Logistical and Economic Aspects of the Floating Container Crane within a Network Terminal

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Abstract of the Final Report

Since 1998 the Port of Rotterdam and Delft University of Technology are working together to make the conventional container terminals capable of coping the demands of the container terminals of the future.

These demands are: the increasingly larger ships service within relatively short times at competitive costs, the increasing service demands on the landside for handling the trucks, trains and barges.

In 2004 both partners participated in a multidisciplinary research project entitled “The Container Terminal of the Future”. The main purpose of this research project was to generate new ideas to cope the demands mentioned above.

From this project they concluded that it is possible to increase the berth productivity by means of a floating crane (the Floating Container Crane) working in the basin side of the ships. Moreover it is expected that this new concept will help to alleviate container terminals’ congestion because there is no demand for storage or internal transport in the deep-sea terminal. Furthermore, it is also expected that the total handling costs for containers to and from the hinterland can be reduced.

This report concerns the logistical and economic aspects of the Floating Container Crane (FCC) in order to collaborate with both partners (the Port of Rotterdam and Delft University of Technology). So, at the end of the year 2006 a detailed analysis related to the Customs operation was carried out with the help of Customs of Rotterdam. Thanks to this analysis some logistical problems were detected in relation to the ideal FCC concept, which means a direct container transport from the deep-sea terminal to the inland terminals. These problems leaded to finding other possibilities to use the FCC, which implied an indirect transport.

At the beginning of the year 2007 an economic analysis was carried out to check if the total handling costs for containers to and from the hinterland were actually reduced. This analysis only considered the possibilities of using the FCC that, for the moment, are feasible after the Customs Analysis.

In the last stage of this project, the basins of the European Ports with inland waterway connections and with a significant amount of TEU were analysed knowing where the FCC has space enough to work in the basin side of the new generation container vessels.
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Chapter 1

Introduction

1 INTRODUCTION

Nowadays, port logistics is characterized by: the extraordinary size and volume of the ships (making the most of the economies of scale), the congestion in deep-sea terminals, and the increasing service demands on the landside for handling trucks, trains and barges.

Trying to solve all these problems, Port of Rotterdam and Delft University of Technology decided to sign a Research Collaboration Agreement for a period of 4 years in 1998. After 4 years working together, both partners decided to start a second phase of the program in 2003 for a period of 5 years. This second phase was called Port Research Centre Rotterdam – Delft (PRC).

As a result of this collaboration, the project “Container Terminal of the Future” was carried out between November 2003 and December 2004. The key-question behind this project was how the berth productivity for the very large container vessels could be increased. At the moment berth productivity was 125-150 moves per hour and the aim was 300 moves per hour (Ligteringen & Beemen, 2004).

After a general outline of the project “Container Terminal of the Future” and its results, the most promising concept for increasing the quay productivity was the Floating Container Crane (FCC), which, moreover, was able to contribute to the flexibility of the quay.

The original concept of the FCC was presented by Jan van Beemen of Royal Haskoning. The FCC worked on the basin-side of a vessel, which was moored along a conventional quay. It transferred containers between the deep-sea containership and barges which transport them to inland terminals through inland waterways.

There are different applications of the FCC, but the one which is subject of this thesis is the direct transport to and from inland terminals, without storage in the deep-sea terminal. When containers are transported directly to the inland terminal by barge or by truck (by barge in the case which is up to this thesis), the deep-sea terminal is called Network Terminal.

In 2004, Jan van Klinken (Klinken, 2004) carried out a study of the options available for the configuration of pontoon and cranes on it using the FCC for the same application as in this thesis. He concluded that the crane should consist of a Main Crane with one trolley, a separate Barge Crane on rails, and two barges side-by-side between the floaters. The Main Crane transports the container
from the hold of the deep-sea vessel to the ship-ward floater; the Barge Crane picks up the container from the floater and transports it to the barge hold; the outside floater is used for the storage of the hatch covers of the deep-sea vessel. The barges are longer than the width of the pontoon, so they have to be shifted during loading/unloading.

With this new concept, it was possible to save money and time in handling and storing containers in deep-sea terminals, furthermore, it helped to alleviate their congestion.

But, although the essence of the concept was promising, it implied problems as well.

This thesis analyzes different logistical and economic aspects of the FCC to make it a success. Thus, the main purpose of this thesis is studying the problems that the Customs operation implies on the FCC’s ideal concept, which is transporting containers from deep-sea terminals to inland terminals directly. The suggestion of alternatives to this way of operation avoiding the detected problems is another goal of this project as well as the estimation of the tariffs applicable to each alternative. Thus, it will be possible to compare them with the Conventional Handling tariff to know which one will be more economically attractive.

The last aim, related with the project carried out by PRC, is the knowledge of the European ports which would be potential users of the FCC in a Network Terminal. This will be studied from the point of view of the dimensions of the basins where the container terminals are placed, thus it will be possible to know if the FCC fits in them or not.

The structure of this report is:
• Chapter 2: This chapter is a study of the different Customs Procedures applicable to goods which entry and/or exit in the EU ports. Furthermore, it contains an identification of the problems for the use of the FCC due to the Customs Procedures and the Customs operation. Finally, there is a proposal of the different ways where the FCC can work taking these problems into account.

• Chapter 3: This will focus on the economics of the FCC in the different ways where the crane can work for the moment. It will be compared with the Conventional Handling of containers. Finally, a sensitive analysis is done. This will compare the cheapest way of handling depending on the current tariffs to handle containers in deep-sea and inland terminals, and the FCC handling tariff.

• Chapter 4: Finally, chapter 4 will analyze the basins of the European ports where the FCC can work as in a Network Terminal.
2. Customs Analysis

Chapter 2

Customs Analysis

2 CUSTOMS ANALYSIS

2.1 INTRODUCTION

Customs is one of the most important members of the port community. It is able to accept or refuse the goods that are going to enter to a country, to enable or stop the exit of goods and thanks to it the states collect a huge amount of money by means of duties and other taxes.

This organisation has the authority to inspect the different goods, opening containers to make sure that they are in accordance with applicable laws. This task is vital facing the fight against smuggling and counterfeit, so penalties are imposed by Customs on natural persons or legal persons that violate court and administrative regulations in this respect.

In the next section, the different customs procedures in the ports all around the European Union will be explained, especially in the Dutch ports, with regards to:

- Entry of goods to the port
- Import of goods
- Export of goods
- Storage of goods
- Transit of goods
- Safety, health, economy and environment

Once all this procedures are described and analysed, the identified problems for the FCC will be explained in section 2.3. In section 2.4, the different possible solutions to these problems will be suggested. Finally, in section 2.5 some conclusions will be formulated.
2. Customs Analysis

2.2 CUSTOMS PROCEDURES

When we talk about Customs procedures we are referring to the set of formalities that goods which enter to or exit from a customs territory of a country have to follow.

As it was mentioned in the previous section, in this chapter the European customs procedures will be analysed. They have been studied in the whole European Union, but especially in The Netherlands. So, the following explanations will be related to every port of the Union and where applicable, the Dutch nuance will be pointed out.

2.2.1 Entry of Goods

Pre-arrival

In recent years International trade has boomed. Ships are becoming larger and larger (see fig. 2-1) and transport increasing quantities of goods. This increase of the cargo flow puts pressure on the logistic chain, as does the phenomenon of 'just-in-time deliveries'.

![Emma Maersk](https://www.jtashipphoto.dk)

**EMMA MAERSK**

- *Length Overall*: 397 m
- *Beam*: 56 m
- *Depth*: 30 m
- *Draft*: 15.5 m

*Fig. 2-1: Emma Maersk. (Source: www.jtashipphoto.dk)*

It is essential that logistics delays are restricted to a minimum. This has major consequences for Customs. On the one hand, it should act swiftly in order to prevent delays in the logistic chain. On the other, it should carry out adequate checks and prevent high-risk goods from entering the EU unchecked.

To reduce this tension, Customs uses a system of pre-arrival information. This system provides Customs at the earliest possible stage with data of the goods that are carried, well before the goods arrive in the EU. In this way, Customs can select high-risk consignments in time, and inform the parties involved in time as to which consignment will be checked upon arrival. Since 1999, it has been possible to present manifests to Customs for handling before the arrival of
the ships. This facility was based on arrangements between Customs and representatives of logistics companies, such as transport companies, storage companies, ship brokers, stevedores and forwarding agents. This has considerably accelerated the selection and inspection process.

The manifest information is supplied electronically in advance by means of the automated Sagitta Entry system. Thanks to the Sagitta System it is possible to prevent logistic delays at the ports and delays in the delivery of the goods.

The automated selection system for entry performs a selection in two phases (see Fig. 2-2):

- During the first phase, a selection based on risk indicators and high-risk areas is generated through an automated process. This selection is divided into three groups:
  - red group: high-risk goods (to be inspected)
  - white group: goods without risk (no inspection)
  - orange group: goods with a limited risk

- During the second phase the latter group is presented to the specially-trained selectors for further selection. Based on available counter-information, the selector has to decide whether or not the goods should be inspected.

![Diagram](image)

*Fig. 2-2: The automated selection system for entry diagram*

The decision whether goods will be subjected to an inspection upon arrival is communicated to the parties involved before the moment of arrival.
Clearance for entry

After the entrance of the goods in the customs territory of the European Union, they should be presented to the Customs immediately; it is called “Presentation of the Goods”. It must be clarified that with the term “goods” both the means of transport and the goods it contains are meant.

Presenting goods means that Customs is informed of the fact that the goods have arrived at the Customs office or at a location designated by Customs.

In addition to the “Presentation of the Goods”, the vessel should be cleared for entry when it arrives to the port. For that:

1) A general declaration should be submitted to Customs in order to clear the ship. This general declaration corresponds with the IMO FAL 1 type. It sets out the general details about the ship. Furthermore, it contains information about the captain, the crew, the port of departure and the port of destination, as well as a general description of the cargo.

2) A Summary Declaration should be filed for those goods that will be unloaded or transhipped. In the next section it will be explained more about this declaration.

3) A statement of navigation assistance should be submitted. This is a declaration with which Customs determines and collects the charges of navigation assistance.

In addition to this information, the following documents have to be submitted to Customs or presented on board:
- IMO FAL 3: to declare provisions and ship’s stores (it must be submitted to Customs);
- IMO FAL 4: to declare crew’s possessions (it must be presented on board).

The forms IMO FAL1, IMO FAL3 and IMO FAL4 are attached in the annex A.

Filling a Summary Declaration

As it is mentioned in the previous section, after goods have been presented to Customs, a Summary Declaration should be filed for the goods that are unloaded or transhipped. The Summary Declaration should be submitted to Customs within 24 hours of the presentation of the goods. Customs may allow that no Summary Declaration is filed if, instead of a Summary Declaration, a declaration is filed immediately for assigning a customs-approved treatment or use to the goods, such as 'release into free circulation' or 'storage of the goods'.

The Summary Declaration should show the goods description, the gross weight and the container number if it is applicable. The goods description may be brief, but should at least be a normal commercial description by which the goods can be identified. This normal commercial description should describe the goods in sufficient detail.
A number of goods types should be described in specific terms.

If goods are described as precise as possible in the Summary Declaration, this will benefit the logistic process. After all, it will improve the selection for inspection. In this way, the number of consignments to be inspected can be restricted.

The Summary Declaration must be filed in a specific form according to the model established by the Customs Authorities. However, authorities will be able to accept the use of any commercial or administrative document which will contain the necessary information to identify the goods.

The submission of the Summary Declaration must be carried out by:

a) The person who introduced the goods in the Customs’ territory of the European Union or the person responsible of goods’ transport after their introduction and before the goods’ presentation.

b) The person who act in the name of the person described in a).

As a general procedure, the different steps of the procedure of Summary Declaration in the Port of Barcelona (Spain) are mentioned:

1. The ship-owner inform, when he knows which goods will be unloaded in the port, to the ship’s agent who acts in his name in this port. The ship’s agent prepares and sends the Summary Declaration to the Port Authority either by EDI (Electronic Data Interchange) (see Fig. 2-3, step 1) or by hard copy (see Fig. 2-4, step1). In the second situation the Port Authority will proceed to save all the data.

2. Every summary declaration must pass the computer filters of the Port Authority, and subsequently they are sent to Customs by means of computer network (see Fig. 2-3 and Fig. 2-4, step 2).

3. The declaration must pass the computer filters of the Customs. Customs answers with a message of acceptance or rejection of the declaration to the Port Authority by EDI (see Fig. 2-3 and Fig. 2-4, step 3). It forwards the same information by EDI to the ship’s agent who sent the summary declaration by EDI (see Fig. 2-3, step 4), and just in case of rejection, the Port Authority forwards the information to the ship’s agent who sent the declaration by hard copy (see Fig. 2-4, step 4).

4. Before the activation of the Summary Declaration the ship’s agent is able to present alterations of the declaration. They are replied by Customs as in the original declaration.

5. The activation of the Summary Declaration happens when harbour pilots insert the arrival time of the vessel in the application of the Port Authority. The Port Authority communicates it to Customs (see Fig. 2-3 and Fig. 2-4, step 5). The activation implies that from here on, the goods are at Customs’ disposal so it is possible to request Customs-approved treatment or use.
2. Customs Analysis

Choosing a customs-approved treatment or use

After the presentation of the goods, they have the status of “goods in temporary storage” until the moment when a further customs-approved treatment or use is assigned to them.

When goods have the status of “goods in temporary storage”, they can only be kept at customs-approved locations. These locations are known as Temporary Storage Premises (TSP). While goods are in TSP, Customs Authorities are able to demand a security to the good’s holder ensuring the payment of any
customs’ debt and it is just allowed to handle the goods in case of maintenance, without any change of the good’s presentation or technical characteristics. The storage of the goods at a TSP is temporary, because the goods should be assigned a subsequent customs-approved treatment or use. The formalities regarding this further customs-approved treatment or use should be fulfilled within 45 days of the receipt of the summary declaration for goods entered by sea. Customs Authorities will be able to reduce or extend the deadline, but only in justified circumstances.

The temporary storage should be terminated before the end of the 45 days period by assigning a new customs-approved treatment or use to the goods. A declaration has to be filed for this new customs-approved treatment or use. The following forms of customs-approved treatment or use are available:

1) Placement of goods under one of the following customs procedures:
   • The procedure of release into free circulation (it will be explained in the Import section).
   • The customs transit procedure (it will be explained in the Transit section).
   • The customs warehousing procedure (it will be explained in the Storage section).
   • The inward processing procedure (it will be explained in the Import section).
   • The processing under customs control procedure (it will be explained in the Import section).
   • The temporary import procedure (it will be explained in the Import section).
   • The outward processing procedure (it will be explained in the Import section).
   • The export procedure (it will be explained in the Export section).

2) Entry of goods into a free zone or a free warehouse (it will be explained in the Storage section).

3) Re-exportation of goods from the customs territory of the community (it will be explained in the Export section).

4) Destruction of goods.

5) Abandonment of goods to the Exchequer.
To finish with the section 2.2.1, a diagram is presented in *Fig. 2-5* to summarize this.

*Fig. 2-5: Summary diagram of the “Entry of goods” section*
2. Customs Analysis

2.2.2 Import of Goods

It should be mentioned that goods that enter the customs territory of the European Union (EU) from a non European Union (non-EU) country are referred to as “non-community goods”. A number of rules apply with respect to these goods. The main rule is that these goods should be assigned a “customs-approved treatment or use”. One of the ways it can be assigned a customs-approved treatment or use is to place them under a customs procedure, as it was mentioned in the section entitled “choosing a customs-approved treatment or use” of 2.2.1. In case of import, these customs procedures are either:

- Procedure of release into free circulation
- The inward processing procedure
- The processing under customs control procedure
- The temporary import procedure
- The outward processing procedure

At this point in time, it should be indicated that the entrance of Community Goods into a Community Country does not imply an importation; it means that Community goods are able to move freely all around the European Union.

2.2.2.1 Procedure of Release into Free Circulation

Before non-community goods can be marketed within the EU they should first be released into free circulation. This means that:

1) A declaration should be filed for the goods. There are various ways of filing a declaration. These are:
   - electronic declaration, with the possibility of simplified procedures
   - written declaration, with the possibility of simplified procedures
   - verbal declaration
   - declaration by a different act

2) Certain formalities should be fulfilled when the declaration is made, such as submitting invoices and keeping the goods available for inspection by Customs.

3) The import duties and/or other import taxes owed should be paid. When non-community goods are imported to the EU the import duties are the same for all the EU countries. The other import taxes differ from one Member State to another.

4) The declaration process involves a check as to whether the goods comply with the regulations in the area of safety, health, the economy and the environment. These regulations often prescribe the submission of a license certificate upon the import of goods.

In the attached annex B, the different ways of filling a declaration are explained in detail.
2.2.2.2 The Inward Processing Procedure

By using this procedure it is possible, under an exemption from import duties, other import taxes and trade policy and agricultural policy measures:
1) to introduce non-Community goods into an EU country, in order subsequently
2) to have these goods treated (undergo a processing operation) in elsewhere in the EU, and finally
3) to re-export the treated goods (the compensating products) and remove them from the EU.

