

Final Report: Cross-docking into 4FOLD Foldable Containers

Imbalances in trade cause the need to reposition empty containers. This results in additional costs and emissions for shipping lines. A possible solution to this problem is 4FOLD Foldable Container. 4FOLD is a 40ft High Cube shipping container that can be folded when empty. After folding, the 4FOLD Foldable Container is only one quarter of the height. As a result, four folded containers stack into one interconnected bundle. This bundle handles like one container, thereby creating savings on empty transport, handling and storage. In general, the positive effects of the 4FOLD can be best exploited on the hinterland transport because of two reasons:

1. The main share of the costs of the container transport chain are accountable for the hinterland transport.
2. The distances are shorter than deep-sea transport in particular in days, which results in higher frequencies of using containers.

By transloading (cross docking) cargo from imported containers into 4FOLD Foldable Containers at the terminal in Rotterdam, means that 4FOLD containers will only be used at land. The imported container is directly available for new cargo in the port of Rotterdam. It is also possible to do this for exporting containers from the European hinterland, it works the same but the other way around.

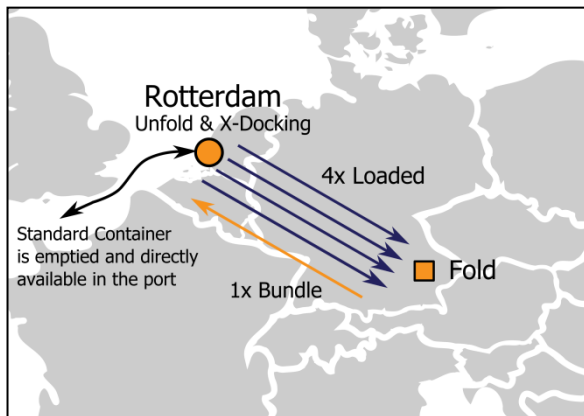


Figure 1: Import Scenario

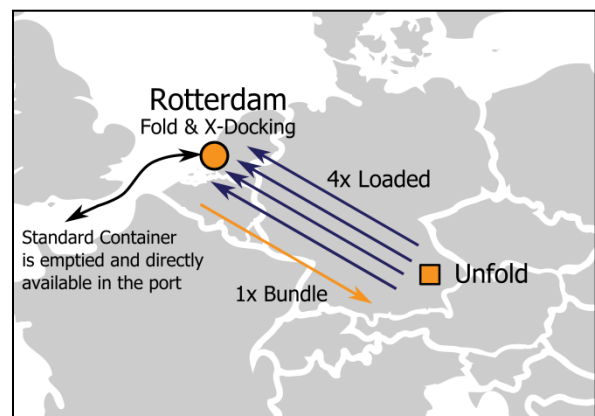


Figure 2: Export Scenario

Brainstorm session

The project started with a brainstorm session, at this session the project partners and other container transportation industry experts participated. In order to discuss the possibilities regarding cross-docking into 4FOLD Foldable Containers within Europe.

Together with the participants we discussed which ideas and factors of influence were most valuable and interesting.

Finding cargo: In order to make cross docking into 4FOLD a success, a fixed flow of cargo is needed to a specific deficit area in the European hinterland. This flow needs a minimum of 4 containers (40ft HQ), preferably on a long stretch where the savings are higher. Furthermore, it is interesting to know the break-even points per modality, whether it is beneficial to use foldable containers instead of standard containers.

X-docking: Further investigate the possibilities with cross-docking. Which cargo is suitable for cross-docking, think about palletized cargo. What is needed in order to strip and stuff the containers. Furthermore, the weight restrictions are something to take care off. After cross-docking which modalities are the best fit, think also about bulk trains.

Folding-package near dock: Creating a 4FOLD service which includes the folding at the terminal, cross-docking at the terminal and arranging that 4FOLD containers can be used. In this way you create a new business at the terminal.

