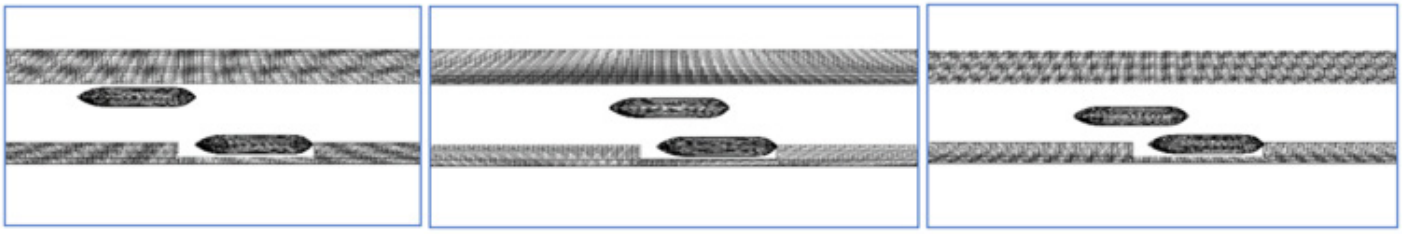
In the dynamic mooring analysis (DMA) we simulate 3-dimensional movements – translations and rotations (six degrees of freedom) - in the time-domain. We follow a digital twin approach, meaning we incorporate all environmental conditions (water levels, wind, different wave fields, currents) and the mooring layout representing the real-life situation. Based on the results we optimize the port layout to provide sufficient sheltering and mooring systems to improve operability and safety.

Multi body

We are capable of assessing side by side mooring (such as LNG Carrier next to an FSRU) by carrying out a DMA study and accounting for wind, current and wave shielding effects. The results of the study are used amongst others to develop operational procedures for safe cargo transfer.

Passing ships

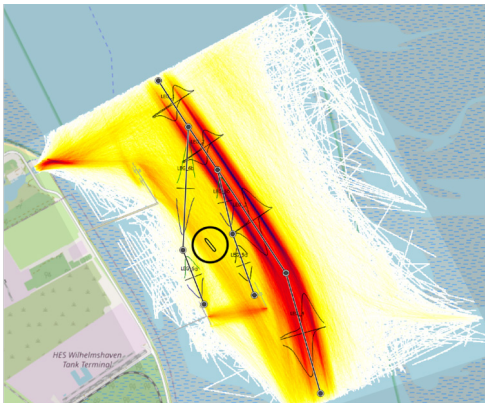
More and larger ships have to be accommodated in existing ports. New terminals are located along busy and narrow waterways. In these restricted waters, passing ships produce suction and draw down. For vessels moored in such a waterway or adjacent harbour, the change in water draw down can result in resonant horizontal vessel motions and large loads in the mooring lines. Container cranes, loading arms for oil and LNG and automated dry bulk excavators can normally only allow limited horizontal vessel motions. Dangerous situations for crew and vessel and large downtime may occur when motion limits are exceeded or when mooring lines fail. In view of the above, the RoPES (Research on Passing Effects of Ships) project was developed in a Joint Industry project. The RoPES software can be coupled to the DMA software to incorporate the forces induced by passing ships. This allows for a detailed evaluation of the effect of passing ships on moored ship operations and based on the outcome regulations can be developed (passing speed and distances) as well as improvements to the mooring system to reduce motions and forces.



ROPES model for passing ships

Marine risk, collision assessment

IMDC carries out marine risks assessments for marine traffic routes, pipelines and cable routes, ports, windfarms and other objects in marine environments. We follow international guidelines like IMO for formal safety assessments. During a HAZID workshop all relevant accident scenarios with potential causes and outcomes will be listed. Hazards in unacceptable regions will be investigated in more detail with the view to identifying potential risk control options.
For quantitative risk assessments we use the IWRAP software to obtain probabilities of different type of collisions in a given waterway based on information about traffic volume/composition and route geometry.



Collision risk results with IWRAP software

Port and channel capacity

Generally, the capacity of a port is dependent on the dimensions of the approach area, tidal conditions, wind and wave conditions, traffic characteristics and terminal facilities. For a sound judgment of the capacity of a port simple methods as the queuing theory or linear programming are not sufficient. The marine traffic system with a complex approach system and with numerous terminals, each with its own characteristics, can only be represented as a complex system. IMDC carries out marine traffic simulations (run for one year in a fast-time simulation) to determine the capacity of the port system. The results provide insights on waiting times of arriving and departing vessels, berth occupancies, anchorage capacity and tug requirements.

Cocoli lock, Panama

Key references

Engineering support for FSRU Wilhelmshaven development

Country: Germany
Year: 2020-2023
Client: Engie

FSRU GmbH, a joint venture between ENGIE and TES-H2, commissioned the construction of an LNG terminal in Wilhelmshaven, Germany. IMDC, acting as Owner's Engineer, played a critical role throughout all stages of the project, from design and procurement to construction and follow-up.

With safety and environmental considerations at the forefront, IMDC's contributions included: providing all necessary studies, documentation and clarifications for permitting (including environmental, dredging and construction permits); executing field measurements to establish metocean conditions; preparing and managing capital and maintenance dredging campaigns, including UXO investigation and clearance, turning basin design, hydrographic surveys planning and sediment plume dispersion studies to assess potential dredging impacts on the marine environment; designing and managing monopile and jetty installations, including steel fabrication, corrosion protection, and noise monitoring during monopile installation; designing, coordinating, and monitoring scour protection installation; conducting Dynamic Mooring Analysis studies, real-time ship manoeuvring studies and supporting procurement processes, perform quality controls via site inspections and offering site supervision and SIMOPS follow-up.

