Inland vessels at sea as efficient hinterland connection for Belgian Seaports: Current practice and future developments

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An essential aspect for the growth of **coastal (cargo) ports** is a strong **hinterland connection**. This can be realised through train, road and/or water transport. As the Belgian roads are getting more and more congested, one needs to look at alternative connections. **Inland vessels** are able to transport big cargo volumes, more than 5000 tons in a single vessel, easily throughout the whole of Europe. Bottleneck here is the size of inland waterways connecting for example Zeebrugge and the hinterland which limits the cargo capacity to 1500 tons. For this reason, it is from an economical viewpoint extremely interesting to perform a short sea-journey to gain access to the mount of the Western Scheldt and, hence, the European inland waterways network.

The vessels need to cross the Dutch territorial sea and inland waters, but from a legal point of view perform a non-international sea voyage in case their ports of departure and arrival are both located in Belgium. The legal framework for these voyages is provided by the **Royal Decree of 2007** [1], in which Ghent University played a key role by developing sea-keeping requirements. The behaviour of inland vessels at sea is analysed by executing a probabilistic **risk analysis** [2], ensuring the safety of the inland vessel on sea by constraining the risk. Based on this practice, several inland vessels, often indicated as 'estuary vessels' are certified to perform sea voyages between two Belgian ports, up to certain significant wave heights.

Recently, Ghent University has been involved in a project which focusses on the future developments in estuary traffic. In the framework of this study, several aspects of the sea-keeping study have been reviewed. As a start, the wave climate in front of the Belgian coast has been assessed, using spectral wave analysis (SWAN, performed by Flanders Hydraulics Research). It has been concluded that the wave climate, expressed as significant wave height, becomes less severe towards the mouth of the Western Scheldt. More realistic ship responses can thus be achieved by considering multiple **wave spectra** along the trajectory, instead of only using (measured) wave data at Bol Van Heist (BVH), which can be considered as a conservative approximation.

SWAN has also been used to model possible developments, within '**Vlaamse Baaien**' (predecessor of '**Kustvisie**'). This involves creating an opening in the eastern harbour dam of Zeebrugge, shortening the path and avoiding severe wave climates in front of the harbour mouth. The effect of wave blocking constructions in front of the Belgian coast, lowering the wave climate behind these structures, is also investigated. Based on these numerical wave spectra, the beneficial effect on the ship responses is mapped.

Part of the short term study is the possible exemption of the need for a risk-analysis for inland vessels, sailing in favourable wave conditions, which would lower the threshold for ship-owners. The upper limit for the deterministic exemption is set at 1.2 m significant wave height, measured at BVH. These deterministic limits concerning water intake are developed based on an extensive systematic study, considering four design inland vessels, which have been selected based on data from more than 500 inland vessels.

References

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