Feasibility study

Based on the findings during the brainstorm session, DN1 found a suitable shipper. Before, the real operations started a feasibility was conducted. The main objective of this study to determine the benefits of 4FOLD Foldable Containers on the hinterland by making use of cross-docking. This means that 4FOLD will only be used on the hinterland. Together with the project-partners, information was gained and analysed in order to answer the following questions in a theoretical way:

Which stakeholders are involved?

Which cost variables are involved?

At what point for which variable is there a positive business case?

The hinterland transport includes four actors: shipper, forwarder, shipping line and terminal operator, and is mainly shaped by five important factors: intermodal transport, infrastructure, hinterland corridors, coalitions and dedicated terminals.

Altogether, this was the theoretical basis for constructing a model to compare a standard container with a foldable container on the hinterland. The results of this model were that cost savings were yielded for using foldable containers instead of standard containers, under the condition that it is possible to (un-) fold at the shipper/consignee. The cost savings increased with a higher imbalance ratio and longer distance. These results provide a theoretical and mathematical basis for the trial. There is a positive case for the trial with cross-docking with APMT, Kuehne + Nagel, a shipping line and a shipper in Austria. The savings are €1.304 for a bundle of 4 containers per roundtrip. The breakeven number of days per roundtrip for this case is 6, which corresponds with a distance of at least 353km. These results are also converted to truck transport, for which a breakeven distance of at least 221km is calculated. Thus, based on all the information provided in this financial impact analysis, there is a positive case for the customer in Austria combined with cross-docking. There is also a positive business case for cross-docking in general when the shipper is located after 353 km of rail transport and 221 km of trucking. These results should be validated by the trial.

Trials

Different trials were set up in order to validate the feasibility study in a practical way.

Trial Blum

Wolfurt - 880 km

Volume per year 100 containers

Annual kilometre reduction: 66.000 km

First, a bundle of 4FOLD Foldable Containers was transported by rail from the Port of Rotterdam to Wolfurt. Saving the costs and emissions of three empty containers. At the terminal in Wolfurt the containers were demonstrated and unfolded with the assistance of HCI. After unfolding and the demonstration of the 4FOLD Foldable Containers, the containers were stuffed. However, there was a problem with the fit of the cargo into the container. As 4FOLD Foldable Containers has a different inner dimension due the folding option. The shipper is using dedication equipment to load containers.



After this first trial the project partners evaluated the trial. During the first trial savings were confirmed as the bundle saved the costs of three containers. The unfolding procedure of the containers was positive. However the shipper stated to not continue with the trial as all cargo should

fit into the 4FOLD Foldable Container. The project partners concluded that they need to find another shipper to continue with cross-docking into 4FOLD. Most important is that the cargo of the shipper should fit into the 4FOLD which was the only threshold after the first trial. In the meantime HCI is further looking into the possibilities to increase the inner capacity of foldable containers for future design.