Fig. 2-6: The inward processing procedure (Source map: europa.eu/abc/maps)

The following are regarded as processing operations:
- The adaptation of goods, including mounting, assembly and adjustment to other goods.
- The processing of goods.
- The repair of goods, including overhaul and tuning.
- The use of certain goods that do not appear in the compensating products, but that facilitates or simplify the production of these products, even if they completely or partly disappear during use.
2. Customs Analysis

2.2.2.3 The Processing Under Customs Control Procedure

By using this procedure, it is possible, under an exemption from import duties, other import taxes and trade policy and agricultural policy measures:

1) to introduce non-Community goods into the EU from a non-EU country, in order subsequently
2) to have these goods undergo certain processing within the EU, and finally
3) to release the processed goods into free circulation or assign them a different customs-approved treatment or use.

Fig. 2-7: The processing under Customs control procedure (Source map: europa.eu/abc/maps)

The processing under customs control procedure may, for example, offer a solution if the raw materials of a certain product are subject to a higher rate than the product itself. In addition, this procedure can be used if goods should first be adjusted to technical requirements in the area of safety, health and environment, before being released into free circulation.
2.2.2.4 The Temporary Import Procedure

By using this procedure it is possible, under an exemption from import duties, other import taxes and trade policy and agricultural policy measures:

1) to introduce non-Community goods into the EU from a non-EU country, and subsequently,
2) to use the goods within the EU for a specific purpose, in order finally
3) to re-export the goods to a (different) non-EU country

Fig. 2-8: The temporary import procedure (Source map: europa.eu/abc/maps)

This is subject to the condition that the goods temporarily imported do not undergo any changes during their stay in the EU and retain the condition in which they were placed under the customs procedure.
2.2.2.5 The Outward Processing Procedure

By using this procedure, it is possible:
1) to transfer Community goods from a EU country to a country outside
   the EU, in order subsequently
2) to have the goods treated (undergo a processing operation) in the
   country outside the EU, and finally
3) to release the treated goods (the compensating products) into free
   circulation in the EU under a full or partial exemption of duties.

Fig. 2-9: The outward processing procedure (Source map: europa.eu/abc/maps)

The following are classified as processing operations:
- the working of goods, including mounting assembly and
  adjustment to other goods
- the processing goods
- the repair of goods, including overhaul and tuning

As opposed to some of the previous procedures, under the outward processing
procedure, no exemption can be granted from the excise duty and consumption
taxes owed upon the import of the compensating products.
2.2.3 Export of Goods

First of all it is going to be mentioned that Community goods are goods that are in free circulation in the EU, for example because the import duties on those goods have been paid or because the goods were produced, harvested or mined in the EU.

Exporting is moving Community goods outside the EU customs territory. Moving Community goods from one EU country, for instance, The Netherlands, to another EU country, like Spain, does not constitute export, but rather an intra-Community transaction, for which an export declaration with Customs is not needed.

Some areas and other EU countries belong to the EU’s territory without being part of the EU customs territory (see annex F). Moving Community goods from an EU country to such an area qualifies as export.

The activities of the Customs Administration are not limited to inspecting imported goods. It also has a task in inspecting goods that are exported. This means that the exporter is also dealing with Customs. For Community goods leaving the EU customs territory, an export declaration must be completed and filed with Customs. In addition to the export declaration, there are certain requirements that the exporter must meet for tax purposes. He must also observe a number of rules concerning safety, health, economy and environment.

It must be mentioned that the exporter is the party who owns the goods to be exported at the moment that the export declaration is filed with Customs, or who possess the goods at that moment.

2.2.3.1 Procedure for Exporting Goods

Before the export of goods, the exporter must meet a number of requirements. For instance, the exporter must “present” the goods to Customs, and he must obtain official permission to export the goods from the EU after he file the export declaration.

The export declaration must be filed by the exporter and it is filed for the exporter's expense. This means that the exporter must pay the export charges and that refunds of export charges must be paid to the exporter.

It is possible that the exporter is not domiciled in the EU. In such cases, the law regards the party dealing with the goods within the EU as the exporter. The exporter may have an intermediary who represents him, for example a customs agent.

What information should be stated in the export declaration depends on the specific situation of the consignment.
The exporter may commission an intermediary, such as a customs agent, to prepare the declaration. Customs agents are specialised in customs declarations. They also have connections that allow the exporter to file declarations electronically.

The export declaration must be filed at a customs office that is competent for the jurisdiction in which:
- the exporter is domiciled
- the goods were packaged
- the goods were loaded for the purpose of the export

The different ways of filing export declarations are the same as in case of "procedure of release into free circulation", but the simplified declarations have some changes, so they are explained in the annex C.

Customs may not take the export declaration into consideration until the exporter has presented the goods at the customs office of export and completed the declaration. Presenting goods to Customs means that the exporter must inform Customs of the fact that the goods have arrived at the customs office or at a location designated by Customs. Presenting goods also means that goods are available there for inspection by Customs.

Customs inspects the goods where they are located. If the goods are already at a location designated by Customs, they generally do not have to be taken to the customs office; Customs carry out its inspection at the designated location.

The customs office where the exporter presents the goods for export is referred to as the "customs office of export". The officials at that office assess the accuracy and completeness of the declaration. Customs may inspect the declaration, the accompanying official documents and the goods if there is any suspicion of inaccuracies. The exporter may not remove the goods until he receives permission from the custom officials. This is called "release of the goods for export".

Goods are released for export on the stipulation that the goods leave the EU customs territory in the same condition as that in which they were when Customs accepted the export declaration.

The goods that have been declared for export will remain under customs supervision from the moment that the export declaration is accepted until the goods actually leave the EU customs territory, or until Customs declares the export declaration null and void. The goods are moved from this customs office, together with the export declaration, to the "customs office of exit".

The "customs office of exit" is the final customs office that the goods pass before leaving the EU. The officials at this office sign the export declaration to confirm the actual departure of the goods from the EU.

After goods have been declared for export and loaded into the ship by which they leave the EU, they have to be cleared. This means that the goods and the
transportation by which they are transported actually leave the EU customs territory under Custom’s supervision. To allow Customs to exercise this supervision, a number of obligations and formalities have been drawn up. Goods leaving the EU customs territory by sea are subject to the following requirements:

1. The captain of the ship on which the goods are situated must go to a customs office of exit and announce there that he intends to set sail with his ship. He must also state his ship’s mooring place.

2. The party entrusted with the transport of the goods, generally the ship’s agent, must report to the customs office of exit of the port and declare all goods presented to the customs office of exit. This is the clearance declaration. This is done by submitting documents accompanying the goods or by submitting the number 3 copy of the previously filed export declarations. A manifest must also be submitted, listing all the goods loaded. Customs compare this manifest with the official documents submitted.

3. With the clearance declaration, the captain of the ship that previously entered the port by sea must submit the “Settlement Certificate” for inspection. It is an official statement with which the captain can prove that he met all the requirements concerning his ship and the goods. Customs issues a Settlement Certificate when the ship and the goods enter the port.

Once the officials of the office of exit have given their approval, the exporter can export the goods, but he may only leave when he has been issued a “Clearance Certificate”. It is an important document for him to prove that he has met all requirements.

The “customs office of exit” records the actual departure of the goods from the EU on the export declaration. Once that departure has been recorded, the goods have been exported from the EU and Custom’s task is done. In this manner, the export of the goods can be verified at other places and by other officials than those of the customs office of exit.
The following diagram summarizes the different steps to export goods.

- Presentation of the Export Declaration
- Presentation of the goods
- Inspection of goods by Customs
- Inspection of the Export Declaration in the “Customs Office of Export”
- Release of the goods for export
- Signing of the Export Declaration in the “Customs office of exit”
- Actual departure of the goods
- Loading of the goods onto the ship
- Clearance of goods
- Issue of the “Clearance Certificate”
- Recording of the actual departure

*Fig. 2-10: Summary diagram of the Procedure of Exporting Goods*
2. Customs Analysis

2.2.3.2 Re-exportations

Re-exportation lies in the exit of non-Community goods, which, previously, were introduced to the customs territory temporarily, from this territory.

There are two ways to declare the goods for re-exportation:
- by filling a re-exportation declaration
- by notifying Customs of the re-exportation

A re-exportation declaration is required if the goods were subject to an economic customs procedure during their stay in the EU. These procedures are:
- customs warehouse
- inward processing (suspensive procedure)
- treatment under customs supervision
- temporary import

The provisions for export declarations also apply to re-exportation declarations. In those instances where one can file a simplified export declaration, therefore, one can also file a simplified re-exportation declaration.

2.2.3.3 Temporary Export

There are two ways of declaring goods for temporary export:
- by filing an export declaration
- by applying for an ATA carnet

The provisions governing export declarations also apply to temporary export declarations, including the possibilities for simplified procedures.
2. Customs Analysis

2.2.4 Storage

First of all, it should be mentioned that all of the specific terms about storage are explained in the annex D.

Goods that enter the customs territory of the EU from outside may be stored under the supervision of Customs (see “supervision” in the annex D). This is known as storage under Customs control. When goods are stored in this manner, no import duties and other import taxes are owed (see “provision of security" in the annex D).

![Fig. 2-11: Storage of containers in TSP. (Source: www.mictweb.com)](image)

Furthermore, certain trade policy and agricultural policy measures, import bans and import restrictions are not applied. This is convenient if the goods are not used immediately or if no customs-approved treatment or use has yet been assigned to the goods.

The storage of goods under customs control requires licence.

EU customs legislation offers various options for the storage of goods under customs control. In the Netherlands, the following storage facilities (see “storage facility” in the annex D) exist:

- **Storage in temporary storage premises** (see Fig. 2-11): It is intended for the storage of goods under customs control for a short period of time.
- **Storage in customs warehouse**: It is intended for the long-term storage of goods under customs control. Depending on the type of customs warehouse, the physical control by Customs may be partly replaced by an audit of the warehouse keeper's accounts (see “warehouse keeper” in the annex D).
- **Storage in free warehouse/free zone**: This form of storage is intended for the long-term storage of goods under customs control in a number of specific situations.

The chosen option depends on the following factors:

- purpose for which the goods are stored under customs control
- the place where the business is based
- the nature of the business
2. Customs Analysis

2.2.4.1 Types of Storage

In the EU there are different options for the storage of goods under customs control. The next diagram shows the options used in The Netherlands:

![Diagram of Storage Facilities]

Temporary Storage Premises
- Type B
- Type C
- Type D
- Type E

Customs Warehouse

Free Warehouse/Free Zone
- Free Warehouse
- Free Zone of Control type 2

*Fig. 2-12: The different types of storage in the Netherlands*

They will be explained in the following lines.

**Temporary Storage Premises**

Temporary Storage Premises (TSP) offer the possibility of storing goods that enter the customs territory of the EU awaiting further customs-approved use or treatment (see section “Choosing a customs-approved treatment or use” in chapter 2.2.1).

As it was mentioned before, the duration of the storage is limited to 45 days for goods that entered the EU customs territory by sea and in principle, anyone can use a TSP. In practice, the temporary storage facility is used mainly by businesses engaged in loading and unloading ships used in international traffic. The administrator of the area (see “warehouse keeper” in the annex D) is liable towards Customs for the goods kept in storage.

The storage premises should have been approved by Customs.

Temporary storage is only possible in the vicinity of a customs office because Customs physically supervises the deposit in and removal from a TSP (see “deposit” and “removal” in the annex D).

The goods are permanently supervised by Customs while they are kept at the temporary storage premises. This means that a customs officer attends the deposit and the removal of the goods and locks the premises upon completion of the activities.
Type B Customs Warehouse

This type of Customs Warehouse (see “Customs warehouse” in the annex D) is a public one (see “public customs warehouse” in the annex D). This means that the warehouse keeper can make the premises available to anyone that wants to store goods under customs control and, the goods can be stored for an unlimited period.

The type B customs warehouse is intended especially for businesses engaged in so called “transit warehouse”, whereby the transit of goods (see section 2.2.5) is interrupted and the goods are stored temporarily awaiting a further customs-approved treatment or use. The depositor (see “depositor” in the annex D) should file a declaration in this respect. The depositor is also the person who is responsible to Customs for the goods. He has to provide security for the deposit of those goods.

Because the type B customs warehouse requires a lot of physical supervision by Customs, a type B customs warehouse can only be established at locations situated near a customs office.

Customs exercises supervision by being present at the deposit, during storage and at the removal. If no activities are performed in the customs warehouse, Customs locks the premises. Customs keeps the storage documents for the stock accounts. It is therefore not necessary for the warehouse keeper and the depositor to keep stock accounts.

Type C Customs Warehouse

A type C customs warehouse is a private customs warehouse (see “private warehouse” in the annex D). This means that only the warehouse keeper can store goods in it. These goods do not have to be his property, he can also store on behalf of others. In that case also, the warehouse keeper remains responsible to Customs for the goods kept in storage. He is also the person that has to provide security to Customs.

In type C customs warehouse, goods can be stored for an unlimited period of time.

Because Customs performs physical inspections, this type of customs warehouse should be situated in the vicinity of a customs office. If the stock accounts enable Customs to exercise a greater degree of administrative control, the location will be less important.

Customs exercises both physical and administrative supervision. The degree of reliability offered by the stock accounts determines which form of supervision is exercised. To the extent that the stock accounts offer more guarantees, a greater degree of administrative supervision will be exercised and the goods movements are followed mainly on paper. If the stock accounts offer fewer guarantees, the supervision is mainly physical.
The warehouse keeper has to keep stock accounts. All deposits and removals need to be entered in the stock accounts.

**Type D and E customs warehouses**

Type D and E customs warehouses are private customs warehouses, so only the warehouse keeper is allowed to store goods in them.

The type D and E customs warehouses are not completely identical. There are a number of important differences:

- **Type D customs warehouse**: at the moment of the deposit of the goods, the type of the deposited goods, by tariff and origin, should be established. In principle, these taxation factors are decisive when the goods are released into free circulation from the type D warehouse. Furthermore, with regard to goods that are released into free circulation from this warehouse, the called “local clearance procedure for import” is compulsory.
- **Type E customs warehouse**: unlike the other customs warehouses, the type E customs warehouse does not require approved premises. All premises where the warehouse keeper stores goods under customs control are part of the type E customs warehouse. It is possible, as a result, that several locations come under the same warehouse authorisation. Nevertheless, the storage locations must be known to Customs.

In both D and E customs warehouses, goods can be stored for an unlimited period of time, and only the warehouse keeper may store goods in these types of customs warehouse. This does not mean that he cannot store goods on behalf of others. However, he remains responsible towards Customs for the goods kept in storage. In this respect it is irrelevant whether or not he is the owner of the goods.

Because physical control has a supplementary character in the case of these customs warehouses, they can be established anywhere in The Netherlands.

The warehouse keeper has to keep stock accounts. All deposits and removals should be entered in the stock accounts.

The condition for the type D and type E customs warehouse is that the entries in the stock accounts should be such that physical supervision by Customs can be limited and will mainly be supplementary in nature. Customs will mainly exercise administrative control. This also means, therefore that the requirements made of the stock accounts will be stricter that in the case of a type C customs warehouse.
Free warehouse

A free warehouse is a building or premises guarded and locked by Customs. Within this building or these premises, anyone can store goods.

The goods stored in a free warehouse are treated as if they are located outside the customs territory of the EU, and provision of security is not needed.

In the free warehouse the goods can be stored for an unlimited period of time. Deposits in and removals from it can only take place on submission of customs documents.

It enables business whose stock accounts do not satisfy the requirements for the type C, D or E customs warehouse to store goods under customs control nevertheless. Although keeping stock accounts is compulsory, the requirements made of the stock accounts are less strict than in case of a type C, D or E customs warehouse.

A free warehouse can only be established at a location designated for that purpose by Customs. In general, these are locations in the vicinity of a customs office.

Customs control takes place when the goods are deposited or removed. Customs is present on these occasions. Furthermore, all activities performed in the building or premises may only be performed in the presence of Customs. A free warehouse therefore involves full physical supervision by Customs. Outside opening hours, Customs locks the free warehouse.

Free zone

Unlike a free warehouse, a free zone is a not building or premises, but a location. This location is a geographical area which has been carefully charted and recorded.

There are two types of free zones:

- Control type 1: It is more like a free warehouse. Instead of the building or premises, this involves a geographical enclosed area. This enclosure takes the form of a fence or wall placed around the free zone. Obviously, controlling this type of free zone is highly labour intensive for Customs. There are no free zones of control type 1 in The Netherlands.

- Control type 2: It is more like a customs warehouse. Here, too, there is a geographical area. Instead of an enclosure created by a fence or wall and inspections when goods enter or leave the free zone, control takes place on the basis of the stock accounts of the administrator or operator of the free zone. In addition, physical inspections are carried out as well. The administrator and/or operator are responsible of the goods.
The goods can be stored in a free zone of control type 2 for an unlimited period of time.

Although the administrator or operator has to keep stock accounts, anyone can store goods within the free zone of control type 2. The storage of goods in a free zone of control type 2 requires the provision of security.

Customs control takes place on the basis of the stock accounts of the administrator and/or operator. In addition, supplementary physical inspections are performed.

