

Summary

An intermodal container transportation network is being developed between Rotterdam and several inland terminals in North West Europe. This EUROPEAN GATEWAY SERVICES (EGS) network enables an integrated network transport between 7 inland terminals and 3 Rotterdam seaports. To use this network cost-efficiently, a more integrated planning of the container transportation is required. The most relevant aspects of such a planning are identified with a new model. This model introduces three new features to the intermodal network planning problem. First, the model combines two formulations for a multi-commodity network: a minimum cost network flow problem and a path-based network design formulation. Secondly, the model allows for overdue delivery at a penalty cost. In this way the practical flexibility of negotiating delivery times with customers is more closely represented than the use of strict delivery time restrictions. Thirdly, the model combines two types of operation: both self-operated services, operated by the network company as subcontracted services, operated by partners are used. The model distinguishes between rail and barge services and the use of truck when necessary.

The model is applied at two different levels. At a tactical level, the optimal service frequencies between the network terminals is determined, considering barge or rail modes and both operation types (self-operated and subcontracted). This is called the service network design. The model is used to determine the optimal service frequencies between the terminals in the EGS network. The most influential aspects for the costs of this service network design are determined. The results of the experiments at the tactical level show that the costs for transferring have a strong impact on the amount of containers that are transported with intermediate transfers. An increase in intermediate transfers can lower the costs for transportation significantly.

The results are used as a basis for an adapted model at an operational level. With this model the impact of a disturbed service is determined, by comparing the undisturbed planning with a full planning update after the disturbance. This impact can be seen as a measure for the gravity of a disturbance: a high impact means that a disturbance comes at high costs, even if handled in the best possible way. Hence, a high impact indicates disturbances that must be prevented. A second measure is the difference between an optimal (full) update and a local update, defined as the relevance. The local update represents the current practice of the manual planners. A high relevance indicates a disturbance that can be solved in a much more cost-efficient way by updating the existing planning fully, compared to only updating directly disturbed containers. The model is used for the same EGS case that was used at the tactical level. The impact and relevance of early departure, late departure and cancellation of services in the network are determined. The results show that service cancellations have the largest impact. Apart from that, early departure of a barge has a high impact as well. Indicators of disturbances that have a high relevance and should be solved with a full update are the

following: the disturbed service is a barge, is self-operated and/or operates on a corridor with a high frequency of alternative services.

The study shows that the new model is suitable for solving the problem at both the tactical and operational level. Points of attention for the manual planning are recommended and a focus for automated planning is proposed.