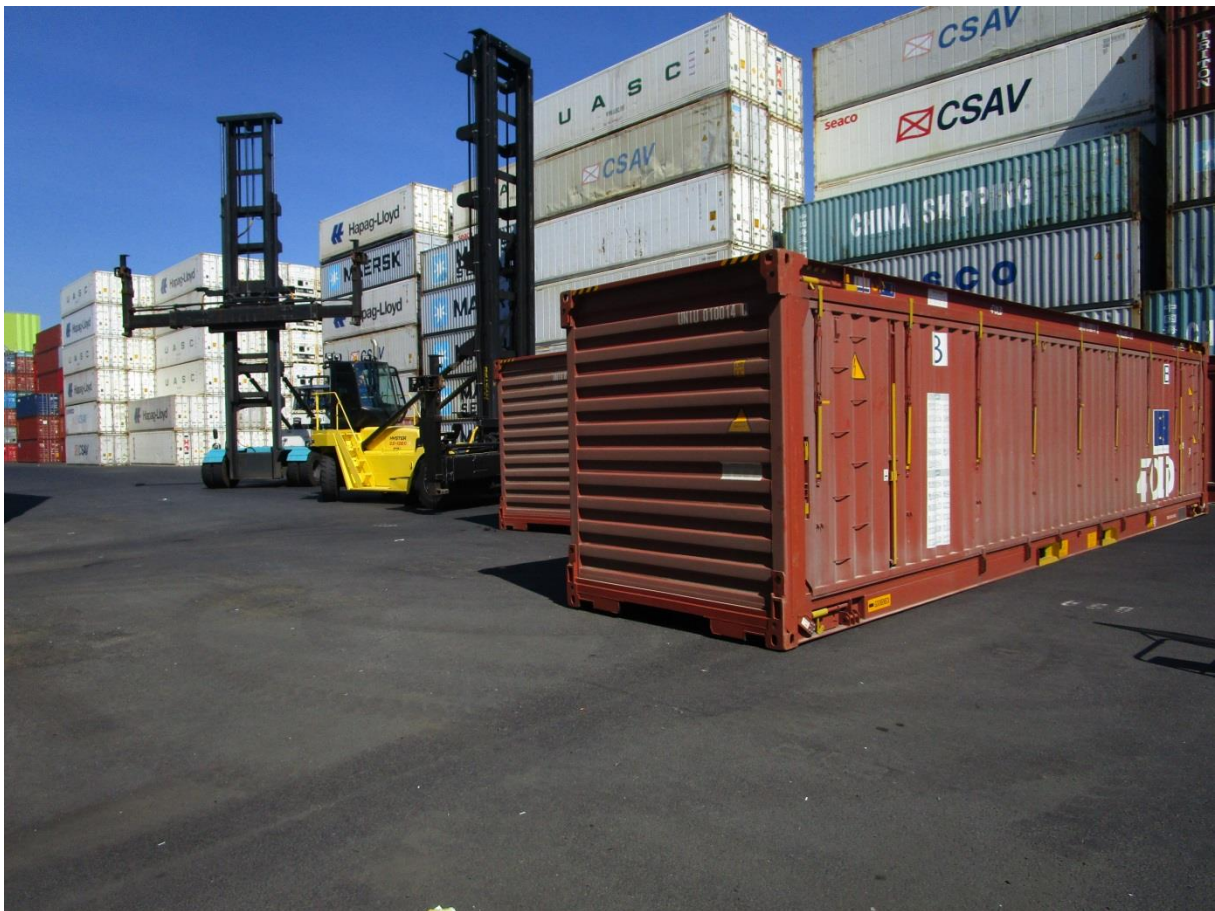
Trial Coca Cola

Mainz - 500 km

Volume per year 100 containers

Annual kilometre reduction: 37.500 km

The project partners found another shipper in one of the regions determined by the feasibility study, Mainz. Shipper stated that the cargo would fit into the 4FOLD Foldable Container, based on a specific document regarding the inner dimensions of 4FOLD. A bundle of 4FOLD Foldable Containers was transported to the terminal Frankenbach near Mainz. HCI guided the unfolding process of the containers. The unfolding of the containers went very efficient.



After unfolding the containers, they were ready to be picked up by the transportation company. However, due to the shortage in trucking in the highly congested area of Mainz, the pick-up of the

containers was delayed. During that time the shipping line used by the customer changed their sailing schedule, adding 5 days of sailing when using the port of Rotterdam compared to Antwerp. That is why the forwarder in collaboration with the shipper stated that it was no longer an option to transport the containers via the Port of Rotterdam instead of Antwerp.

Unfortunately the project partners had to conclude that this trial was no longer an option and needed to find another shipper.

Trial Magontec

Bottrop - 275 km

Volume per year 50 containers

Annual kilometre reduction: 10.313 km

Another shipper was found in the Duisburg region for the trial. Before, the trial started the project partners needed to offer a quotation for the shipper. Based on the information gained by the two trials before it was possible to provide this quotation. The shipper responded positive on the quotation and stated that it would book the containers when they got a request from their customer in the US. This proves that with the cross-docking case it is possible to attract new business as the shipper was not in contact before with one of the project partners.