The next table summarize the most important aspects of the different types of storage in The Netherlands.
## 2. Customs Analysis

<table>
<thead>
<tr>
<th></th>
<th>TSP</th>
<th>TYPE B C.W.</th>
<th>TYPE C C.W.</th>
<th>TYPE D C.W.</th>
<th>TYPE E C.W.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Storage period</strong></td>
<td>&lt; 45 Days</td>
<td>Unlimited Period</td>
<td>Unlimited Period</td>
<td>Unlimited Period</td>
<td>Unlimited Period</td>
</tr>
<tr>
<td><strong>Who can use it?</strong></td>
<td>Loading or Unloading Business</td>
<td>Everyone, specially “Transit Warehouse”</td>
<td>Warehouse Keeper (he can store on behalf if others)</td>
<td>Warehouse Keeper (he can store on behalf if others)</td>
<td>Warehouse Keeper (he can store on behalf if others)</td>
</tr>
<tr>
<td><strong>Liability towards customs</strong></td>
<td>Warehouse Keeper</td>
<td>Depositor</td>
<td>Warehouse Keeper</td>
<td>Warehouse Keeper</td>
<td>Warehouse Keeper</td>
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<tr>
<td><strong>Do storage premises need customs approval?</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Vicinity of a Customs Office</td>
<td>Near a Customs Office</td>
<td>Vicinity of a Customs Office</td>
<td>Anywhere in The Netherlands</td>
<td>Anywhere in The Netherlands</td>
</tr>
<tr>
<td><strong>Supervision by customs</strong></td>
<td>Permanently</td>
<td>At the deposit, during the storage and at the removal</td>
<td>Yes, but it depends on the stock accounts</td>
<td>Physical controls supplementary.</td>
<td>Physical controls supplementary</td>
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<tr>
<td><strong>Security to customs</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, Warehouse Keeper</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Free Warehouse</strong></td>
<td>Free Warehouse</td>
<td>Free Zone type 2</td>
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</table>
### 2. Customs Analysis

<table>
<thead>
<tr>
<th><strong>Storage period</strong></th>
<th>Unlimited Period</th>
<th>Unlimited Period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Who can use it?</strong></td>
<td>Anyone. Goods stored are treated like outside the customs territory of the EU</td>
<td>Anyone</td>
</tr>
<tr>
<td><strong>Liability towards customs</strong></td>
<td>Warehouse Keeper</td>
<td>Administrator</td>
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<tr>
<td><strong>Do storage premises need customs approval?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Location designated for that purpose by Customs</td>
<td>Location designated for that purpose by Customs</td>
</tr>
<tr>
<td><strong>Supervision by customs</strong></td>
<td>All activities performed may only be in the presence of Customs</td>
<td>Inspection when goods enter to or leave the free zone</td>
</tr>
<tr>
<td><strong>Security to customs</strong></td>
<td>Not needed</td>
<td></td>
</tr>
</tbody>
</table>
2. Customs Analysis

2.2.4.2 Filing a Declaration

It is compulsory to file a declaration to deposit goods in a storage facility or remove goods stored in this facility. By submission of this declaration, the goods are placed under the customs warehousing system or deposited in premises for temporary storage, a free warehouse or a free zone of control type 2, or the placement of goods under this system is terminated or the storage or the temporary storage premises, free warehouse or free zone of control type 2 is terminated. These declarations should be made to the customs office specified in the authorisation. It is only when a declaration has been filed that the goods may be transferred to or taken from the storage facility.

The declaration should be made by the person who wants to store or remove the goods and declares himself willing to fulfil the obligations applicable to these goods.

In a number of cases, a simplified declaration procedure may be followed, depending on the degree of reliability offered by the warehouse keeper’s accounts. This requires a separate authorisation from Customs. The following simplified procedures are possible:

- Deposit in the customs warehouse based on the customs document with which the goods were presented to Customs. In this case, simultaneously a written application for placement under the system to Customs should be made, stating that the person who is demanding for the storage facilities is also responsible for the goods.

- The local clearance procedure. This means that an authorisation is going to be granted after Customs has checked the warehouse keeper’s accounts. In that case, the goods can be deposited in the customs warehouse directly, without the intervention of Customs. The warehouse keeper should enter the deposit of the goods in his accounts. A local clearance procedure is not possible with regard to a type B customs warehouse.
2. Customs Analysis

2.2.5 Transit of goods

Customs transit is a kind of transport that takes goods from one place to another place, but under Customs supervision.

Customs transit is vital for the European integration and for the interest to European business. It enables goods to move more freely and makes customs clearance formalities more accessible. It does so by temporarily suspending duties and taxes that are applicable to goods.

It holds an important place within the EU, and especially within The Netherlands, where many of the goods brought in via a Dutch seaport are not destined for the Dutch market but to another EU country or to a non-EU country.

If goods are introduced into the EU from a non-EU country, they are under customs supervision. In order to transport the goods from one of the EU countries to another EU country or to a non-EU country, a customs transit procedure is needed, and to place the goods under this procedure it must be filed a declaration. The declaration is filled by using the Transit-NCTS system (see annex E).

There are two kinds of customs transit distinguished by Customs, the first one is the external customs transit and the second one is the internal customs transit (see Fig. 2-14). External customs transit involves the transit of non-Community goods, which are goods that are not yet in free circulation in the EU, so the import duties with respect to these goods are still to be paid. Internal customs transit involves the transit of Community goods, which are goods that are in free circulation within the EU because they were produced in the EU or because they were imported from a non-EU country and the duties owed on import were already paid.

Fig. 2-14: The different kinds of Customs Transit
Next, external customs transit procedure and internal customs transit procedure will be explained.

### 2.2.5.1 External Customs Transit Procedure

There are two cases where external customs transit procedure is applied. The first procedure is applied to the transport of non-Community goods that are moved from one location in the EU customs territory (see annex F) to another location in the customs territory. The second one is applied to Community goods with special measures in relation with their export (see annex H).

External customs transit can take place under:
- the external Community transit procedure
- the TIR carnet
- the ATA carnet
- Rhine Navigation
- Military consignments
- The postal procedure

### The External Community Transit Procedure

When non-Community goods are transported from one location in the EU to another location in the EU, Customs speaks of external Community transit. For instance, when non-Community goods are transported from The Netherlands to France.

Customs still speaks of external Community transit when non-Community goods are transported via a non-EU country with which an agreement for the application of common customs transit has been concluded. For instance, when non-Community goods are transported from The Netherlands to France via Switzerland.

This procedure is compulsory for the transport within the EU of:
- non-Community goods
- Community goods to which special measures apply

The external Community transit procedure is known as T1 transit procedure because in order to place the goods under this procedure a T1 declaration must be filed.

Under external Community transit procedure, the customs transit declaration is filed by means of the Transit-NCTS system. A paper declaration can only be filed in the following cases:
- Under the emergency procedure in Transit, if no electronic data interchange is possible because of technical malfunctions;
- By travellers.
The TIR Carnet

In common with other Customs procedures, the TIR procedure enables goods to move under Customs control across international borders without the payment of the duties and taxes that would normally be due at importation or exportation. A condition of the TIR procedure is that the movement of the goods must include transport by road. This explains the meaning of the letters TIR, what stands for Transport Internationaux Routiers.

Goods move from a Customs office of departure in one country to a Customs office of destination in another country under cover of an internationally accepted Customs transit document, the TIR carnet, which also provides a financial guarantee for the payment of the suspended duties and taxes. The guarantee system is managed by an international organisation, which is currently the International Road Transport Union.

Although each Member State is a Contracting Party to the TIR Convention, the European Community is considered to be a single territory for the purposes of the TIR procedure. This means TIR procedure does apply to:

- transports of goods that begin or end in an EFTA (see annex I) country;
- transport of goods from one EU country to another EU country, via a non-EU country with which no agreement for the application of common customs transit has been concluded.

In addition, the following conditions apply:

- the goods should be transported in approved containers or means of transport;
- the goods should be transported subject to security provided by the organisations designated in the TIR convention.

Apart from the EU countries, it is mainly the countries in Central Europe, Eastern Europe and Asia that are associated with TIR convention.

Goods that are transported under the TIR procedure may be delivered directly to a “holder of an Authorised Consignee authorisation for goods transported under the TIR procedure”. To enable direct delivery, the recipient of the goods should possess an “Authorised Consignee authorisation for goods transported under the TIR procedure”.

ATA Carnet

By means of ATA procedure temporary import and temporary export of goods are simplified. The letters ATA stand for: Admission Temporaire- Temporary Admission.

Temporary import presumes a subsequent re-exportation, while temporary export presumes a re-importation. When it regards temporary import, temporary export, re-importation and re-exportation, the ATA carnet serves as a declaration of the goods to which it relates.
In case of The Netherlands, all Chambers of Commerce are authorised to issue ATA carnets.

**Rhine Navigation**

The river Rhine is one of the main traffic arteries of Western Europe, so The Rhine Manifest Procedure was established to facilitate the movement of goods on the Rhine and its associated tributaries across national frontiers (see Fig. 2-15).

![Barge transporting containers along a river](source: www.iei-corp.com)

The legal bases for this procedure are the Mannheim Convention and the Protocol adopted by the Central Rhine Navigation Commission. The Mannheim Convention concerns the following countries bordering the Rhine:

- The Netherlands,
- Belgium
- Germany
- France
- Switzerland

This convention guarantees an unimpeded passage on the Rhine between these countries and, customs transit on the river and its waterways can take place without the provision of security.

**Military Consignments**

There are specific rules concerning the transit of goods for North Atlantic Treaty Organisation (NATO) forces, and The Netherlands is a member of the NATO.

Customs legislation prescribes special forms for the transport of military goods of the NATO countries across the territory of NATO partner countries. The military unit for which the goods are intended will issue the forms.
The Postal Procedure

In case of postal consignments that enter, leave or are transported, a declaration is not required to file as long as they are “under the responsibility of the postal service”. The transport phase from the point of entry to the post sorting or storage location is included. The customs procedures and formalities are fulfilled by the postal and courier companies. These companies file the customs declarations and cooperate with the Customs regarding the verification activities, such as inspection of parcels sent by post and courier.

Only the postal items that are carried in compliance with the Postal Convention fall “under the responsibility of the postal service”. This does not extend to the parcels that are dispatched by courier.

2.2.5.2 Internal Customs Transit Procedure

The internal customs transit procedure enables to transport Community goods from one location within the EU customs territory to another location within the EU Customs territory, via the territory of a non-EU country, without this changing their customs status.

It should be reminded that Community goods can be transported from one location within the EU customs territory to another location within the EU Customs territory without customs supervision, as long as the transport is direct. Internal customs transit can take place in compliance with the “internal Community transit procedure”.

Internal Community Transit Procedure

Internal community transit procedure is used when Community goods:
- are moved from, to and between the areas not belonging to the fiscal territory of the EU;
- are moved from one EU country to another EU country, via the territory of a country that is neither an EU country nor an EFTA country (see annex I);
- are moved between two countries in the EU, via the territory of an EFTA country.

The procedure is compulsory if Community goods are transported:
- from a part of the EU customs territory where Directive 77/388/EEC applies to another part of the EU customs territory, where this directive does not apply;
- from a part of the EU customs territory where Directive 77/388/EEC does not apply to another part of the EU customs territory, where this directive does apply;
- from a part of the EU customs territory where Directive 77/388/EEC does not apply to another part of the EU customs territory, where this directive does not apply either;
A T2 declaration has to be filed in order to transport the goods under the internal Community transit procedure. In those cases where Community goods are transported from, to and between areas that do not belong to the fiscal territory of the EU, a T2F declaration has to be filed.

Under internal Community transit procedure, the customs transit declaration is filed by means of the Transit-NCTS system. A paper declaration can only be filed in the following cases:

- Under the emergency procedure in Transit, if no electronic data interchange is possible because of technical malfunctions;
- By travellers.

2.2.5.3 Common Customs Transit

This procedure is used for the movements of goods between the EU and the EFTA countries. The common customs procedure prevents delays at the borders between both territories.

With a few exceptions, it is the same procedure as the Community transit procedure. The customs transit declaration has to be filed by means of the Transit-NCTS system. In respect of common customs transit, too, a paper declaration can only be filed:

- Under the emergency procedure in Transit, if no electronic data interchange is possible because of technical malfunctions;
- By travellers.
2.2.6 Safety, Health, Economy and Environment

Customs supervises the import, export, transit and storage of goods checking whether the taxes payable upon import are paid and whether exported goods meet the relevant requirements. But this is not the only task for Customs; it also supervises compliance with legislation concerning safety, health, economy and environment. This legislation states that importing, exporting or transporting certain goods to, from or within the EU is prohibited, or is only permitted if certain conditions are met, or if the goods meet certain requirements. In accordance with these responsibilities, Customs carries out a large number of supervisory, observational and investigative tasks.

In accordance with safety, health, economy and environment, Customs carries out three functions (see Fig. 2-16):

- the stop function: Customs prevents prohibited goods from entering EU territory with a view on protecting safety, health, the economy or the environment;
- the supervisory function: Customs ensures that goods entered are kept under supervision until they have been given a permitted destination. This means that Customs monitors goods either until they are imported and the taxes payable upon import have been paid or until they are exported from the EU's customs territory or are transported to another country;
- the levy and collection function: Customs ensures that taxes payable upon import are calculated in the correct manner and are actually collected.

![The functions of Customs in accordance with Safety, Health, Economy and Environment](image)

*Fig. 2-16: The three functions of Customs in accordance with safety, health, economy and environment*
To develop these functions, Customs carries out the following tasks:
- Customs supervises goods traffic that crosses external frontiers;
- Customs monitors the domestic production and storage of excise goods;
- Customs inspect goods and goods transport;
- Customs contributes to the enforcement of other regulations and other inspections of goods and cross-border goods transport;
- Customs officials are appointed as special investigators for investigating offences.
2.3 IDENTIFIED PROBLEMS

After the thorough analysis of the different Customs requirements and of the information provided by members of the Customs of Rotterdam, in this section the problems which affect directly the transport chain via barge using the FCC will be explained. These are:

- Seals
- Temporary storage period for goods
- Inspection time schedule
- Stowage of containers over the deep-sea vessel
- Notice Period of the Containers’ Inspection
- New safety technologies

2.3.1 Seals

Customs seals are devices demanded by custom authorities to secure the goods contained in a unit of transport or a means of transport, so goods are sealed during the transport.

Customs proceed to check the seals to ensure that neither the seals nor the mean of transport have signs of having been forced or invaded. In case of this kind of signs Customs has to verify the goods, their weight and quantity. If these are in accordance with the documents of the customs procedure, Customs seals the goods with its own seal. Otherwise, Customs stops the customs procedure.

Furthermore, after a regular inspection, where Customs breaks the seal of the container that the ship’s agent put, it puts another one. This is its own seal.

But this is not the only case where Customs seals the units of transport. It may seal every container that visits its territory as transit when the container is going to leave the seaport. With this last seal, Customs proves that every container that was under transit procedure, for instance, in the Port of Rotterdam, followed the rules of this procedure. It is like a port guarantee.

It should be mentioned that although technically every container should be sealed, the reality is that Customs does not do it always because of time and economic problems. Only after an inspection Customs seals the containers (not in all cases).
2. Customs Analysis

Fig. 2-18: Container seal 2. (www.securityseal.com)

In spite of this, sealing of containers is a problem that will be considered in the analysis of the different solutions, which is developed in the section 2.4.

Fig. 2-19: Container seal 3. (Source: www.securityseal.com)

2.3.2 Temporary Storage Period for Goods

As it was named in section 2.2.1, “Entry of Goods”, after the Summary Declaration is submitted and before the Customs-Approved Treatment or Use, goods are in “Temporary Storage”. This period could be up to 45 days, although most of the time it is just two or three days.

Customs is already working to reduce time, but the solution is not imminent. So for the moment, the proposed solution in section 2.4 should consider that the temporary storage period of the goods could be up to 45 days.
2. Customs Analysis

2.3.3 Inspections Time Schedule

In practice, Customs does not inspect containers during the whole day and everyday in each container terminal. It inspects just some days and some hours, so containers cannot be inspected when it is appropriate for trade, but when it suits Customs.

This complicates the transport chain so it must be taken into account to find a solution.

2.3.4 Stowage of containers in the deep-sea vessel

The stowage of containers in the deep-sea vessel is one of the most researched issues because with a thorough planning of the stowage a lot of time can be saved during the unloading of the deep-sea vessel. Nowadays, unloading the containers in the port as fast as possible is really important because the cost of a container ship in the port is considered to be very high.

Furthermore, solving this problem is becoming more difficult due to the economies of scale. The deep-sea vessels are bigger and bigger so handling them is really complicated (see Fig. 2-20). For instance, if a vessel comes from Shanghai to Europe, it should be known which European port will be visited first, which one second, etcetera. It should be known which containers will be unloaded and loaded in each European port as well. Thus, when the vessel arrives to the port the number of container moves will be minimum because they are ready to be unloaded and/or loaded in the correct order. As it was mentioned, this is much more difficult with large deep-sea vessels, since the volume of containers on such vessels is so large.

Fig. 2-20: Container ship being loaded at the Burchardkai container terminal in the port of Hamburg (Germany). (Source: www.alamy.com)
Other problems related to the storage of containers in the deep-sea vessel can appear depending on FCC’s operation. There are two possible ways to operate:

1) When the deep-sea vessel arrives to the destination port and some of the containers that this is carrying have to be unloaded, the containers which are going to be further transported by barge (Barge Containers) are unloaded by the FCC to the barges, and the rest of the containers are unloaded by a quay crane to the quay (see Fig. 2-21).

2) When the deep-sea vessel arrives to the destination port and some of the containers that this is carrying have to be unloaded, all of them are unloaded by the FCC, which accommodates two barges between the two floaters. All the Barge Containers are loaded in one barge, and the rest is loaded in the other barge which will bring them next to the quay. Later, a quay crane will transfer them to the quay.

