



PIB Vietnam: ship concept dimensioning

MARIN's proposal for the PIB Vietnam work package

The PIB Vietnam, in which multiple Dutch companies participate, aims at improving the Vietnam inland waterway transport (IWT) sector by exchange of knowledge focusing at specific areas of the IWT sector. One of these areas concerns the concept design of ships. MARIN will share its knowledge in this area by assessing various ship concept designs on fuel consumption, manoeuvring at critical situations, safety of harbour manoeuvres and harbour logistics. MARIN proposes to focus on the following aspects: ship main dimensions, propulsion configuration and manoeuvring systems.

DESP

MARIN provides statistical predictions of ship performance using the DESP tool. DESP is based on the vast database of model-test results for a wide range of ships. The DESP tool includes the impacts of propulsion types, dimensions and overall hull form parameters.

Gulliver

Gulliver allows to simulate ship voyages. The hydrodynamic ship behaviour is simplified, allowing fast calculation and thereby enabling the assessment of multiple routes or ship designs in an efficient way. By coupling Gulliver to databases that provide information on the environment (wind, waves, water depth, currents), long-time operational analysis can be performed as well, assessing the ship in real operational conditions.

Concept design of inland waterway vessels

Improvement of the Vietnam IWT sector requires the assessment of, among others, port and fairway network capacity, intermodal connections, cargo throughput, regulations, dockyard capacity. The ship itself is important as well: the design of the ship has an impact on cargo throughput, emissions, fuel consumption, harbour logistics and safety of operations. MARIN can assess these impacts for various design concepts to provide information that the Vietnamese IWT sector can use to lay down regulations, stimulate the building of specific vessel types or to advice on fairway design and fairway dimensions. MARIN will focus on determining main dimensions (length, width, draught and displacement), propulsion unit(s) and manoeuvring configuration. For the correct implementation, information on the IWT network, cargo flows and river conditions is required. MARIN will need contact with Vietnamese counterparties to acquire this information. The following discusses each of the topics addressed by MARIN in more detail.

Fuel consumption and emissions

Inland ships consume less fuel and produce less emissions compared to road transport for the same amount of cargo. Still, improvements are possible by well-considered design selections and balancing cargo volumes/flows on main dimensions. MARIN will apply its experience and tools (DESP and Gulliver) to assess the impacts of the conceptual design choices on fuel consumption, emissions and efficiency. As water depth is an important parameter that affects ship performance in this area, MARIN will collaborate with Vietnamese counterparties to incorporate river conditions into the investigation.

ScenSim

With ScenSim, multiple software packages can be coupled. This allows, for example, to couple Gulliver (for the long-distance trip) to manoeuvring software such as SHIPMA (for in-port manoeuvres). Also, logistics can be assessed by modelling harbour cargo throughput and coupling that to voyage simulations with Gulliver.

SHIPMA

Manoeuvring performance can be assessed with SHIPMA. An auto-pilot attempts to follow a pre-defined track. The extent to which the pilot succeeds can be used as an indication for the manoeuvring performance of a ship. By varying design parameters such as dimensions or propulsion units, impacts of such parameters can be assessed.

SIMDAS

Based on ship parameters and regulations, SIMDAS can be used to assess the capacity of a certain fairway or corridor. Comparing such data with a specific cargo throughput, insight in the safety of transport can be gained.

More information

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Logistics

In most cases, a larger ship is efficient in terms of building costs and operational costs per amount of cargo transported, but may cause logistical issues in harbours as large ships cause peaks of cargo throughput and may also block a significant part of the harbour quay for other, smaller vessels. Smaller ships, on the other hand, may cause busier fairways and ports, but lead to a more continuous flow of cargo through the harbours. Multiple of the aforementioned voyage simulations can be coupled to MARIN's logistics-simulation software package (ScenSim). MARIN will assess the impacts of ship main dimensions on harbour logistics based on cargo throughput provided by Vietnamese counterparties.

Manoeuvring assessment

Similar to cargo throughput and harbour capacity issues, ship main dimensions also affect the manoeuvring performance and safety during manoeuvring operations. A too large ship may have difficulties in operating in smaller harbours, thereby losing effectiveness compared to smaller ships. To find the upper limits of ship dimensions, dedicated manoeuvring simulations (SHIPMA) will be carried out for various ship concepts with a ship sailing a path across crucial network nodes or into small ports. In this way the impacts of ship main dimensions on manoeuvring will be assessed, providing valuable information to devise regulations for ship dimensioning in the Vietnamese IWT sector.

Safety assessment

Whereas larger ships may have troubles manoeuvring in smaller ports, smaller ships will lead to a larger number of ships navigating the Mekong Delta. This increases the risk for congestion and can lead to safety issues at crucial fairway network nodes or in ports. With information on cargo flows and the IWT fleet, fairway capacity assessments will be conducted based on international (PIANC) and Dutch guidelines, if needed a more detailed analysis will be performed with SIMDAS to show the relation between the number of ships, their main dimensions and fairway capacity.

Putting it all together

The aforementioned work provides support the Vietnamese government in developing regulations and vision in multiple areas. It can help to focus dredging, get insights in the impact of ship design in relation to fairway safety, assess manoeuvrability in harbours to investigate options for improvements IWT fleet composition, lay down regulations to stimulate the construction of specific ship designs or to investigate the effects of ship design choices on harbour logistics. With a combination of tools, MARIN is able to provide such insights through the analysis of various inland ship concept designs.