Unfortunately, the customer of the shipper in US stopped their booking and no cargo was available for the trial at the short term. The shipper stated that the booking changed into a seasonal booking, most likely in the beginning of 2019. The shipper will inform the project partners when they receive this booking. From there the process can start. In the meantime the project partners decided to look further into other options in order to start a new trial as soon as possible.

Trial Philips

Oostrum - 200 km

Volume per year 400 containers

Annual kilometre reduction: 60.000 km

The project partners found another shipper based in The Netherlands. Currently, we are in discussion to start with 8 containers, with a short term potential of 400 containers. Oostrum will be the folding location of the containers, it is a shorter route however it still creates possibilities as Philips wants to invest in sustainable solutions as well. Because of the shorter route a feasibility study needs to be conducted. The project partners are working on this business case, we expect to have the study ready by the end of 2018.

Conclusion Trials

Several trials were done; each trial had its own conclusions. Based on the three trials the following conclusions are important to keep in mind for the further elaboration of cross-docking into 4FOLD Foldable containers:

First of all the inner dimensions of the 4FOLD Foldable Containers, shippers often maximize the capacity of the containers they use. Some shippers even have their dedicated equipment, like customized pallets or loading equipment. When less cargo fits in the container it could be that based on costs it is not beneficial to use foldable containers. Furthermore, within in Europe cargo is often transported in 45ft containers. As 4FOLD is a 40ft HC container it has to deal with capacity competition. Therefore not all routes within Europe are feasible with the 4FOLD Foldable Containers.

Furthermore it's important that all actors involved support the idea and have their benefits. Collaborating in the transportation chain is key. Another example is changing a current way of transporting containers, for example the route which also influences the transit time. Therefore, it is easier to implement crossing-docking into 4FOLD Foldable Containers on a current route which is already in use (via the port of Rotterdam).

Another important factor is to have a fixed flow of cargo. This flow needs to be divided over different customers (when exporting) or different suppliers (when importing). In this way you are less dependent on one customer. This means that the process can still continue even when one customer stops booking orders.

These factors are kept in mind with the current feasibility study regarding the transportation flows of Philips. Based on current information Philips fits the characteristics of the 'ideal shipper' perfectly.

Conclusion & Next steps

As kick off the project partners organized a brainstorm session together with other industry experts. Based on this brainstorm session the characteristics of the shippers were identified. In order to make cross docking into 4FOLD a success, a fixed flow of cargo is needed to a specific deficit area in the European hinterland. This flow needs a minimum of 4 containers (40ft HQ), preferably on a long stretch where the savings are higher. Cargo should be palletized as this is the best fit for cross-docking.

Based on the findings during the brainstorm session, the project partners found a suitable shipper. Before, the real operations started a feasibility was conducted. Together with the project-partners, information was gained and analysed in order to answer the following questions in a theoretical way. Based on all the information provided in this financial impact analysis, there is a positive case for the customer in Austria combined with cross-docking. Furthermore in general it is a positive business case for cross-docking in general when the shipper is located after 353 km of rail transport and 221 km of trucking.

In order to confirm the findings from the feasibility study different trials were done. Based on the savings cross-docking into 4FOLD Foldable Containers is feasible. Furthermore, during the trials operational factors were from influence as well. The most important lessons learned from the trials were that shippers may have dedicated equipment in order to stuff standard containers. Due to the

fact that the 4FOLD Foldable Container has slightly different inner dimensions it may cause problems regarding stuffing efficiency. Another important factor is that all actors involved should benefit and are open in communication. Furthermore, a fixed flow of cargo divided over different customers or suppliers is necessary to continue the process and being less dependent.

In general can be concluded that it is hard for the industry to change the current way of transporting containers. Therefore it is key to stay as close to the current way of transporting goods. In fact you should just change the container into a foldable one, and keeping all further factors the same. For example, the route, actors involved and stay close to standardizations. All these factors are kept in mind with the current collaboration with Philips. Currently we are working on the business case together with all actors involved, the next step with Philips is to start a trial and scale up soon. In the meantime, other shippers are still approached as well, keeping all lessons learned in mind.