(Both possible ways to operate have been described in case of unloading the deep-sea vessel, but it is the same process in case of loading, but in the other sense).

To go on with this thesis, it has been assumed that the FCC operates as in the first mentioned way. Thus, one additional problem appears. It should be known which containers will be unloaded (and/or loaded) by the FCC because all the containers that are going to be unloaded (and/or loaded) by the FCC should be placed in separated holds to minimize the moves of the cranes along the vessel. Thus, some holds will transport the containers which are going to be unloaded by the FCC and others will transport the containers which are going to be loaded by the quay cranes.

Fig. 2-21: The correct stowage of containers over the deep-sea vessel
It could be a problem the fact that some containers do not have a specific destination, but this depends on the rules of the market. The fact is that the amount of containers which do not have a specific destination is negligible.

As it is named in the previous paragraph, most of the containers have a specific destination, but this is not known by the terminal, only by forwarders and shippers. For instance, APMT Rotterdam does not know the final destination of the 60% of the containers that pass through it. To make the FCC a success in the anticipated future, terminals, forwarders and shippers should be involved in the hinterland transport and share the information.

### 2.3.5 Notice Period of the Containers' Inspection

As it was mentioned in the previous section, “stowage of containers on the deep-sea vessel”, it is very important to know the destination of each container for the stowage planning. But this planning can also be affected by the inspections of containers when these are carried out in the port area.

It could be thought that the solution is placing the containers which are going to be inspected in the holds handled by quay cranes, thus, as it is done nowadays, these containers would be moved to the Customs office in the deep-sea terminal. But the problem is that Customs does not know which containers will inspect until 24 hours before of the arrival of the vessel to the port, or, in case of vessels coming from Asia, 42 hours before, while the vessel left the departure port some weeks before. Therefore, this is not the solution.

This problem has to be taken into account to find a solution in chapter 2.4

### 2.3.6 New Safety Technologies

Since the 9-11 attacks, the threat of a weapon of mass destruction falling into the hands of terrorists has become a major concern all around the world. In response, many nations are taking steps to prevent such weapons from being smuggled into their countries.

These countries have begun to develop technology to prevent clandestine importation via intermodal shipping containers of materials that could be used in a radiological dispersal device or a nuclear weapon. One example of such technology is the radiation portal monitor (RPM). A RPM is a detection device that provides Customs and Border Protection with a passive, non-intrusive means to screen trucks (see Fig. 2-22), trains (see Fig. 2-23) or other conveyances for the presence of nuclear and radiological materials. These systems are capable of detecting various types of radiation emanating from nuclear devices, dirty bombs, special nuclear materials, natural sources and isotopes commonly used in medicine and industry.

But many of these devices impede the transport process, making difficult the inspection of many containers. In addition, as far as this thesis is concerned,
many containers arrive at and depart from terminals by barge and never pass through a portal.

![Fig. 2-22: A RPM used in truck control. (Source: www.ifpta.org)](image)

Fig. 2-23: A RPM used in train control. (Source: www.ifpta.org)

Although American policymakers (even more and more policymakers around the world) are discussing the goal of monitoring every container, the current reality is that only 2% of containers are screened.

Both problems can be solved using a detecting device in the container crane spreader (see Fig. 2-24) in such a way that one-hundred percent of containers can be scanned in the normal transportation flow. It integrates sensitive neutron and spectroscopic gamma ray detectors in the container crane spreader, the piece of the container crane that directly engages a container as it is moved onto and off of the deep-sea vessel. Every container loaded or unloaded by the crane must be handled by a spreader, so the device takes advantage of this handling time to monitor for radiation, without impeding the flow of commerce, using spectral measurements to reduce false alarms due to naturally occurring radioactive material and to increase sensitivity.
Using this device into the Floating Container Crane it is possible to scan every container that will flow to the inland terminal.

Fig. 2-24: The crane mounted radiation detection. (Source: www.amptek.com)
2.4 INITIAL SOLUTIONS’ PROPOSAL

In this section the different possible solutions for the use of the FCC will be analysed taking into account the problems detected in the previous section. It has been assumed that Customs does not seal every container, it only seals which were inspected, as practically it is done. The three initial solutions:
- Inspection and sealing at the platforms of the FCC;
- Inspection and sealing in the deep-sea terminal;
- Inspection and sealing in a Distribution Inland Terminal.

2.4.1 Inspection and sealing at the platforms of the Floating Container Crane

With this first solution a direct transport of containers from the deep-sea terminal to the inland terminal is proposed.

As it was explained in the introduction chapter of this report, the Floating Container Crane is made up of two platforms. This solution proposes a bigger platform where Customs officers could inspect and seal the suspicious containers. In case of import the fixed main crane would move containers from the deep-sea vessel to the big platform. There if the container had to be inspected the barge crane would move it to the inspection area at the same platform, subsequently it would be sealed by Customs. If the container had not to be inspected the barge crane would transfer it to the barge.

In case of export containers would be unloaded from the barges by the barge crane. This crane would leave containers at the big platform. If Customs needed to inspect a container, it would do it at the same platform but in the special area, where the barge crane would move it, and then it would be sealed and moved to the place where the fixed main crane would take and move it to the deep-sea vessel. If Customs did not need to inspect the containers, when the barge crane placed them onto the platform, the customs officers would seal the containers and the fixed main crane would move them to the deep-sea vessel.

It means that containers should arrive arranged to the Floating Container Crane because there would be no place on it to organize them before the movement to the deep-sea vessel and if the stowage of the containers was not appropriate, container handling would be very complicated and expensive when the vessel arrived to the arrival port. It is very complicated because the barges flow through the rivers stopping in the inland terminals and picking the containers up, so in the last terminal before the sea port, the barges should stop to arrange the loaded containers.
This solution presents all the next problems:

- The situation created for the customs officers would be in many cases dangerous because they would work below the cranes. This situation is always avoided in ports.

- Customs officers don’t inspect during the whole day whereas most of the ports load or unload deep-sea vessels 24 hours per day. Consequently some containers could be placed onto the crane waiting for the inspection. This problem could be solved in case of import if the inspection was done in the deep-sea terminal and the FCC approached the quay each time that a deep-sea vessel leaved the port. Thus, the crane would move the containers to the quay where terminal workers would transport them to the customs office. In case of export the solution would be the same but in the opposite direction.

- In case of import, containers onto the deep-sea vessel would have to be arranged in such a way that, when the barge that flowed to a specific destination was below the FCC, this took from the vessel the corresponding containers. Arrange all the containers depending on the inland terminal is very complicated and takes a lot of time. It is the same for export.

- As it was mentioned, goods can be in temporary storage up to 45 days, before the Customs-Approved Treatment o Use. It is an important problem to move directly the containers to the inland terminal.

Keeping these problems in mind, it is concluded that, although not impossible, for the moment it is really difficult to put this solution into practice. But, when the period in temporary storage decreases (Customs is already working on it); it will change because the rest of the problems could be solved more easily.
2.4.2 **Inspection and Sealing in the Deep-Sea Terminal**

With the second analysed solution containers would not be transported directly to the inland terminals, as in the first one, but via the deep-sea terminal. It is proposed that containers were unloaded from both sides of the deep-sea vessel, but the FCC would handle both containers that later would be transported by barge and that later would be transported by truck or rail. The same situation would be for the quay crane.

Containers would be transported to the quay of the deep-sea terminal, even those which were unloaded by the FCC, which would be unloaded from the barges to the quay by a quay crane. Subsequently, in the terminal, containers would be handled as usual.

The terminal would work as usual, but the handling time of the deep-sea vessel would be reduced. Thus, there would not be any of the Customs related problems presented before. The disadvantage is the double handling of the FCC-containers and possible waiting time for the barges.

*Fig. 2-26: Inspection and sealing in the deep-sea terminal*
2.4.3 Inspection and Sealing in a Distribution Inland Terminal

With this third solution containers would not be transported from the deep-sea terminal to the inland terminal directly, as in the previous solution but they would stop in an intermediate area, the so called, “Distribution Inland Terminal” (see Fig. 2-27).

It is proposed that the inspection and sealing areas are placed in a zone far from the congested area of the port. Thus, in case of import, in the sea-port the containers which were going to be transported by barge would be loaded directly onto it (even the containers that Customs wanted inspect) and, in case of export, containers would arrive arranged on barges to be loaded onto the appropriate deep-sea vessel.

Every barge would stop in this area to seal all the containers that it transported and to inspect some of the containers in the Customs office, which would be placed in the same area.

In case of import, it must be known which containers will be transported by barge before the departure port. It is not necessary to know the final inland terminal because in the “Distribution Inland Terminal” all the containers will be unloaded from the barges and will be distributed depending on the final inland terminal there.

In case of export, in the “Distribution Inland Terminal” barges would be loaded depending on the destination of containers. It means that when the deep-sea vessel which was going to transport some of the containers of the distribution terminal was placed in the deep-sea port, the containers would be loaded onto a barge and guided to the deep-sea vessel. Cooperation between terminal and forwarding companies or/and shippers is vital.

This solution is not optimum because the container transport is not direct and in the “Distribution Inland Terminal” containers would be unloaded and loaded again. It takes time and money, but at least the deep-sea vessel is charged or discharged faster because both sides of it are used to load or unload containers. Thus, the service time is reduced compared to one side handling.
Fig. 2-27: Inspection and sealed in a Distribution Inland Terminal

This solution presents some advantages. The most important one is that the deep-sea terminal would be much less congested because all the containers moved by barge would be placed in another terminal. The percentage of containers transported by barge could be very important, as in Rotterdam, where in 2005 31.1% of the total land containers (9.287 MTEU) were transported by barge. Moreover, containers would be stored in an inland terminal instead of in the deep-sea terminal and a lot of money can be saved because the storage in the inland terminals is cheaper, as it will be analysed in the chapter 3 of this thesis, Economic Analysis.

It must be taken into account that barges take different directions after (in case of import) or before (in case of export) visiting the deep-sea terminal, so the “Distribution Inland Terminal” should be placed between the port and the place where the waterway splits in different branches. Sometimes it is really difficult to find an area with this characteristic and with sufficient surface area, because the surrounding areas of the port are very congested in most of the cases.

With this solution the Temporary storage for goods is not a problem because goods can wait for the Customs-Approved Treatment o Use in the “Distribution Inland Terminal”.
2.5 CONCLUSIONS

Once the different possible solutions have been analysed on the basis of the arisen Customs analysis' problems, it is possible to conclude giving an order of preference of the solutions.

This is:

1) Inspection and sealing in a “Distribution Inland Terminal”.
2) Inspection and sealing in the deep-sea terminal.
3) Inspection and sealing at the platforms of the FCC.

In both first solutions proposed the transport of the containers is indirect; it means that after the loading onto the barge, the containers will be unloaded in an intermediate terminal and subsequently loaded once again to another barge which will transport it to the final inland terminal.

This extra handling will increase the cost of the transport, but the service time of the deep-sea vessel is considerably reduced.

The third solution proposed is not a reality for the moment, but in an anticipated future, it could would change, making the transport of the containers a direct transport, and therefore, saving money in handling and storage in the terminal.
3 ECONOMIC ANALYSIS

After the previous chapter, “Customs Analysis”, and its conclusions, in this chapter two of the three proposed solutions were analysed from an economic point of view. These are: “Inspection and Sealed in the Deep-Sea Terminal” and “Inspection and Sealed in a Distribution Inland Terminal”. They also were compared with the current handling in ports using quay cranes.

The solution “Inspection and Sealing at the platforms of the FCC” was not analyzed because, as it was concluded in chapter two, this has many problems for the moment.

At the beginning of this analysis it was thought that it would be better to compare both solutions on the basis of the different chargeable costs. Later it was decided that instead of costs, tariffs would be more useful because customers would be interested in the money they would have to pay for the service.

Besides comparing these three options, another aim of this analysis was the comparison between road transport and inland waterway transport to bring containers to the final destination.

All the data adopted to develop chapter 3 is the result of reflections with different port experts from Rotterdam Port Authority and Delft University of Technology. But, since this data could change among container terminals and some information could be different to the accepted, at the end of the chapter, a sensitive analysis is developed to compare the results obtained in each case.
3.1 ANALYSIS OF THE CURRENT TARIFFS

To be able to charge the tariffs in the different solutions and the different options of transport (barge or truck), first the current tariffs in deep-sea container terminals and in inland container terminals were analyzed, including the distribution into tariff components per move.

Sometimes these tariffs were given in different units so for comparing them it was necessary to convert the data. For every calculation the unit used was TEU.

In the following table the required conversions are shown:

<table>
<thead>
<tr>
<th>CONVERSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 move = 1.6 TEU</td>
</tr>
<tr>
<td>1 FEU = 2 TEU</td>
</tr>
<tr>
<td>1 move = 0.8 FEU</td>
</tr>
</tbody>
</table>

*Table 3-1: Conversions used to harmonize all the data*

In case of a deep-sea terminal where containers were loaded on trucks to be transported by road transport to the final destination, the tariff to move the container from the deep-sea vessel to the truck was 160 Euro per movement. Using the above conversions, it was known that 160 Euro per movement is equivalent to 100 Euro per TEU.

This tariff includes all movements of the containers within the terminal. In the next table the percentages that relate to each movement are shown:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVEMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel to the quay (%)</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
</tr>
<tr>
<td>Movement to truck and loading to truck (%)</td>
</tr>
</tbody>
</table>

*Table 3-2: Percentages of the different movements of a container within a deep-sea terminal, transported further by truck*
So the tariffs attributed to each movement of a container in a deep-sea terminal from the deep-sea vessel to a truck are estimated:

<table>
<thead>
<tr>
<th>Deep-Sea Terminal + Truck</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL (€/movement)</td>
<td>160</td>
</tr>
<tr>
<td>TOTAL (€/TEU)</td>
<td>100</td>
</tr>
<tr>
<td>Unloading from the vessel to quay (€/TEU)</td>
<td>40,0</td>
</tr>
<tr>
<td>Movement to stack (€/TEU)</td>
<td>20,0</td>
</tr>
<tr>
<td>Storage in stack (€/TEU)</td>
<td>15,0</td>
</tr>
<tr>
<td>Movement to truck and loading to truck (€/TEU)</td>
<td>25,0</td>
</tr>
</tbody>
</table>

Table 3-3: Partial tariffs of the different movements of a container within a deep-sea terminal, transported further by truck

In case of moving later the container by barge instead of by truck, the handling at the terminal was more expensive and the tariff increased 15 Euro per move, which is equivalent to 9 Euro per TEU.

This amount just related to moving the container from stack to a barge and loading it onto the barge. Consequently, the tariffs attributed to each movement of a container in a deep-sea terminal from the deep-sea vessel to a barge are:

<table>
<thead>
<tr>
<th>Deep-Sea Terminal + Barge</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL (€/movement)</td>
<td>160+15</td>
</tr>
<tr>
<td>TOTAL (€/TEU)</td>
<td>109</td>
</tr>
<tr>
<td>Unloading from the vessel to quay (€/TEU)</td>
<td>40,0</td>
</tr>
<tr>
<td>Movement to stack (€/TEU)</td>
<td>20,0</td>
</tr>
<tr>
<td>Storage in stack (€/TEU)</td>
<td>15,0</td>
</tr>
<tr>
<td>Movement to barge and loading to barge (€/TEU)</td>
<td>34,0</td>
</tr>
</tbody>
</table>

Table 3-4: Partial tariffs of the different movements of a container within a deep-sea terminal, transported further by barge

Subsequently, the same tariffs were studied for the inland terminals. In case of further road transport the whole tariff to move the container from a barge to a truck was 60 Euro per move, which is equivalent to 37.5 Euro per TEU. The final distribution of the tariff in the different movements and handling is:

<table>
<thead>
<tr>
<th>Inland Terminal + Truck</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL (€/move)</td>
<td>60</td>
</tr>
<tr>
<td>TOTAL (€/TEU)</td>
<td>37,5</td>
</tr>
<tr>
<td>Unloading from the barge to quay (€/TEU)</td>
<td>15,0</td>
</tr>
<tr>
<td>Move to stack (€/TEU)</td>
<td>7,5</td>
</tr>
<tr>
<td>Storage in stack (€/TEU)</td>
<td>5,6</td>
</tr>
<tr>
<td>Move to truck and loading to truck (€/TEU)</td>
<td>9,4</td>
</tr>
</tbody>
</table>

Table 3-5: Partial tariffs of the different movements of a container within an inland terminal, transported further by truck
In case of inland waterway transport instead of road transport, the tariff in inland terminals was 10 Euro per move more, what means 6.25 Euro per TEU. As in deep-sea terminals, this amount was charged just because of the movement to barge and loading to barge.

