

W.J.D. Piet *Ro-ro freight shipping. Current situation and developments*
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The purpose of this thesis is to give an overview of the transportation of freight over sea by means of a Roll-on / Roll-off loading method. Ro-Ro is a loading method that in terms of transported tonnage is a small player in the market of the transportation of freight overseas. For certain types of goods and trade routes it is still a competitive player in the market of transporting goods overseas.

Ro-Ro is merely a term for the manner in which the ship is loaded. It is possible that different types of goods can be transported more efficiently in specialized types of ships. In this paper an overview is given of the different types of ships and the alterations to the design of the vessels are given. The planning and designing of a dedicated Ro-Ro terminal is explained, and with the planning/designing of a Ro-Ro terminal an overview is given of the different types of Cargo Handling Equipment and when to use certain equipment.

Furthermore this thesis mentions the developments in Ro-Ro freight transportation in terms of new Ro-Ro vessel designs and new developments of Ro-Ro transshipment methods.

The found information is used to comment on two Ro-Ro case studies in the end of the thesis. The first case is about the possibility of a newly to be implemented Ro-Ro trade network on the Lake Superior between Canada and the U.S.A. and the second case is the design of a Ro-Ro terminal in the UK by the Posford Duvivier company.

Summary

Due to globalization the amount of goods that need to be transported from one place to another keeps increasing much more than you should expect based on the growth of the population. Large vessels travel from China to Europe, packed with containers to deliver the goods which are produced in China and bought by Europeans. In the market of nonbulk goods the Lift-On/Lift-Off (Lo-Lo) loading method on a cellular vessel is dominant. A crane is used to lift the container from the ground to the ship during the loading of a vessel and the container is lifted from the vessel to the ground by means of the same crane, which is the Lo-Lo method.

The loading of a vessel can also be done by rolling the cargo onboard a vessel. This can be achieved with cargo which from itself is equipped with wheels, like cars or trucks, or by with wheeled equipment which is able to carry the cargo onboard a vessel. A Rollon/ Roll-off (Ro-Ro) vessel is equipped one or more loading decks which can be accessed by one or more ramps at the quay side or by means of an onboard ramp or elevator.

All in all a Ro-Ro vessel is less space efficient when compared to a Lo-Lo vessel and mostly due to this reason Ro-Ro is a more expensive method of cargo handling. This can be countered by introducing dedicated Ro-Ro vessels, like for instance Pure Car Truck Carriers, trailer ships for either transport accompanied by a driver or unaccompanied, Ro-Ro vessels for the transport of forest products, rail ferries for the transport of rail wagons or even complete trains and Ro-Ro/Passenger (Ro/Pax) vessels.

In the design of a vessel the optimal height of the decks can vary. A Pure Car Carrier for instance or a trailer vessel requires less height per deck than for instance double container stacked MAFI-trailers. It is optional to implement hoistable decks in the design of a Ro-Ro vessel in order to vary the deck height so a mixed combination of cargo can be stored more efficiently.

Due to the variety in Ro-Ro cargo there is a variety in lashing methods onboard the vessel in to prevent the shifting of cargo. Since in principle Ro-Ro cargo is wheeled blocking its movement is important. This can be simplified by using a Sto-Ro method (Stow and Roll), since then the cargo only has to be supported instead of secured. This can be done by means of wooden structures, air cushions, units or nets.

When compared with the commonly used Lo-Lo method, Ro-Ro has its pros and its cons.

- Ro-Ro for instance is able to handle and store heavy cargo, whereas a container has its limitations;
- Accompanied transport is possible and therefore the cargo can have a higher security;
- A Ro-Ro terminal has lower initial investment costs whereas a Lo-Lo vessel has a lower vessel investment cost;
- A Ro-Ro vessel can be loaded and unloaded more quickly and therefore spent time in port;
- When comparing transport cost, trailers are more expensive to transport than containers;
- Less chance of cargo damage with a Ro-Ro method.

When planning and designing a Ro-Ro terminal the first thing to do is estimate the total annual cargo throughput. Is the terminal economically viable? The Ro-Ro cargo has to be split into types of Ro-Ro cargo volume. With a high volume of a certain type of Ro-Ro cargo, it can be economically viable to dedicate the terminal to a single type of cargo. Furthermore the location can be varied as well as the lay-out of the berthing area. A type of land connection has to be chosen which depends on local conditions, like tidal variations, or vessels type, like for instance single, double or more deck-vessels.

In general Ro-Ro cargo cannot be stacked. Therefore a short stay on terminal is critical to limit the costs of transporting with a Ro-Ro method. Is a Ro-Ro terminal dedicated to a single type of Ro-Ro good, it is an option to have dedicated cargo handling equipment on site of the terminal. In general dedicated equipment is more expensive in terms of initial investment, but its efficiency is higher.

The tendency in Ro-Ro shipping is offering flexibility. It is not unthinkable that containers are being moved from A to B, but return cargo is of another type.

Containers are being mixed with bulk, cars, cassettes and other types. An all-in-one vessel has been designed to be able to handle mixed types of cargo. The hybrid freight Ro-Ro has been designed based on a similar concept. In this case it combines Ro-Ro decks with cellular container capacity. In the European Union the Marco Polo program has been set up to seek other means of transportation in order to offset some of the disadvantages of road transportation. In general transportation over water is less polluting per tonnage than transportation of water. The European High Speed Cargo Vessel has been developed in order to give a solution for the growing transport of goods, with other methods than road transportation. The fastship concept has been set up with similar reasons, to provide another alternative transportation method. The IPSI and INTEGRATION projects have been set up in order to improve the Ro-Ro chain. An optimal system of automation on the terminal side and the ship side and automating the lashing process onboard the vessel. The concept "intermodeship" had been developed to achieve a higher onboard-storage efficiency. Ro-Ro cannot be stacked, but by using onboard lifts an optimal loading efficiency can be achieved. On the connection with the hinterland the main disadvantage is the incompatibility of RoRo equipment with other modes of transportation. Specialized rail wagons for lifting swap bodies and cassettes have been developed. The commonly used cassette is too wide for road and rail transportation. Therefore a new cassette had been developed which is less wide in order to be compatible with rail and road transportation. This is called the wheelless system. A rollerbarge has been introduced in order to be able to load large blocks of containers at once in order to reduce to time in port.

At the end two case studies have been discussed in order to provide a link between information found in literature and choices made in a case study. Two different angles have been reviewed; the "Lake Superior" case handles the possibility of creating a complete new network of Ro-Ro terminal along side the lake and the "UK" case study by Posford Duvivier handles the development of a single terminal.

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Modified: 2006.05.23; logistics@3mE.tudelft.nl , [TU Delft](#) / [3mE](#) / [TT](#) / [LT](#).
