Transport system specification - Case A

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Advanced, Efficient and Green Intermodal Systems

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Executive Summary

This report specifies a transport system for use case A, based on a combination of mother and daughter (feeder) vessels to enable a more flexible and cost-efficient waterborne transport solution for fjords and smaller ports. Hitra Kysthavn, which is located at the main fairway along the Norwegian coast, has been assigned as the hub terminal in the transport system. NCL's existing container vessels sailing between Port of Rotterdam and the Norwegian coast are passing there today on their journey north/south. The three major building blocks of the transport system (mother and daughter vessels and terminals) have been further specified in this report.

Important parts of a transport system specification include route information, sailing frequency, estimated cargo volumes, distances and sailing time, as-is situation, relevant vessel requirements, terminal requirements such as cargo equipment and charging infrastructure, involved ICT systems and last but not least, regulatory hindrances with specific focus on transhipment.

The table below shows in brief the focus areas in the use case A transport system.

	Customer -> terminal (NO)	Domestic transport	Terminal (NO)	Short-Sea, international transport	Terminal (EU)	Hinterland
	 Orkanger, Trondheim, Skogn	 Daughter transport	 Kysthavna - Hitra	 Mother transport	 Rotterdam	 Hinterland transport
Cargo volume						
Containers						
AGVs						
Cranes						
Ship concepts						
Terminal concepts						
ICT systems						
KPIs						
Regulatory hindrances						
Autonomy levels						

The colour *green* is defined as focus area, for instance cargo volume in the regional ports in the Trondheimsfjorden will be highly relevant as input to the "daughter vessel" specification. The colour *yellow* is defined as less relevant (but still touched upon), while the colour *red* is an area considered outside of the scope of use case A.

An example is that the "green colour" for "Cargo volume" describes that the focus in use case A is the goods from Norway on its way to Rotterdam. The cargo volume in Rotterdam and hinterland out of Rotterdam is considered less important for the case study performed. Furthermore, it says that the

focus is on container transport, and use of AGVs is most important when talking about the daughter vessel operation in Norwegian ports. One example is whether the AGVs can lift/move the containers between the vessel and the terminal or operate in the terminal area such that the vessel cranes can load them onto a vessel. The AGVs and (vessel) cranes must be able to lift all types of containers (20, 40 and 45 feet). The "red colour" for cranes on Rotterdam indicates that use case A will not do a detailed specification of cranes to be used in a big port such as Rotterdam. The focus within use case A is therefore the daughter vessel(s) operating in a specific region and the transhipment of goods from a small port, via a daughter vessel, to a transhipment terminal, then loaded onto a mother vessel sailing to a bigger port such as Rotterdam.

This report recognises the dilemma related to investments in the transport system, and specifically related to mooring and cargo handling systems. Autonomous mooring solutions and cranes are expensive, and it is not realistic that such investments are done at the small ports in the fjord, with limited cargo volume. However, to make the transport system flexible, the daughter vessel(s) should be able to call on these ports as well. The report concludes that the daughter vessel must be equipped with its own cargo handling capabilities and preferably also with an on board autonomous mooring solution. Two different cargo handling equipment solutions have been proposed:

1. Deck crane on the vessel, fully autonomous
2. Autonomous AGV (reachstacker), brought on board the vessel, to be driven on shore to do the cargo handling operations. This is most relevant when looking at the flexibility of calling on the small ports with no cargo handling equipment.

The AGVs are suggested to also do the terminal operations at the smaller ports, enabling moving of containers from the vessel to quayside and further onto a storage area or directly onto a truck.

A use case A transport system has been proposed as follows:

- Ports as part of a regular schedule: Hitra Kysthavn, Orkanger, Trondheim, Skogn and Holla
- Ports to be called on demand: Steinkjer, Follafoss and Verdal
- Total cargo handling time (loading + discharging), based on 15 containers/hour: 90 hours
- Total sailing distance and time (at 12 knots): 469 nm in 39 hours
- One (100 TEUs) or two (each 60 TEUs) daughter vessel(s), sailing at 12 or eight and five knots
- The daughter vessels will be equipped with either a crane or a reachstacker
- Batteries as energy source for daughter vessels, either based on conventional charging at the terminals, or containerized and swappable. The latter implies implementation of charging stations at specific terminals in the transport system.

The specified transport system is subject to cost-benefit analysis (CBA) and Logistics Analysis tool will be used to assess the overall logistics system. Further detailing and validation of the transport system will be documented in deliverable *D8.4 Detailing and validation of use case A,* which work will be based on the results of the CBA and simulations from the Logistics Analysis tool.