The next table shows the different tariffs for each movement of a container from a barge to another barge in an inland terminal:

<table>
<thead>
<tr>
<th>Inland Terminal + Barge</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL (€/move)</td>
<td>60+10</td>
</tr>
<tr>
<td>TOTAL (€/TEU)</td>
<td>43.75</td>
</tr>
<tr>
<td>Unloading from the barge to quay (€/TEU)</td>
<td>15.00</td>
</tr>
<tr>
<td>Move to stack (€/TEU)</td>
<td>7.50</td>
</tr>
<tr>
<td>Storage in stack (€/TEU)</td>
<td>5.6</td>
</tr>
<tr>
<td>Move to Barge and loading to Barge (€/TEU)</td>
<td>15.65</td>
</tr>
</tbody>
</table>

Table 3-6: Partial tariffs of the different movements of a container within an inland terminal, transported further by barge
3.2 TARIFF OF THE SOLUTION “INSPECTION AND SEALED IN THE DEEP SEA TERMINAL”

As it was mentioned in the chapter 2 of this thesis, the solution “Inspection and Sealed in the Deep-Sea Terminal” lies in unloading the containers from the deep-sea vessel to the barges under the FCC. Later they are put near the quay, by the same barge, where a quay crane transfers them from the barge to the quay. From this moment on, the process is like the conventional one.

Once all the partial tariffs in section 3.1 are known, the only unknown figures to analyze the tariff of the solution “Inspection and Sealed in the Deep-Sea Terminal” are:
- Tariff to unload a container from the vessel to a barge by means of the FCC;
- Tariff to move a container by barge from between the two platforms of the FCC to the quay;
- Tariff to unload a container from the barge to the quay by a quay crane in the deep-sea terminal.

The first tariff was obtained thanks to confidential information and has been assessed at 41 Euro per TEU. The other two were estimated and compared with port experts. They resulted in 4 Euro per TEU and 18 Euro per TEU, respectively. In the next table, the additional data is shown:

| Unloading from the vessel to a barge by means of the FCC | 41 €/TEU |
| Movement to the quay by means a barge | 4 €/TEU |
| Unloading from the barge to the quay in a Deep-Sea Terminal | 18 €/TEU |

Table 3-7: Additional partial tariffs to analyze the solution “Inspection and Sealed in the Deep-Sea Terminal”

Adding the different tariffs of each movement of a container, it is concluded that the tariff for moving a container from the deep-sea vessel to a truck in case of the first proposed solution is 123 Euro per TEU. The following table specifies the different parts of the total tariff.

<table>
<thead>
<tr>
<th>Solution 1 + Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel to a barge by means of the FCC</td>
</tr>
<tr>
<td>Movement to the quay by means a barge</td>
</tr>
<tr>
<td>Unloading from the barge to the quay</td>
</tr>
<tr>
<td>Movement to stack</td>
</tr>
<tr>
<td>Storage in stack</td>
</tr>
<tr>
<td>Movement to truck and loading to truck</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>

Table 3-8: Tariffs of moving a container according to the first proposed solution, “Inspection and Sealed in the Deep-Sea Terminal”, transported further by truck
In case of transporting by barge instead of by truck, the tariff increases, but just due to the last movement. Thus, the total tariff becomes 132 Euro per TEU. This is explained in the next table:

<table>
<thead>
<tr>
<th>Solution 1 + Barge</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel to a barge by means of the FCC</td>
<td>41 €/TEU</td>
</tr>
<tr>
<td>Movement to the quay by means a barge</td>
<td>4 €/TEU</td>
</tr>
<tr>
<td>Unloading from the barge to the quay</td>
<td>18 €/TEU</td>
</tr>
<tr>
<td>Movement to stack</td>
<td>20 €/TEU</td>
</tr>
<tr>
<td>Storage in stack</td>
<td>15 €/TEU</td>
</tr>
<tr>
<td>Movement to barge and loading to barge</td>
<td>34 €/TEU</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>132 €/TEU</strong></td>
</tr>
</tbody>
</table>

Table 3-9: *Tariffs of moving a container according to the first proposed solution, “Inspection and Sealed in the Deep-Sea Terminal”, transported further by barge*
3.3 TARIFF OF THE SOLUTION “INSPECTION AND SEALED IN A DISTRIBUTION INLAND TERMINAL”

This second solution implies, as the first one, an indirect transport of containers to their destination. Containers are handled by the FCC from the vessel to a barge, which instead of putting them near the quay, moves them to a Distribution Inland Terminal where containers will be distributed, and, if necessary, inspected by Customs in the Customs office, placed in the Distribution Inland Terminal.

One of the requirements to place the Distribution Inland Terminal is that it should be between the sea port and the point of the waterway where it splits in different branches. Thus, in case of the Port of Rotterdam by analyzing the surrounding area of the port the Distribution Inland Terminal is suitable placed about 50 km far from Maasvlakte, where the river splits in (see Fig. 3-1). It must be mentioned that the aim of this analysis was not to find a concrete location where the distribution terminal can be located, but just to have some notion of the possible place and to be able to calculate the tariff to move a container from the deep-sea terminal to the Distribution Inland Terminal by barge.

![Fig. 3-1: Location of the Distribution Inland Terminal for the Port of Rotterdam. (Source: www.maps.google.com)](image-url)

The previous picture shows the area around the port and the waterway connections between Maasvlakte, where the most important container terminals are located in the Port of Rotterdam (APMT, ECT), and the adopted Distribution Inland Terminal, from here on, the Distribution Inland Terminal (DIT).
After consulting some container transport companies, like “Hapag-Lloyd” among others, and experts who work in the Port Authority, it was concluded that the tariff of carrying a 20 feet standard container from the Maasvlakte to the DIT was 40 Euro per FEU, which is equivalent to 20 Euro per TEU.

| Movement to the distribution inland terminal by means of a barge | 40 €/FEU |

*Table 3-10: Additional tariffs to analyze the solution “Inspection and Sealed in a Distribution Inland Terminal”*

At this point in time, it was possible to calculate the tariffs of handling the containers from the vessel to the barges by the FCC, moving them to the DIT and loading them to trucks or other barges.

In case of loading a container onto a truck, the tariff is estimated at 98.5 Euro per TEU, as it is shown in the next table:

<table>
<thead>
<tr>
<th>Solution 2 + Truck</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel to a barge by means of the FCC</td>
<td>41    €/TEU</td>
</tr>
<tr>
<td>Movement to the distribution inland terminal by means of the barge</td>
<td>20  €/TEU</td>
</tr>
<tr>
<td>Unloading from the barge to the quay by means of a quay crane</td>
<td>15  €/TEU</td>
</tr>
<tr>
<td>Movement to stack</td>
<td>7,5  €/TEU</td>
</tr>
<tr>
<td>Storage in the specific inland terminal</td>
<td>5,6  €/TEU</td>
</tr>
<tr>
<td>Movement to truck and loading to truck</td>
<td>9,4  €/TEU</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>98,5  €/TEU</strong></td>
</tr>
</tbody>
</table>

*Table 3-11: Tariffs of moving a container according to the second proposed solution, “Inspection and Sealed in a Distribution Inland Terminal”, transported further by truck*

In case of transporting the container by barge instead of by truck, the tariff is estimated at 104.75 Euro per TEU. The different added tariffs were:

<table>
<thead>
<tr>
<th>Solution 2 + Barge</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel to a barge by means of the FCC</td>
<td>41    €/TEU</td>
</tr>
<tr>
<td>Movement to the distribution inland terminal by means of the barge</td>
<td>20  €/TEU</td>
</tr>
<tr>
<td>Unloading from the barge to the quay by means of a quay crane</td>
<td>15  €/TEU</td>
</tr>
<tr>
<td>Movement to stack</td>
<td>7,5  €/TEU</td>
</tr>
<tr>
<td>Storage in the specific inland terminal</td>
<td>5,6  €/TEU</td>
</tr>
<tr>
<td>Movement to barge and loading to barge</td>
<td>15,65 €/TEU</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>104.75  €/TEU</strong></td>
</tr>
</tbody>
</table>

*Table 3-12: Tariffs of moving a container according to the second proposed solution, “Inspection and Sealed in a Distribution Inland Terminal”, transported further by barge*
The next table summarizes the different obtained tariffs:

<table>
<thead>
<tr>
<th></th>
<th>Road Transport</th>
<th>Inland Waterway Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling</td>
<td>100 €/TEU</td>
<td>109 €/TEU</td>
</tr>
<tr>
<td>Solution 1</td>
<td>123 €/TEU</td>
<td>132 €/TEU</td>
</tr>
<tr>
<td>Solution 2</td>
<td>98,5 €/TEU</td>
<td>104,75 €/TEU</td>
</tr>
</tbody>
</table>

*Table 3-13: Summary of the obtained tariffs*
3.4 EXTRA TARIFFS

The tariffs presented in Table 3-13 are not completely comparable due to two different reasons. The first is that in solution 2 the container has reached the DIT, while for the Conventional Handling and Solution 1, it is still in Maasvlakte. Thus, the three handling options are not comparable.

Secondly, if the container is further loaded onto a truck, this is able to carry it to the final destination, but if the container is carried onto a barge, in the destination inland terminal it must change the means of transport and be loaded onto a truck which moves it to the final destination. This involves an extra handling tariff and makes the road transport and the inland waterway transport not comparable (see Fig. 3-2).

![Fig. 3-2: The different way of handling and transport](image)

To be able to compare the three handling options, it was decided to determine the tariff required to move a 20 feet standard container by truck from Maasvlakte to the DIT (by barge it was already known). Some container road companies were consulted and the information was checked with members of the Port Authority of Rotterdam. Finally, this tariff is estimated at 50 Euro per FEU, which means 25 Euro per TEU. Adding this tariff to the Conventional Handling tariff and to the solution “Inspection and Sealed in the Deep-Sea Terminal” when the container left the Maasvlakte by truck, and 20 Euro per TEU in case of by barge, the three handling options are comparables.

![Fig. 3-3: Comparable handling options](image)

<table>
<thead>
<tr>
<th></th>
<th>Road Transport</th>
<th>Inland Waterway Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling</td>
<td>(100 + 25) €/TEU</td>
<td>(109 + 20) €/TEU</td>
</tr>
<tr>
<td>Solution 1</td>
<td>(123 + 25) €/TEU</td>
<td>(132 + 20) €/TEU</td>
</tr>
<tr>
<td>Solution 2</td>
<td>98,5 €/TEU</td>
<td>104,75 €/TEU</td>
</tr>
</tbody>
</table>
Solving the second problem was easier because it was known the standard tariff to move a container from a barge to a truck in an inland terminal, so adding this tariff to the inland waterway transport options, these and the road transport options are comparables.

<table>
<thead>
<tr>
<th></th>
<th>Road Transport</th>
<th>Inland Waterway Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling</td>
<td>100 €/TEU</td>
<td>(109 + 37.5) €/TEU</td>
</tr>
<tr>
<td>Solution 1</td>
<td>123 €/TEU</td>
<td>(132 + 37.5) €/TEU</td>
</tr>
<tr>
<td>Solution 2</td>
<td>98.5 €/TEU</td>
<td>(104.75 + 37.5) €/TEU</td>
</tr>
</tbody>
</table>

Fig. 3-4: Comparable means of transport

The next table shows the extra tariffs that are necessary to add in each option:

<table>
<thead>
<tr>
<th>EXTRAS</th>
<th>M-DIT(^1) by Truck</th>
<th>M-DIT(^1) by Barge</th>
<th>Barge to Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

\(^1\) From Maasvlakte to the DIT

Table 3-14: Extras to add in each option to make them comparables

The next table summarizes the required extra tariffs:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Going to the DIT by Truck</td>
<td>25 €/TEU</td>
</tr>
<tr>
<td>Going to the DIT by Barge</td>
<td>20 €/TEU</td>
</tr>
<tr>
<td>Change from Barge to Truck in the DIT</td>
<td>37.5 €/TEU</td>
</tr>
</tbody>
</table>

Table 3-15: Extra tariffs required to make comparable the different options
Working on the last two tables, the total amount that had to be added to each option is:

<table>
<thead>
<tr>
<th></th>
<th>TOTAL EXTRA TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>25 €/TEU</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>57,5 €/TEU</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>25 €/TEU</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>57,5 €/TEU</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>0 €/TEU</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>37,5 €/TEU</td>
</tr>
</tbody>
</table>

*Table 3-16: Total Extra tariffs required for each option to make comparable the different handling options*

### 3.5 FINAL TARIFFS

In the last section it was calculated the total amount that should be added to each option in order to make all of them comparables. In the following table it is summarized the initial tariffs, the extra tariffs and the final tariffs.

<table>
<thead>
<tr>
<th>Initial TARIFF</th>
<th>Extra</th>
<th>Final TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100</td>
<td>125 €/TEU</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109</td>
<td>166,5 €/TEU</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>123</td>
<td>148 €/TEU</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>132</td>
<td>189,5 €/TEU</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>98,5</td>
<td>98,5 €/TEU</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>104,75</td>
<td>142,25 €/TEU</td>
</tr>
</tbody>
</table>

*Table 3-17: Final tariffs*
3. Economic Analysis

3.6 CONCLUSIONS

As can be appreciated in Table 3-17, the cheapest solution is the second one, “Inspection and Sealed in a Distribution Inland Terminal”. So, it is concluded that the FCC will be economically feasible using it like it is done in Solution 2.

Locating the Distribution Inland Terminal 50 km far away from Maasvlakte, Solution 2 is already the cheapest one before adding the extra tariffs, but in other cases where the distribution terminal was farther and the transport to it was more expensive, the results could be different. Anyhow, when the extra tariffs were added, the final results would be the same, because the costs in the terminals would not change, they do not depend on the distance.

Another important conclusion is that, in the studied case, it is more interesting the further road transport instead of the inland waterway transport in the three handling options (Conventional Handling, Solution 1, and Solution 2). But, the tariff to move the container from the Distribution Inland Terminal to the destination inland terminal is not included yet, so, assuming that the FCC will work as in Solution 2, when the difference between the tariff to transport the container from the DIT to the destination inland terminal by truck and by barge is more than 43.75 Euro per TEU, the further inland waterway transport will be more interesting. This conclusion can be done because the rest of the handling and transport partial tariffs was already taken into account, and because it was assumed that trucks always pass through the destination inland terminal to go to the final destination (see Fig. 3-2).

<table>
<thead>
<tr>
<th></th>
<th>Final Tariff (Truck)</th>
<th>Final Tariff (Barge)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solution 2</td>
<td>98,5 €/TEU</td>
<td>142,25 €/TEU</td>
<td>43,75 €/TEU</td>
</tr>
</tbody>
</table>

*Table 3-18: Difference of the final tariffs between road transport and inland waterway transport*

In the annexe J some tariffs between Maasvlakte and other inland terminals are shown to compare the tariffs between road transport and inland waterway transport. It is concluded that, even for a distance like the one between Rotterdam (Maasvlakte) and Antwerp, the inland waterway transport is more economically interesting, because the difference between transporting a container from Rotterdam (Maasvlakte) to Antwerp (46 Euro per TEU) by truck and by barge is more than 43.75 Euro per TEU.

It should be mentioned that all these conclusions are based on the data assumed at the beginning of the analysis, but they could change if the data varied, as it is shown in section 3.7, Sensitivity Analysis.
3.7 SENSITIVITY ANALYSIS

This analysis aims at showing the variability of the final tariffs depending on the data adopted for the different variables that take part in them.

The followed method was to change one variable while the rest kept constant. Thus, the changes affect the next variables:
- Conventional Handling tariff in a deep-sea terminal;
- Conventional Handling tariff in an inland terminal;
- Percentages that relate to each movement in a terminal;
- FCC handling tariff.

Different options have been studied for each variable:
- Conventional Handling tariff in a deep-sea terminal:
  • 115 €/move
  • 160 €/move
- Conventional Handling tariff in an inland terminal:
  • 60 €/move
  • 80 €/move
- Percentages that relate to each movement in a terminal:
  • Option A%:
    | PERCENTAGE OF THE DIFFERENT MOVES |  |
    |-----------------------------------|---|
    | Unloading from the vessel (barge) to quay (%) | 40 |
    | Movement to stack (%)              | 20 |
    | Storage in stack (%)               | 15 |
    | Movement to truck (barge) and loading to truck (barge) (%) | 25 |
  • Option B%:
    | PERCENTAGE OF THE DIFFERENT MOVES |  |
    |-----------------------------------|---|
    | Unloading from the vessel (barge) to quay (%) | 55 |
    | Movement to stack (%)              | 15 |
    | Storage in stack (%)               | 10 |
    | Movement to truck (barge) and loading to truck (barge) (%) | 20 |
- FCC handling tariff:
  • 35 €/TEU
  • 41 €/TEU
  • 55 €/TEU
3. Economic Analysis

The next figure will help to understand all the arguments of this section.

**Fig. 3-5: Handling cases summary**

- **a) Conventional Handling (CH)**

- **b) Solution 1 (S1)**

- **c) Solution 2 (S2)**

It should be mentioned that all the Initial Tariffs, Extra Tariffs and Final Tariffs given in the following options are given in Euro per TEU.
Next, all the options are shown:

- **OPTION 1:**
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>40</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>20</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>25</td>
</tr>
</tbody>
</table>

  - FCC handling tariff: 35 €/TEU

  The final results are:

<table>
<thead>
<tr>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71,88</td>
<td>25</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81,25</td>
<td>57,5</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>100,13</td>
<td>25</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>109,50</td>
<td>57,5</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>92,50</td>
<td>0</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>98,75</td>
<td>37,5</td>
</tr>
</tbody>
</table>

  *Table 3-19: Option 1 results*

  This option shows the same results as the option adopted for the whole study. Solution 2 is the cheapest one, followed by the Conventional Handling and finally, by the Solution 1.

  The further truck transport is cheaper in every case.