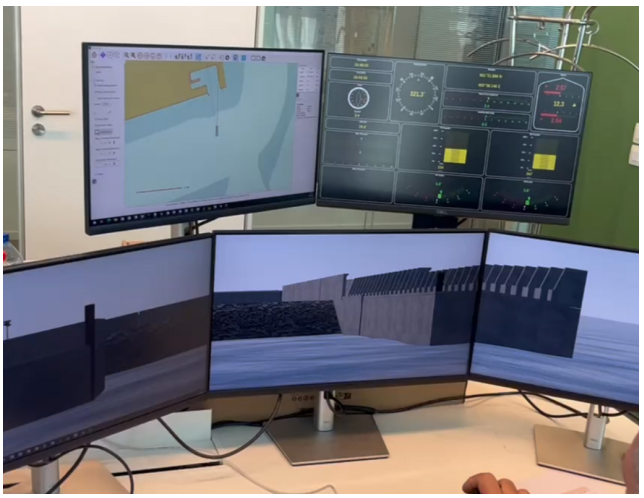
Sustainable Development Goals

MOG2 Owner's Engineer

Country: Belgium
Year: 2023-2026
Client: Elia Asset NV/SA

IMDC acts as Owner's Engineer, on behalf of Elia, for the world's first energy island, the Princess Elisabeth Energy Island in the Belgian Part of the North Sea. After developing the energy island's concept design, preparing the reference design and tender documentation, IMDC, supported by partners, is performing Owner's Engineering services during the Early Works phase (concept to detailed design) and the Fabrication / construction phase of the project up to the commissioning of the Energy Island. As part of these consultancy services, IMDC is responsible for review of the Island Contractor design, providing independent verification studies for example for Dynamic Mooring Analysis and real-time ship simulations and supporting during the fabrication and construction phase.

Sustainable Development Goals



Navigation and mooring study Poly Terminais Brazil

Country: Brazil
Year: 2024
Client: Poly Terminais Portuarios S.A

Poly Terminais Portuarios S.A. requested a navigation study to assess the feasibility of receiving larger design vessels at their terminal on the Itajai river in Brazil. IMDC supported in this request and additionally performed a passing ship study and a Dynamic Mooring Analysis for the new design vessels passing by and calling at their terminal.

Sustainable Development Goals

Ship navigation study of two different bulkers Poly Terminais Brazil

Country: Brazil
Year: 2024
Client: Poly Terminais Portuarios S.A

Poly Terminais requested ship navigation simulations in the Itajai river in Brazil to assess the feasibility of receiving two different bulkers at their terminal using two different channel layouts.

Sustainable Development Goals

Navigation study of a partly loaded 180 m tanker

Country: Brazil
Year: 2025
Client: Poly Terminais Portuarios S.A.

Poly Terminais requested a new navigation study under recommendation of the harbour pilots to investigate the effect of liquid cargo free surface on the manoeuvrability of a partly loaded tanker. This was done by performing real-time simulations in the Itajai river and assessing the feasibility of the upstream and downstream transit.

Sustainable Development Goals

Paldiski DMA multibody

Country: Estonia
Year: 2022
Client: ConX PM Ltd. (Alexela)

Tractebel Ports and Waterways conducted an OPTIMOOR mooring analysis for the quay wall located on the Arcelor Mittal site in Ghent, Belgium. As part of the study, IMDC estimated the passing ship forces in a very complex berth configuration, a sheet pile combined with whirl chambers on the Arcelor Mittal site in Ghent. Novel application of ROPES. The purpose was to provide data for the assessment of the safety of the moored ship and to determine the maximum speed of sailing ships..

Sustainable Development Goals

GARDEC Quay Zeebrugge – Mooring study

Country: Belgium
Year: 2024
Client: GARDEC

GARDEC SDS was planning a new terminal at the Kiwiweg in Zeebrugge. The envisaged quay wall will be constructed on the existing slope in the verbindingsdok connected to the Van damme Sluis. The final length of the quay wall will be in between 230 m and 320 m depending on the overall CAPEX of the project. A first design of the quay wall was prepared. GARDEC requested IMDC to investigate the following changes to this design: A shift towards the navigation channel to reduce dredging and ease entering the berth pocket while berthing the vessel (while checking the impact on the navigation channel); a Connection of the quay wall to the existing slopes to be adapted. As a part of this scope, a passing ship study with ROPES and a Dynamic Mooring Analysis was performed to assess the feasibility of staying at berth in storm conditions and passing ships.

Sustainable Development Goals

Review mooring arrangment EDR shipyard, DMA & evaluation bollard capacity

Country: Belgium
Year: 2023
Client: EDR Shipyards

To ensure safe operations EDR Shipyard Antwerp wants to verify the loads on the mooring system induced by vessels moored in their docks due to the combined effect of wind and passing ships.

IMDC carried out a passing ship and dynamic mooring study to investigate the motions of the moored ship and the loads in the mooring system. The results of the mooring study were compared with the capacity of the existing bollards.

Sustainable Development Goals

Passing ship analysis with ROPES for the quay wall located on the Arcelor Mittal site in Ghent

Country: Belgium
Year: 2024
Client: Tractebel Engineering N.V.

Tractebel Ports and Waterways conducted an OPTIMOOR mooring analysis for the quay wall located on the Arcelor Mittal site in Ghent, Belgium. As part of the study, IMDC estimated the passing ship forces in a very complex berth configuration, a sheet pile combined with whirl chambers on the Arcelor Mittal site in Ghent. Novel application of ROPES. The purpose was to provide data for the assessment of the safety of the moored ship and to determine the maximum speed of sailing ships.

Sustainable Development Goals