

SUMMARY

To reduce delay in a complex transport network there might be several optimisation scenarios. Comparing these proposed scenarios on a scientifically based method requires quantification of the relevant predefined decision making parameters concerning costs, safety, environment, etc. Depending on the scope of interest (relevant decision making parameters, geographical area, services, transport type, timeframe,...) a simulation model can be used to analyse the behaviour of the network under different circumstances to quantify the effect of the proposed scenarios or to come to an even better optimisation scenario using a combination of both management and technical optimisation scenarios.

In this case such a chain approach simulation is performed for the working field of the Flemish/Dutch Common Nautical Management (Gemeenschappelijk Nautisch Beheer (GNB)). This was done in the framework of the study 'Chain Approach'¹. The objective was to quantify current delay times and bottlenecks and to compare the different optimisation scenarios that were suggested during the study for different expected future conditions.

- Effect of the deepening of the Scheldt river
- Increasing traffic (of bigger ships)
- Change in pilot or tug management

Therefore, a discrete event simulation model, called Vessel Traffic simulation (VTSim) was used. This Discrete Event Simulation Model consists out of different modules, nodes and segments, based on the existing VTS of the Scheldt area. Each module represents a part of the real life chain in the GNB working area: sea/river/canal segments, locks, pilots, tugs, berth, tidal windows,

etc. To build each module, analysis of the working principles and interviews with operational people was conducted to make sure each module approaches reality as good as possible. Once all the modules are implemented and the entire physical chain network has been built, different ships are generated in the 'entry' nodes at the border of the model. These different ship types were generated as transactions running through the model according to statistical generation times which were obtained by analysing the VTS registration data of 2008. After calibration of the model, scenarios could be modelled. The log files for each 365-day run, containing waiting times, travelling times, occupation of services, etc. could be analysed and compared using ANOVA (Analysis of Variance).

The calculated scenarios showed a relevant correlation between several services. Increasing the river tug capacity for example showed a decrease in waiting time due to river tug's, but an increase in waiting time for river pilots. Increasing the tug or pilot capacity to reduce average waiting times due to tug's or pilots to less than 0.01h showed an economically uninteresting tug or pilot pool would be needed to reach this target.

Another important factor is the distribution time of the ships leaving the quay. Currently this is determined by the labour shift regime of the dock workers. Spreading the departure time of the ships can cause a significant decrease in overall waiting time.

Using the VTSim model, relevant effects of different scenarios could be quantified. This model provides decision makers and operators a scientifically based tool to analyse the effects of each scenario on the entire chain.

¹ Study 'Chain Approach in the GNB Scheldt Area' conducted by Antea Group for the GNB (2011).