- **OPTION 2:**
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>40</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>20</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>25</td>
</tr>
</tbody>
</table>

  - FCC handling tariff: 41 €/TEU
The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71.88</td>
<td>25</td>
<td>96.88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81.25</td>
<td>57.5</td>
<td>138.75</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>106.13</td>
<td>25</td>
<td>131.13</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>115.50</td>
<td>57.5</td>
<td>173.00</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>98.50</td>
<td>0</td>
<td>98.50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>104.75</td>
<td>37.5</td>
<td>142.25</td>
</tr>
</tbody>
</table>

Table 3-20: Option 2 results

Option 2 shows that the Conventional Handling is the cheapest case, although the difference between this and Solution 2 is just 1.62 Euro per TEU in case of further road transport, and 3.5 Euro per TEU in case of further barge transport.

Solution 2 tariff is the same as in the results shown in Table 3-17 because the only difference between both options is the conventional handling in a deep-sea terminal and this does not affect solution 2.

• OPTION 3:
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>40</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>20</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>25</td>
</tr>
</tbody>
</table>

  - FCC handling tariff: 55 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71.88</td>
<td>25</td>
<td>96.88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81.25</td>
<td>57.5</td>
<td>138.75</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>120.13</td>
<td>25</td>
<td>145.13</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>129.50</td>
<td>57.5</td>
<td>187.00</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>112.50</td>
<td>0</td>
<td>112.50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>118.75</td>
<td>37.5</td>
<td>156.25</td>
</tr>
</tbody>
</table>

Table 3-21: Option 3 results

Solution 1 and 2 are the only cases affected by the FCC handling tariff, so these are the cases that change regarding option 2. They are more expensive now
because the FCC handling more expensive. Thus, the Conventional Handling is the cheapest handling, followed Solution 2 and, finally, Solution 1.

**• OPTION 4:**
- Conventional Handling tariff in a deep-sea terminal: 115 €/move
- Conventional Handling tariff in an inland terminal: 60 €/move
- Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>55</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>10</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>20</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 35 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71,88</td>
<td>25</td>
<td>96,88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81,25</td>
<td>57,5</td>
<td>138,75</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>89,34</td>
<td>25</td>
<td>114,34</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>98,72</td>
<td>57,5</td>
<td>156,22</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>92,50</td>
<td>0</td>
<td>92,50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>98,75</td>
<td>37,5</td>
<td>136,25</td>
</tr>
</tbody>
</table>

*Table 3-22: Option 4 results*

In option 4, the changing data with regard to option 1 are the percentages that relate to each movement in a terminal. As it is shown, Conventional Handling is not affected by this change because the total handling in a deep-sea terminal is the same.

This has repercussions on Solution 1 because the movement “Unloading from the vessel to quay” now is more expensive, so the rest of the movements in the deep-sea terminal, which affect Solution 1, are cheaper (see *Fig. 3-5*).

Although Solution 1 is now cheaper, this is still the most expensive. The cheapest is Solution 2.
• **OPTION 5:**
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>55</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>10</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>20</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 41 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
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<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71,88</td>
<td>25</td>
<td>96,88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81,25</td>
<td>57,5</td>
<td>138,75</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>95,34</td>
<td>25</td>
<td>120,34</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>104,72</td>
<td>57,5</td>
<td>162,22</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>98,50</td>
<td>0</td>
<td>98,50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>104,75</td>
<td>37,5</td>
<td>142,25</td>
</tr>
</tbody>
</table>

*Table 3-23: Option 5 results*

The cheapest option is Conventional Handling. In comparison with option 4 this change due to the increase of the FCC handling tariff. In comparison with option 2, is just Solution 1 which changes. It is the same situation as option 4 regarding option 1.

• **OPTION 6:**
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>55</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>10</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>20</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 55 €/TEU
The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71.88</td>
<td>25</td>
<td>96.88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81.25</td>
<td>57.5</td>
<td>138.75</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>109.34</td>
<td>25</td>
<td>134.34</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>118.72</td>
<td>57.5</td>
<td>176.22</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>112.50</td>
<td>0</td>
<td>112.50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>118.75</td>
<td>37.5</td>
<td>156.25</td>
</tr>
</tbody>
</table>

*Table 3-24: Option 6 results*

Since in option 5 Conventional Handling is cheaper than Solution 2, the same situation is shown here because the FCC handling is now more expensive.

**OPTION 7:**
- Conventional Handling tariff in a deep-sea terminal: 115 €/move
- Conventional Handling tariff in an inland terminal: 80 €/move
- Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>40</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>20</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>25</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 35 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71.88</td>
<td>25</td>
<td>96.88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81.25</td>
<td>70</td>
<td>151.25</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>100.13</td>
<td>25</td>
<td>125.13</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>109.50</td>
<td>70</td>
<td>179.50</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>105.00</td>
<td>0</td>
<td>105.00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>111.25</td>
<td>50</td>
<td>161.25</td>
</tr>
</tbody>
</table>

*Table 3-25: Option 7 results*

This option shows a Conventional Tariff cheaper than the rest of the Solutions. In case of Solution 2 it is because the difference between the conventional handling tariff in a deep-sea terminal and in an inland terminal is small.
3. Economic Analysis

• **OPTION 8:**
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 80 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>40</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>20</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>25</td>
</tr>
</tbody>
</table>

  - FCC handling tariff: 41 €/TEU

  The final results are:

<table>
<thead>
<tr>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71,88</td>
<td>25</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81,25</td>
<td>70</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>106,13</td>
<td>25</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>115,50</td>
<td>70</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>111,00</td>
<td>0</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>117,25</td>
<td>50</td>
</tr>
</tbody>
</table>

  *Table 3-26: Option 8 results*

  Solution 2 is more expensive than Conventional Handling, as expected.

• **OPTION 9:**
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 80 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>40</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>20</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>25</td>
</tr>
</tbody>
</table>

  - FCC handling tariff: 55 €/TEU
3. Economic Analysis

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
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<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71,88</td>
<td>25</td>
<td>96,88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81,25</td>
<td>70</td>
<td>151,25</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>120,13</td>
<td>25</td>
<td>145,13</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>129,50</td>
<td>70</td>
<td>199,50</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>125,00</td>
<td>0</td>
<td>125,00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>131,25</td>
<td>50</td>
<td>181,25</td>
</tr>
</tbody>
</table>

Table 3-27: Option 9 results

In comparison with option 8, the difference between Solution 1 and Solution 2, and Conventional Handling is now larger because the FCC handling tariff is now larger.

• OPTION 10:
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 80 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>55</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>10</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>20</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 35 €/TEU

The final results are:

<table>
<thead>
<tr>
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<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71,88</td>
<td>25</td>
<td>96,88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81,25</td>
<td>70</td>
<td>151,25</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>89,34</td>
<td>25</td>
<td>114,34</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>98,72</td>
<td>70</td>
<td>168,72</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>105,00</td>
<td>0</td>
<td>105,00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>111,25</td>
<td>50</td>
<td>161,25</td>
</tr>
</tbody>
</table>

Table 3-28: Option 10 results

In comparison with option 4, Solution 2 is now more expensive. This is because the conventional handling tariff in an inland terminal is 20 Euro per move more expensive and this affects only to Solution 2 (see Fig. 3-5).
• **OPTION 11:**
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 80 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>55</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>10</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>20</td>
</tr>
</tbody>
</table>

  - FCC handling tariff: 41 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71,88</td>
<td>25</td>
<td>96,88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81,25</td>
<td>70</td>
<td>151,25</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>95,34</td>
<td>25</td>
<td>120,34</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>104,72</td>
<td>70</td>
<td>174,72</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>111,00</td>
<td>0</td>
<td>111,00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>117,25</td>
<td>50</td>
<td>167,25</td>
</tr>
</tbody>
</table>

*Table 3-29: Option 11 results*

This option is equivalent to option 5, but the Conventional Handling tariff in an inland terminal is 20 Euro more. This is shown in Solution 2 because it is now more expensive.

So, since Solution 2 is more expensive than Conventional Handling in option 5, in option 11 it is shown the same, but the difference between both of them is now larger.

• **OPTION 12:**
  - Conventional Handling tariff in a deep-sea terminal: 115 €/move
  - Conventional Handling tariff in an inland terminal: 80 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>55</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
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<tr>
<td>Storage in stack (%)</td>
<td>10</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>20</td>
</tr>
</tbody>
</table>

  - FCC handling tariff: 55 €/TEU
The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>71.88</td>
<td>25</td>
<td>96.88</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>81.25</td>
<td>70</td>
<td>151.25</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>109.34</td>
<td>25</td>
<td>134.34</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>118.72</td>
<td>70</td>
<td>188.72</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>125.00</td>
<td>0</td>
<td>125.00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>131.25</td>
<td>50</td>
<td>181.25</td>
</tr>
</tbody>
</table>

Table 3-30: Option 12 results

Conventional handling is the cheapest option, as expected. Solution 1 and Solution 2 are now more expensive than in option 11 because the FCC handling tariff is also more expensive.

**OPTION 13:**
- Conventional Handling tariff in a deep-sea terminal: 160 €/move
- Conventional Handling tariff in an inland terminal: 60 €/move
- Percentages that relate to each movement in a terminal:

```
<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
</tr>
</tbody>
</table>
```

- FCC handling tariff: 35 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100.00</td>
<td>25</td>
<td>125.00</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109.38</td>
<td>57.5</td>
<td>166.88</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>117.00</td>
<td>25</td>
<td>142.00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>126.38</td>
<td>57.5</td>
<td>183.88</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>92.50</td>
<td>0</td>
<td>92.50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>98.75</td>
<td>37.5</td>
<td>136.25</td>
</tr>
</tbody>
</table>

Table 3-31: Option 13 results

As in option 1, Solution 2 is the cheapest option. But the difference between this and the rest of the handling cases is larger because conventional handling tariff is now higher, so the Conventional Handling and Solution 1 tariffs are also higher.
3. Economic Analysis

• OPTION 14:
  - Conventional Handling tariff in a deep-sea terminal: 160 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 41 €/TEU

The final results are:

<table>
<thead>
<tr>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100,00</td>
<td>25</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>57,5</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>123,00</td>
<td>25</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>132,38</td>
<td>57,5</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>98,50</td>
<td>0</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>104,75</td>
<td>37,5</td>
</tr>
</tbody>
</table>

Table 3-32: Option 14 results

Solution 2 is the cheapest one, followed by Conventional Handling and Solution 1.

• OPTION 15:
  - Conventional Handling tariff in a deep-sea terminal: 160 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 55 €/TEU
The final results are:

<table>
<thead>
<tr>
<th>Conventional Handling + Truck</th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>57.5</td>
<td>166,88</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>137,00</td>
<td>25</td>
<td>162,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>146,38</td>
<td>57.5</td>
<td>203,88</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>112,50</td>
<td>0</td>
<td>112,50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>118,75</td>
<td>37.5</td>
<td>156,25</td>
</tr>
</tbody>
</table>

Table 3-33: Option 15 results

Although Solution 2 tariff has increased due to the growth of FCC handling tariff, Solution 2 is still the cheapest. This situation was different in option 3, so the growth of FCC handling tariff make up for the increase of the Conventional Handling tariff in a deep-sea terminal from 115 Euro per TEU to 160 Euro per TEU.

**OPTION 16:**
- Conventional Handling tariff in a deep-sea terminal: 160 €/move
- Conventional Handling tariff in an inland terminal: 60 €/move
- Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 35 €/TEU

The final results are:

<table>
<thead>
<tr>
<th>Conventional Handling + Truck</th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>57.5</td>
<td>166,88</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>102,00</td>
<td>25</td>
<td>127,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>111,38</td>
<td>57.5</td>
<td>168,88</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>92,50</td>
<td>0</td>
<td>92,50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>98,75</td>
<td>37.5</td>
<td>136,25</td>
</tr>
</tbody>
</table>

Table 3-34: Option 16 results

With the new percentages, Solution 2 is the cheapest, as expected. The new distribution of percentages only affects Solution 1, which was the most expensive in option 13 (same situation but different percentages) and is still the most expensive.
3. Economic Analysis

• OPTION 17:
  - Conventional Handling tariff in a deep-sea terminal: 160 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:
    
    | PERCENTAGE OF THE DIFFERENT MOVES                        |   |
    |---------------------------------------------------------|---|
    | Unloading from the vessel (barge) to quay (%)           | 55|
    | Movement to stack (%)                                  | 15|
    | Storage in stack (%)                                   | 10|
    | Movement to truck (barge) and loading to truck (barge) (%) | 20|

  - FCC handling tariff: 41 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100,00</td>
<td>25</td>
<td>125,00</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>57,5</td>
<td>166,88</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>108,00</td>
<td>25</td>
<td>133,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>117,38</td>
<td>57,5</td>
<td>174,88</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>98,50</td>
<td>0</td>
<td>98,50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>104,75</td>
<td>37,5</td>
<td>142,25</td>
</tr>
</tbody>
</table>

Table 3-35: Option 17 results

Although the FCC handling tariff has increased, Solution 2 is still the cheapest one.

• OPTION 18:
  - Conventional Handling tariff in a deep-sea terminal: 160 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:
    
    | PERCENTAGE OF THE DIFFERENT MOVES                        |   |
    |---------------------------------------------------------|---|
    | Unloading from the vessel (barge) to quay (%)           | 55|
    | Movement to stack (%)                                  | 15|
    | Storage in stack (%)                                   | 10|
    | Movement to truck (barge) and loading to truck (barge) (%) | 20|

  - FCC handling tariff: 55 €/TEU
The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100,00</td>
<td>25</td>
<td>125,00</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>57,5</td>
<td>166,88</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>122,00</td>
<td>25</td>
<td>147,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>131,38</td>
<td>57,5</td>
<td>188,88</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>112,50</td>
<td>0</td>
<td>112,50</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>118,75</td>
<td>37,5</td>
<td>156,25</td>
</tr>
</tbody>
</table>

Table 3-36: Option 18 results

Even for a FCC handling tariff of 55 Euro per TEU, Solution 2 is the cheapest one because it is made up for the difference between the conventional handling tariff in a deep-sea terminal and in an inland terminal. It is the same situation as in option 15.

**OPTION 19:**
- Conventional Handling tariff in a deep-sea terminal: 160 €/move
- Conventional Handling tariff in an inland terminal: 80 €/move
- Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>40</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>20</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>25</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 35 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100,00</td>
<td>25</td>
<td>125,00</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>70</td>
<td>179,38</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>117,00</td>
<td>25</td>
<td>142,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>126,38</td>
<td>70</td>
<td>196,38</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>105,00</td>
<td>0</td>
<td>105,00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>111,25</td>
<td>50</td>
<td>161,25</td>
</tr>
</tbody>
</table>

Table 3-37: Option 19 results

In this case Solution 2 is still the cheapest one. This situation is different than option 7, so the difference between the conventional handling tariff in a deep-sea terminal and in an inland terminal makes feasible Solution 2.
• **OPTION 20:**
  - Conventional Handling tariff in a deep-sea terminal: 160 €/move
  - Conventional Handling tariff in an inland terminal: 80 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>40</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>20</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>25</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 41 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100,00</td>
<td>25</td>
<td>125,00</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>70</td>
<td>179,38</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>123,00</td>
<td>25</td>
<td>148,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>132,38</td>
<td>70</td>
<td>202,38</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>111,00</td>
<td>0</td>
<td>111,00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>117,25</td>
<td>50</td>
<td>167,25</td>
</tr>
</tbody>
</table>

*Table 3-38: Option 20 results*

Solution 2 is the cheapest one.

• **OPTION 21:**
  - Conventional Handling tariff in a deep-sea terminal: 160 €/move
  - Conventional Handling tariff in an inland terminal: 80 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>40</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>20</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>25</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 55 €/TEU
The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100,00</td>
<td>25</td>
<td>125,00</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>70</td>
<td>179,38</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>137,00</td>
<td>25</td>
<td>162,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>146,38</td>
<td>70</td>
<td>216,38</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>125,00</td>
<td>0</td>
<td>125,00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>131,25</td>
<td>50</td>
<td>181,25</td>
</tr>
</tbody>
</table>

Table 3-39: Option 21 results

The most expensive handling way is Solution 1, but Conventional Handling and Solution 2 have the same tariff.

• OPTION 22:
  - Conventional Handling tariff in a deep-sea terminal: 160 €/move
  - Conventional Handling tariff in an inland terminal: 80 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>55</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>10</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>20</td>
</tr>
</tbody>
</table>
  - FCC handling tariff: 35 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100,00</td>
<td>25</td>
<td>125,00</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>70</td>
<td>179,38</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>102,00</td>
<td>25</td>
<td>127,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>111,38</td>
<td>70</td>
<td>181,38</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>105,00</td>
<td>0</td>
<td>105,00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>111,25</td>
<td>50</td>
<td>161,25</td>
</tr>
</tbody>
</table>

Table 3-40: Option 22 results

Solution 2 is the cheapest one. Conventional Handling and Solution 1 have similar tariffs.
• **OPTION 23:**
  - Conventional Handling tariff in a deep-sea terminal: 160 €/move
  - Conventional Handling tariff in an inland terminal: 80 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>55</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>10</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>20</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 41 €/TEU

The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100,00</td>
<td>25</td>
<td>125,00</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>70</td>
<td>179,38</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>108,00</td>
<td>25</td>
<td>133,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>117,38</td>
<td>70</td>
<td>187,38</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>111,00</td>
<td>0</td>
<td>111,00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>117,25</td>
<td>50</td>
<td>167,25</td>
</tr>
</tbody>
</table>

*Table 3-41: Option 23 results*

Solution 2 tariff has increased, but it is still the cheapest one. In comparison with option 22, the difference between Conventional Handling tariff and Solution 1 tariff is making larger.

