

RoRo Stowage Optimization Tool

The RoRo Stowage Optimization tool has been developed by ACCIONA within the WP4: PortForward Services. The development of this tool has been focused on the Roll-on/Roll-off (RoRo) ships considering the needs of the ports directly involved in the project. However, this service is easily adaptable to any port with the same type of shipping activity.



Figure 1. Trasmediterránea RoRo ship.



Figure 2. MAFI unloading cargo.

The RoRo ships are the most important shipping between islands and mainland. They are very useful and versatile to transport heterogeneous cargo and short turnaround times in ports. Nevertheless, the optimal utilization of cargo space (ship's decks) has been fundamentally problematic with the RoRo concept. Considering the existing attempts to contrive the stowage plans, the PortForward RoRo stowage tool proposes some state-of-the-art improvements. These improvements lead to **a better approach to ship stability** in conjunction with an **optimized cargo stowage on RoRo decks**.

The service expresses the stowage problem as a mixed-integer linear programming (MILP) problem and solve it to optimality. The complex mathematical problems one could only hope to solve just a decade ago are now possible to crack using commercial optimisation software. However, computational capacity will always have its limitations if the problem is complex enough. To deal with this, optimisation problems must be modelled in the simplest possible way, while ensuring that the solution also meets the desired level of quality.

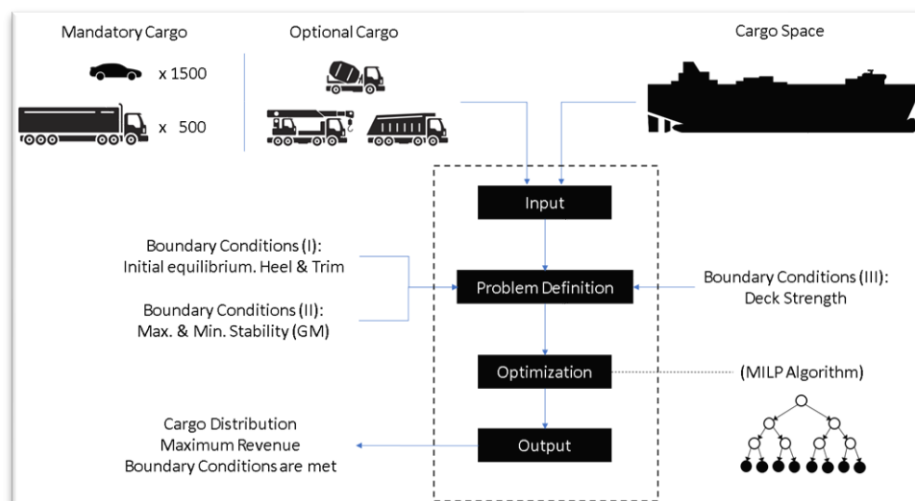


Figure 3. Stowage optimization script problem overview.

An operational planning perspective of a RoRo cargo stowage problem has been considered in this tool, and an optimisation model has been used as a base. This service focuses on stowage in an operational planning perspective, with tasks from a naval architecture point of view. Additionally, as one of the important aspects of stowage on a RoRo vessel is the intact stability, the service will include stability constraints that mimic reality.

The cargo plans will be checked by more exact hydrostatic calculations to ensure that the stability is indeed satisfactory.

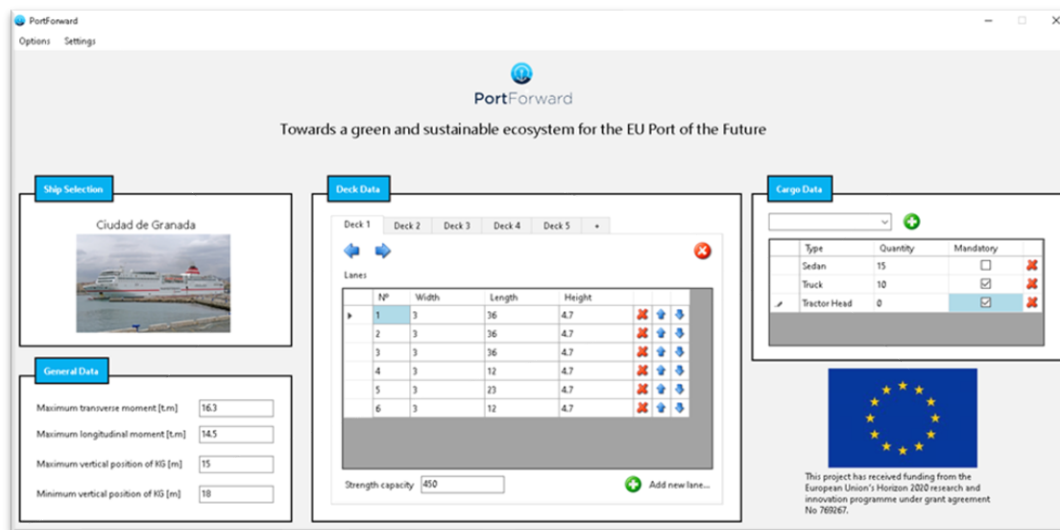


Figure 4. RoRo Stowage tool. Front end input.

The RoRo stowage tool will run at two different levels: at a higher level, the service will be able to **optimize the operations at port level by finding the best scheduling choice** for the operations based on heterogeneous input data such as time of arrival of vessels, types of operations to be done, resources available, times of operation and environmental data.

At lower level, the stowage service will provide to the shipping company support for the optimization of the stowage plans of each individual RoRo vessel. The service will include a **plan optimizer** based on the following goals: reductions of modification of the cargo plan, reduction of vessel stays at the port, and maximized utilization of the space available at each deck.

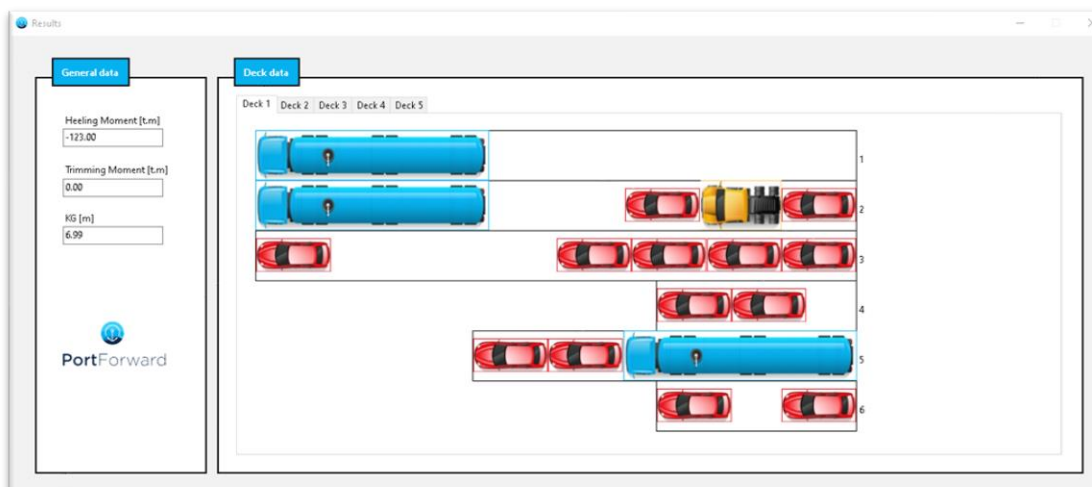


Figure 5. General outputs and decks distribution example.

About the project

PortForward is a project funded under H2020 MG-7.3-2017 topic: “The Port of the Future”. The project proposes a holistic approach towards smarter, greener and more sustainable port ecosystems

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