• **OPTION 24:**
  - Conventional Handling tariff in a deep-sea terminal: 160 €/move
  - Conventional Handling tariff in an inland terminal: 60 €/move
  - Percentages that relate to each movement in a terminal:

<table>
<thead>
<tr>
<th>PERCENTAGE OF THE DIFFERENT MOVES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading from the vessel (barge) to quay (%)</td>
<td>55</td>
</tr>
<tr>
<td>Movement to stack (%)</td>
<td>15</td>
</tr>
<tr>
<td>Storage in stack (%)</td>
<td>10</td>
</tr>
<tr>
<td>Movement to truck (barge) and loading to truck (barge) (%)</td>
<td>20</td>
</tr>
</tbody>
</table>

- FCC handling tariff: 55 €/TEU
The final results are:

<table>
<thead>
<tr>
<th></th>
<th>INITIAL TARIFF</th>
<th>EXTRA</th>
<th>FINAL TARIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Handling + Truck</td>
<td>100,00</td>
<td>25</td>
<td>125,00</td>
</tr>
<tr>
<td>Conventional Handling + Barge</td>
<td>109,38</td>
<td>70</td>
<td>179,38</td>
</tr>
<tr>
<td>Solution 1 + Truck</td>
<td>122,00</td>
<td>25</td>
<td>147,00</td>
</tr>
<tr>
<td>Solution 1 + Barge</td>
<td>131,38</td>
<td>70</td>
<td>201,38</td>
</tr>
<tr>
<td>Solution 2 + Truck</td>
<td>125,00</td>
<td>0</td>
<td>125,00</td>
</tr>
<tr>
<td>Solution 2 + Barge</td>
<td>131,25</td>
<td>50</td>
<td>181,25</td>
</tr>
</tbody>
</table>

Table 3-42: Option 24 results

As in option 21, the most expensive way of handling is Solution 1, but Conventional Handling and Solution 2 have the same tariff. In comparison with option 21, Solution 1 is cheaper because the new distribution of percentages makes more expensive the movement “unloading from the barge to the quay”, so the rest is cheaper (see Fig. 3-5).
After the previous detailed analysis, the next figure summarizes the obtained results:

**Fig. 3-6: Sensitivity Analysis summary**

As it is shown in *Fig. 3-6*, when the difference between the conventional handling tariff in a deep-sea terminal and in an inland terminal is large, Solution 2 is the most economically interesting. It means when the conventional handling tariff in a deep-sea terminal is 160 Euro per move and conventional handling tariff in an inland terminal is 60 Euro per move (see *Fig. 3-5*).

On the contrary, when the difference between both tariffs is small, Conventional Handling is the most interesting. It means when the conventional handling tariff
in a deep-sea terminal is 115 Euro per move and conventional handling tariff in an inland terminal is 80 Euro per TEU.

When the difference between these two tariffs is not so extreme, the FCC handling tariff is the one which define the most interesting way of handling. This is when the conventional handling tariff in a deep-sea terminal is 115 Euro per move and the conventional handling tariff in an inland terminal is 60 Euro per move, or when these are 160 Euro per move and 80 Euro per move respectively (see Fig. 3-6).

The options of percentages that relate to each movement in a terminal do not define the most interesting way of handling in any option. The only influence shown in Fig. 3-6 is when the conventional handling tariff in a deep-sea terminal is 115 Euro per move, the conventional handling tariff in an inland terminal is 60 Euro per move, and the FCC handling tariff is 41 Euro per TEU, because at this moment, with A% Solution 2 and Conventional Handling have approximately the same tariff, but with B% the Conventional Handling is the cheapest.
Chapter 4

Potential Market Analysis

4 POTENTIAL MARKET ANALYSIS

4.1 INTRODUCTION

In this chapter the European potential market of the FCC is analysed based on its use as in a Network Terminal. For this, all the deep-sea ports with a large volume of containers and with inland waterway transport connections in Europe were studied. These are:

- Le Havre (France)
- Antwerp (Belgium)
- Rotterdam (The Netherlands)
- Amsterdam (The Netherlands)
- Bremen-Bremerhaven (Germany)
- Hamburg (Germany)
- Constantza (Romania)

There are a lot of factors influencing the study of the potential market, but this thesis focuses on the dimensions of the basins (basin width and water depth) where container terminals are placed in the mentioned ports, also on the nautical access of the vessels to these basins. Thus, it is possible to know the basins where the FCC has space enough to work as in a Network Terminal. The remaining factors are put off for further studies.

This chapter is structured according to the previous ports, but first of all, the required dimensions for the basins are studied.
4.2 REQUIRED DIMENSIONS

In this section the required dimensions for a basin to place the deep-sea vessel and the FCC (with two barges between its floaters) were studied. These depend on the vessels handled by the crane, hence to be able to go on with this analysis, it was necessary to make an assumption. The FCC is intended to handle the new generations of container vessels, but it is known that nowadays just a few ports are able to accommodate vessels as large as, for instance, the Emma Maersk (11000 TEU). So, finally the Pamela MSC (2005) was the standard vessel used to study the potential market. Pamela MSC is a new generation vessel, but does not present the problems that, for instance, Emma Maersk presents.

The dimensions of the Pamela MSC are:

<table>
<thead>
<tr>
<th>Pamela MSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (L): 336.7 m</td>
</tr>
<tr>
<td>Beam (B): 45.6 m</td>
</tr>
<tr>
<td>Draft (D): 15 m</td>
</tr>
<tr>
<td>9200 TEU</td>
</tr>
</tbody>
</table>

*Table 4-1: Pamela MSC*

In the lecture notes “Ports and Terminals” (Ligteringen, 2000), distinction is made between very long basins (1000 m or more) and not very long basins (less than 1000 m).

In case of not very long basins, these should give a sufficient width (W) for safe towing in and towing out of the vessels, while other berths are occupied.

For container ships and basins with terminals in both sides, this means (see Fig. 4-1):

\[
W'_{\text{max}} = 5 \times B + 50 + 25 + 20 = 5 \times 45.6 + 50 + 25 + 20 = 323 \text{ m}
\]

\[
W'_{\text{min}} = 4 \times B + 50 + 20 + 20 = 4 \times 45.6 + 50 + 20 + 20 = 272.4 \text{ m}
\]

For container ships and basins with terminals in only one side, this means:

\[
W'_{\text{max}} = 4 \times B + 50 + 25 + 20 = 4 \times 45.6 + 50 + 25 + 20 = 277.4 \text{ m}
\]

\[
W'_{\text{min}} = 3 \times B + 50 + 20 + 20 = 3 \times 45.6 + 50 + 20 + 20 = 226.8 \text{ m}
\]
In case of very long basins, it is desirable that ships can be turned in the basin, but it is assumed here that this will be a local widening of the basins and not over the full length of the basin.

At this point, the extra width due to the FCC is the only missing width. Referring to the study carried out by Jan van Klinken (Klinken, 2004), the resulting design of the FCC is shown in Fig. 4-2.

Looking at Fig. 4-2, the extra width necessary to place the FCC ($W_{FCC}$) is 50 m, plus the middle of the floater next to the vessel (13 /2 metres), plus an extra width to avoid damages between the deep-sea vessel and the crane (0.5 metres):

$$W_{FCC} = 50 + 13 / 2 + 0.5 = 57 \text{ m}$$
Therefore, the required widths for the basins, adding the extra width to place the FCC on one side, are:

- Basins with terminals in both sides:
  \[ W_{\text{max}} = W'_{\text{max}} + W_{\text{FCC}} = 323 + 57 = 380 \, \text{m} \]
  \[ W_{\text{min}} = W'_{\text{min}} + W_{\text{FCC}} = 272.4 + 57 = 329.4 \, \text{m} \]

- Basins with terminals in only one side:
  \[ W_{\text{max}} = W'_{\text{max}} + W_{\text{FCC}} = 277.4 + 57 = 334.4 \, \text{m} \]
  \[ W_{\text{min}} = W'_{\text{min}} + W_{\text{FCC}} = 226.8 + 57 = 283.8 \, \text{m} \]

As a criterium the following average values are adopted:
- Basins with terminals in both sides: \( W_{\text{req}} = 350 \, \text{m} \)
- Basins with terminals in only one side: \( W_{\text{req}} = 305 \, \text{m} \)

Once these dimensions were known, the next step was to study the basins of the European ports mentioned in section 4.1. Not all of the basins were studied, just those with water depth enough to accommodate the Pamela MSC.

It was assumed that the nautical access to the basins which can accommodate the Pamela MSC is not a limitation.
4.3 PORT OF LE HAVRE (FRANCE)

The Port of Le Havre is connected by means of a vast net of inland waterways to the North-Eastern region of France, Belgium and the Mediterranean Sea, as is shown in Fig. 4-3. While at present these canals are mostly rather narrow the French Government is planning to make them suitable for Class V barges, such as the Seine-Nord connection to Belgium.

![Map of France showing inland waterways](https://example.com/map.png)

*Fig. 4-3: Inland waterway connections of the Port of Le Havre (Source: EuroCanals 2006)*

Furthermore, in 2005 this port moved 2,118,509 TEU, more than 60% of all the containers handled in the French ports, and 98,524 TEU were transported by barges. The modal split of the total land moves (not considering the feeder throughput) in 2005 was:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Transport</td>
<td>86.8 %</td>
</tr>
<tr>
<td>Inland Waterway Transport</td>
<td>7.2 %</td>
</tr>
<tr>
<td>Rail Transport</td>
<td>6 %</td>
</tr>
</tbody>
</table>

*Table 4-2: Modal split of the total land moves of the Port of Le Havre*
The volume of containers moved by the port and its inland waterway connections make the Port of Le Havre a potential user of the FCC.

The next figure (Fig. 4-4) shows the map of the Port of Le Havre and its container terminals:

![Map of Port of Le Havre and container terminals](image)

*Fig. 4-4: Container terminals in the Port of Le Havre. (Source: Port of Le Havre website)*

The next step was to study the different basins of the port where the container terminals are placed. The first studied was “Darse de L’Ocean”, placed next to Bougainville and Osaka quays (see figure 4-4):

![Ocean’s Basin (Port of Le Havre)](image)

*Fig. 4-5: Ocean’s Basin (Port of Le Havre). (Source: Port of Le Havre website)*

This basin is 355 m wide (W = 355 m) and 1,670 m long (dimensions obtained with the program “Google Earth”). There are terminals only in one side, so the required width to accommodate the Pamela MSC and the FCC is 305 m. It would be possible to handle container vessels from both sides, but the problem is that the basin is behind a lock (see Fig. 4-4) which is not large enough, so the Pamela MSC is not able to reach these berths. Therefore, it is not feasible to use the FCC in “Darse de L’Ocean”. 
The next basin studied was the “Canal Bossiere”, next to the “quay of Europe”.

Fig. 4-6: “Canal Bossiere” (Port of Le Havre.) (Source: Port of Le Havre website)

The width of “Canal Bossiere” is not constant. In the narrowest section this is 190 m wide, so it is not possible to handle container vessels with the FCC there. This changes in the other side of the terminal because, as it is shown in Fig. 4-6, the width in some berths is more than 800 m. In this last part of the “Quay of Europe”, there are not other terminals in front of it, so the required width is 305 m.

Although the basin is wide enough to accommodate the Pamela MSC and the FCC in some berths, the vessel cannot reach them because they are behind the lock which is not large enough. Thus, “Canal Bossiere” has the same problem as “Darse de L’Ocean”. Both are rejected.
Later, “Bassin Rene Coty” and “Bassin du Pacifique” (Fig. 4-7) were studied.

![Fig. 4-7: “Bassin Rene Coty” and “Bassin du Pacifique” (Port of Le Havre) (Source: Port of Le Havre website)](image)

The width of the “Bassin du Pacifique” is around 280 – 285 m, depending on the section, and there is not any berth in front of the Normandy Terminal. The required width to place the FCC is 305 m, so it will not be possible to handle the vessel from both sides. Furthermore, the Pamela MSC is not received to this basin because the depth is insufficient.

The “Bassin Rene Coty” is not constant wide. The narrowest section is 410 m, where there is a liquid bulk terminal in front of the container terminal. This section has been measured from the quay of the Atlantic Terminal to the place where the liquid bulk vessel is moored (see Fig. 4-7), so it is the same situation as in the rest of the sections. Thus, the FCC could work in the basin because $W > W_{\text{req}}$ (410 > 350 m), but the depth is insufficient to accommodate the Pamela MSC.

The last basin studied was “Port 2000 Basin” (see Fig. 4-4). This will consist of several terminals; the first is already operational and able to accommodate new generation vessels (see Fig. 4-8).
Fig. 4-8: Port 2000 (Port of Le Havre) (Source: Port of Le Havre website)

The berths of Port 2000 will be accessible at any tide without the need for vessels to pass through locks. The first berths permit ships with draughts to 14.50 m to dock at any tide and offer 500 m wide. It will be possible to deepen the westernmost berths to a level that allows for the reception of ships with draughts to 17 m. With these dimensions it is concluded that there will not be any problem to handle container vessels from both sides ($W > W_{req}; 500 > 305$ m).
4.4 PORT OF ANTWERP (BELGIUM)

The position of Antwerp in the delta of the Scheldt, Meuse and Rhine Rivers means that Antwerp is placed in an exceptional area connected by means of inland waterways to the North-Eastern region of France, The Netherlands, and Centre and Eastern region of Europe (see Fig. 4-9).

Fig. 4-9: Inland waterway connections of the Port of Antwerp (Source: Port of Antwerp website)

As well as having a very good net of inland connections, Antwerp moves a large amount of containers. In 2005 this port moved 6,488,029 TEU of which 1,751,768 TEU were transported by barge. The modal split of the total land moves (not considering the feeder throughput) in 2005 was:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Transport</td>
<td>60 %</td>
</tr>
<tr>
<td>Inland Waterway Transport</td>
<td>33 %</td>
</tr>
<tr>
<td>Rail Transport</td>
<td>7 %</td>
</tr>
</tbody>
</table>

Table 4-3: Modal split of the total land moves of the Port of Antwerp

The next step was the study of the different basins where the container terminals are placed. There are other small container terminals in the port
besides the terminals shown in the Fig. 4-10, but they are too small to place the Pamela MSC.

![Fig. 4-10: Container terminals in the Port of Antwerp (Source: Port of Antwerp website)](image)

**Noordzee Terminal**

**Europe Terminal**

**Deurganck Dock**

**Delwaide Dock**

The first analyzed terminal was the Noordzee Terminal. As it can be seen in Fig. 4-10, this terminal is placed on the River Scheldt. The width of the river at this point is about 1350 m in the narrowest section; so there is no problem to handle the largest container vessels from both sides by the FCC in the Noordzee Terminal.

Secondly, the Europe Terminal was studied. This is located on the River Scheldt as well (see Fig. 4-10). Therefore, the FCC can work there as in a Network Terminal.
“Delwaide Dock” was the third basin studied. This comprises MSC Home Terminal, operated by PSA HNN, and P&O Ports Terminal. Its width is about 325 m and there are berths in both sides of the dock. The required width to handle container vessels in this situation is 350 m. It can be concluded that the “Delwaide Dock” cannot handle from both sides the vessels accommodated in it.

The last analysed basin was “Deurganck Dock” (Fig. 4-11). This basin is still not totally operational. It began operation in July 2005, and its full capacity will be in use by 2007. It is 450 m wide and it will be 2600 m long. Since there will be terminals in both sides, the required width will be 350 m. So, it is possible to handle vessels from both sides with the FCC because $W > W_{req}$ (450 > 350 m).

Fig. 4-11: Deurganck Dock (Port of Antwerp) (Source: Deurganck Dock website)
4.5 PORT OF ROTTERDAM (THE NETHERLANDS)

Rotterdam has an ideal situation on the estuary of the Rhine and Meuse Rivers giving it an important natural advantage over other European ports (Fig. 4-12). Barges can quickly, cost-effectively and environmentally-friendly transport large volumes of cargo to destinations in the Netherlands, but also to destinations in Germany, Belgium, France, Switzerland, Austria and beyond. The Rhine-Main-Danube Canal even makes Central and Eastern Europe accessible for inland shipping from Rotterdam.

![Inland waterway connections of the Port of Rotterdam](Source: Port of Rotterdam website)

As well as an excellent situation, Rotterdam moved 9,286,756 TEU in 2005, of which 2,112,000 TEU were transported by barge. The modal split of the total land moves (not considering the feeder throughput) was in 2005:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Transport</td>
<td>59.6 %</td>
</tr>
<tr>
<td>Inland Waterway Transport</td>
<td>31.1 %</td>
</tr>
<tr>
<td>Rail Transport</td>
<td>9.3 %</td>
</tr>
</tbody>
</table>

*Table 4-4: Modal split of the total land moves of the Port of Rotterdam*

These two characteristics make Rotterdam an ideal port to use the FCC.

Next, the basins where the container terminals are were studied in detail to know in which the FCC can be used.
The next map shows the distribution of the cargo and terminals in the port.

Fig. 4-13: Distribution of the cargo and terminals map of the Port of Rotterdam (Source: Port of Rotterdam website)

Eemhaven area accommodates container ships up to 6000 TEU, so the terminals placed there are not potential users of the FCC. This does not apply to Maasvlakte, where the largest deep-sea vessels can be moored.

In the following all the basins where the container terminals are placed in Maasvlakte 1 and Maasvlakte 2 (not built yet) are analyzed.
4. Potential Market Analysis

- Maasvlakte 1:

As a result of Fig. 4-13 and Fig. 4-14, the interesting basins for this study are “Europahaven” and “Amazonehaven”, because these are which serve to container vessels.

The first studied basin was “Europahaven”. As it is shown in Fig. 4-15, the narrowest section in “Europahaven” is 375 m wide. In one side of the basin APM Terminal and ECT terminal are placed and in the other side there is a liquid bulk terminal. So the required width is 350 m. Therefore, the FCC can be

---

**Fig. 4-14: Maasvlakte 1 map (Source: Rotterdam Port Authority)**

**Fig. 4-15: “Europahaven” (Maasvlakte 1). Port of Rotterdam (Source: Rotterdam Port Authority)**
placed in the basin “Europahaven”, even in the narrowest section because $W > W_{req}$ ($375 > 350$ m). It must be mentioned that in front of the specific area for turning around the vessels, the depth of the quay is not large enough to accommodate the Pamela MSC, so for the moment the FCC is not feasible there.

Secondly, “Amazonehaven” was studied.

![Fig. 4-16: “Amazonehaven” (Maasvlakte 1). Port of Rotterdam. (Source: Rotterdam Port Authority)](image)

In this case, every section is the same width, 275 m. In front of the container terminal (ECT), there is a dry bulk terminal (EMO). Comparing the width of the basin with the required one calculated in section 4.2, it is clear that it is not possible the use of the FCC in “Amazonehaven” ($W < W_{req}; 275 < 350$ m).

As well as these two terminals (APM and ECT) placed in “Europahaven” and “Amazonehaven”, this year a new container terminal will be in operation along the Yangtze Basin. This is the Euromax Terminal. The basin is more than 600 m width (see Fig. 4-17), so the FCC can be placed there.

![Fig. 4-17: Euromax Terminal in Yangtze Basin. (Source: Rotterdam Port Authority)](image)
4. Potential Market Analysis

- **Maasvlakte 2:**

  The next map shows the master plan of Maasvlakte 2. On it, the future container terminals are shown in pink colour.

  ![Maasvlakte 2 Map](source)

  *Fig. 4-18: “Maasvlakte 2” map. (Source: Rotterdam Port Authority)*

  Next, the different basins were analysed one by one.
4. Potential Market Analysis

As it is shown in the previous picture, the basin 1 is 600 m wide in the narrowest section. This basin will be two ways traffic. Even so, looking at the required width calculated in section 4.2 (350 m) there is no problem to use the FCC in this basin in any case.

The second analysed basin is 450 m wide and 2415 m long. In both sides there are container terminals, so the required width is 350 m. So, in principle it allows FCC operation.
4. Potential Market Analysis

This basin has the same features than the second one, so the conclusion is the same; it is possible to use the FCC.

Fig. 4-21: Basin 3, Maasvlakte 2.  
(Source: Rotterdam Port Authority)

The basin 4 is 625 + 100 m wide, so there will be no problem to use the FCC on it in any case.

Fig. 4-22: Basin 4, Maasvlakte 2.  
(Source: Rotterdam Port Authority)
4.6 PORT OF AMSTERDAM (THE NETHERLANDS)

Amsterdam, as the other ports studied above, is placed in a privileged area for the inland waterway transport. This is shown in Fig. 4-23.

Fig. 4-23: Inland waterway connections of the Port of Amsterdam. (Source: APA, 2004).

In spite of this situation, the port moved 65,844 TEU in 2005.

Fig. 4-24: Map of the Port of Amsterdam. (Source: Port of Amsterdam website)
The basins to study in the port are “Amerikahaven” because the Ceres Paragon Terminal has container quays along it (in addition to the Indented Berth) (see Fig. 4-25). “Afrikahaven”, because there is a project to expand the Ceres Paragon Terminal to the “Afrikahaven”. Finally, “Westhaven” because there is the Ceres Amsterdam Marine Terminal, which main activities are ro-ro and containers.

“Afrikahaven” is about 350 m wide and 2000 m long. Assuming that the Ceres Paragon Terminal would expand to this basin, in the other side of the basin there are bulk terminals. Furthermore, these bulk terminals operate the vessels by means of floating cranes. The floating cranes are placed between the quay and the vessels because the quay is not deep enough. Thus, extra width is required due to the floating cranes. It would be not possible to handle the vessels from the basin side in the container terminal.
"Amerikahaven" is 400 m width. In front of the Ceres Paragon terminal there is a terminal for oil and chemicals, so vessels can be moored there. Thus, the required distance to place the FCC being another vessel moored in the other side is: $W_{req} = 350$ m. Therefore, the FCC can be used in the Ceres Paragon Terminal ("Amerikahaven").

"Westhaven" has a width of 250 m where the container terminal is (in front of the terminal for oil and chemical terminal between "Sonthaven" and "Bosporushaven" (see Fig. 4-28)). It is not possible to place the FCC because the basin is too narrow.
4.7 PORT OF BREMEN-BREMERHAVEN (GERMANY)

The position of the ports of Bremen and Bremerhaven is ideal for the inland waterway transport. They are located in the mouth of the River Weser and connected to Poland thanks to the East-West corridor, to the Czech Republic, Austria, Hungary and Romania thanks to the Rhine and South-East corridor, but they are connected also to Belgium, The Netherlands and France thanks to a network of rivers and canals.

Fig. 4-29: Inland waterway connections of the ports of Bremen and Bremerhaven. (Source: Binnenvaart website)

The two ports handled 3,743,969 TEU in 2005, of which 3,698,681 TEU were handled in Bremerhaven, where the largest terminals are placed. This amount is increasing thanks to the “Container Terminal 4 (CT4)”, a project that will be completed in April 2008 and that will increase the capacity up to 7 million TEU. The first berth was already inaugurated 20th October 2006.
First of all, it must be mentioned that the container terminals of the Port of Bremen are not large enough to accommodate the new generations of container vessels. These are placed in the River Weser’s banks in Bremerhaven, where the construction work of the CT4 is as well.

All the container terminals which can receive the Pamela MSC are placed along the River Weser’s bank, as it was mentioned before. The width of the river does not present any problem to place the FCC next to the vessels because the narrowest section is more than 2000 m. But the problem of this terminal is the waves of the river. These waves make impossible the use of the FCC working as in a Network terminal.
4.8 PORT OF HAMBURG (GERMANY)

The Port of Hamburg is directly connected to the North-Eastern part of Germany and Czech Republic by means of the River Elbe, but, as can be seen in Fig. 4-32, thanks to a sophisticated net of rivers and canals, it is connected to France, Belgium, The Netherlands, Austria, Hungary and the Eastern part of Europe.

![Fig. 4-32: Inland waterway connections of the Port of Hamburg. (Source: Binnenvaart website)](image)

In the Port of Hamburg there are 4 container terminals: Altenwerder, Burchardkai, Eurogate and Tollerort. In total they moved 5,117,654 TEU in 2005. Next, the different terminals are going to be analysed.
4. Potential Market Analysis

• Altenwereder Container Terminal:

![Map of Altenwereder Terminal](image)

Altenwereder Terminal:
Quay Length: 1400 m
Max. Draft: 16.7 m
Capacity: 1.9 M TEU

**Fig. 4-33: Altenwereder Terminal. (Source: Hamburg Port Authority website)**

The basin where the terminal is located has a width of 350 m. A ro-ro terminal is found on the other side, but this does not have quay in the common basin, so there are no vessels moored in front of the quay of the container terminal. Taking this characteristic into account, the required width to place the FCC along the vessel moored is: 305 m. It is concluded that the vessels can be handled from both sides in the Altenwereder Terminal.
4. Potential Market Analysis

- Burchardkai Container Terminal:

Fig. 4-34: Burchardkai Terminal. (Source: Hamburg Port Authority website)

The Burchardkai Container Terminal has three quays, the one in the River Elbe, the one in “Park-hafen”, and the one in “Waltershofer Hafen”. In the River Elbe quay there is no problem to handle the deep-sea vessels by the FCC because it is about 450 m wide.

The width in Park-hafen quay is 585 m, so this is not a limitation, but the length is 367 m and the Pamela MSC is 337 m long, so the length is a limitation. The Pamela MSC cannot be accommodated there.

Finally, the “Waltershofer Hafen” quay is 1500 m long, 300 m wide and in front of it there is another container terminal (Eurogate). The required width is 350 m, so it is not possible to handle the container vessels from both sides.
4. Potential Market Analysis

• Eurogate Container terminal:

![Map of Eurogate Container terminal](image)

**Eurogate Terminal:**
- Quay Length: 2050 m
- Max. Draft: 15.5 m
- Capacity: 2.6 M TEU

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*Fig. 4-35: Eurogate Terminal. (Source: Hamburg Port Authority website)*

The “Eurogate Container Terminal” only has a quay, the one which is located in the basin in common with the “Burchardkai Container Terminal”. This basin was already studied in the “Burchardkai Container Terminal” section, and it was concluded that the FCC cannot work on it.
4. Potential Market Analysis

- Tollerort Container terminal:

Fig. 4-36: Tollerort Terminal. (Source: Hamburg Port Authority website)

At the other side of the basin there is not any berth (see Fig. 4-36), so vessels cannot be moored. Thus, the required width to handle container vessels from both sides in “Vorhafen” is \( W_{\text{req}} = 305 \text{ m} \). Therefore, the FCC could transfer containers to the barges.
4.9 PORT OF CONSTANTZA (ROMANIA)

The Port of Constantza is connected to the Pan European Corridor VII –Danube that links two of the main trade poles of Europe: Rotterdam and Constantza, creating a navigable inland waterway from the North Sea to the Black Sea. The length of the navigable river is 2,414 km from the Romanian terminus Sulina to Kelheim in Germany, where it connects to the Main-Danube Canal, the Romanian sector having a length of 1,075 km.

The Danube-Black Sea Canal links the Port of Constantza to the Rhine-Main-Danube Corridor, offering the most efficient and ecological transport alternative within the hinterland and at the same time a 4,000 km shortening of the sea trade routes coming from Far East and Australia through the Suez Canal.

Nowadays, there are still some infrastructural limitations to the inland waterway transport. For instance, there are some bridges in Serbia where barges cannot go through them, especially in summer. All these problems are being solved.

![Inland waterway connections of the Port of Constantza. (Source: Binnenvaart website)](image)

In the port of Constantza there are five container terminals. They are operated by Socep, Constantza South Container Terminal (this operates two terminals), Umex and APM Terminals. Except one of the terminals operated by Constantza South Container Terminal (CSCT), the rest do not allow new generation container vessels, so using the FCC there makes no sense.

The only terminal which handles post-panamax container vessels has a capacity of 1 M TEU and a total quay length of 840 m. Its location is shown in Fig. 4-38.
The basin where the terminal is placed is 380 m wide. In the other side of the basin vessels can be moored. Thus, the required width is $W_{req} = 350$ m. Therefore, the FCC can transfer directly container from the deep-sea vessels to the barges from the sea-side of the vessels in this basin.
4.10 CONCLUSIONS

In this section the different basins where the FCC can work in the ports mentioned at the beginning of chapter 4 are going to be shown.

- Port of Le Havre:
  - Port 2000 basin.

- Port of Antwerp:
  - Noordzee Terminal;
  - Europe Terminal;
  - “Deurganck Dock” basin.

- Port of Rotterdam:
  - Europahaven;
  - Yangtze Basin;
  - Maasvlakte 2 (every basin).

- Port of Amsterdam:
  - Amerikahaven.

- Port of Hamburg:
  - Altenwereder Terminal;
  - Burchardkai Terminal:
    - River Elbe
    - Tollerort Terminal.

- Port of Constantza:
  - Constantza South Container Terminal.

Finally, it can be concluded that in the 70% of the basins where the Pamela MSC can be accommodated in the studied ports, the FCC can handle vessels from the basin side.
5 ANNEXES

5.1 ANNEX A: IMO FAL DOCUMENTS

IMO FAL 1 General Declaration

<table>
<thead>
<tr>
<th>Field</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Name and description of ship</td>
<td></td>
</tr>
<tr>
<td>2. Port of arrival/Departure</td>
<td></td>
</tr>
<tr>
<td>3. Date and time of arrival/Departure</td>
<td></td>
</tr>
<tr>
<td>4. Nationality of ship</td>
<td></td>
</tr>
<tr>
<td>5. Name of master</td>
<td></td>
</tr>
<tr>
<td>6. Port arrived from/Port of destination</td>
<td></td>
</tr>
<tr>
<td>7. Certificate of registry (Port, date, number)</td>
<td></td>
</tr>
<tr>
<td>8. Name and address of ship’s agent</td>
<td></td>
</tr>
<tr>
<td>9. Gross tonnage</td>
<td></td>
</tr>
<tr>
<td>10. Net tonnage</td>
<td></td>
</tr>
<tr>
<td>11. Position of the ship in the port (berth or station)</td>
<td></td>
</tr>
<tr>
<td>12. Brief particulars of voyage (previous and subsequent ports of call, undocking where remaining cargo will be discharged)</td>
<td></td>
</tr>
<tr>
<td>13. Brief description of the cargo</td>
<td></td>
</tr>
<tr>
<td>14. Number of crew (incl. Master)</td>
<td></td>
</tr>
<tr>
<td>15. Number of passengers</td>
<td></td>
</tr>
<tr>
<td>16. Remarks</td>
<td></td>
</tr>
</tbody>
</table>

*Attached documents (indicate number of copies)*

<table>
<thead>
<tr>
<th>Field</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. Cargo Declaration</td>
<td></td>
</tr>
<tr>
<td>18. Ship's Stores Declaration</td>
<td></td>
</tr>
<tr>
<td>19. Crew List</td>
<td></td>
</tr>
<tr>
<td>20. Passenger List</td>
<td></td>
</tr>
<tr>
<td>21. Date and signature by master, authorized agent or officer</td>
<td></td>
</tr>
<tr>
<td>22. Crew's Effects Declaration*</td>
<td></td>
</tr>
<tr>
<td>23. Maritime Declaration of Health*</td>
<td></td>
</tr>
</tbody>
</table>

* Only on arrival
### IMO FAL 3 Ship's Stores Declaration

<table>
<thead>
<tr>
<th></th>
<th>Arrival</th>
<th>Departure</th>
<th>Date of arrival/departure</th>
<th>Port of arrival/departure</th>
<th>Port arrived from/Port of destination</th>
<th>Name of ship</th>
<th>Nationality of ship</th>
<th>Number of persons on board</th>
<th>Period of stay</th>
<th>Place of storage</th>
<th>Name of article</th>
<th>Quantity</th>
<th>For official use</th>
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<td></td>
</tr>
</tbody>
</table>

12. Data and signature by master, authorized agent or officer
## IMO FAL 4 Crew’s Effects Declaration

### IMO CREW’S EFFECTS DECLARATION

<table>
<thead>
<tr>
<th>1. Name of ship</th>
<th>2. Effects which are subject to prohibitions or restrictions*</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Nationality of ship</td>
<td></td>
</tr>
<tr>
<td>4. No.</td>
<td>5. Family name, given names</td>
</tr>
<tr>
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5.2 ANNEX B: DIFFERENT WAYS TO FILE A DECLARATION

The aim if this annex B is to explain the different ways to file a declaration. These are:
- Electronic declaration
- Written declaration
- Verbal declaration
- The declaration by a different act

Electronic Declaration

The advantages of filing an electronic declaration are:
1) The declaration is swiftly dispatched and swiftly processed.
2) Completing the declaration is simple and efficient.
3) Filing electronic declaration saves time.
4) When filing electronic declarations, various data can be recorded more easily and can be checked more efficiently in retrospect.

How exactly the electronic declaration works depend on each situation. In general the person who is declaring enters the declaration in his computer system. Subsequently, he sends his declaration to Customs via his computer. He can even submit documentation electronically. Customs will check his data and subsequently send him an electronic notification about his declaration. This notification will state, for instance, that he may remove the goods or that Customs wants to carry out a further inspection of the goods. This notification will also show the amount of duties and levies he has to pay for these goods.

It is necessary a proper software package to make the declaration electronically and an Authorisation. In case of The Netherlands, both can be requested in the National Customs Helpdesk.

The costs associated with filing declarations electronically depend upon:
- the software package,
- the type of declaration,
- the number of declarations.

In case of electronic declaration the possibility of simplified procedures exists. It may happen that the person who is going to make a declaration does not yet possess all the required details or documents at the moment when he wants to file an import declaration. Provided that certain conditions are fulfilled, he may then follow a simplified procedure. Simplified procedures may also be helpful in filing the declarations more efficiently.
Customs distinguishes the following simplified procedures with respect to the import declaration:

- **The incomplete declaration**: a declaration is considerate incomplete if not all the required details have been filled in or not all the required documents have been enclosed. Customs may still take up an incomplete declaration if there is a valid reason for the incomplete declaration. This is the case, for instance, if the origin documents with which the person who is going to present the declaration wants to import the goods under a preferential rate cannot yet be submitted, because they are on their way by post or courier. In such cases, Customs can nevertheless take up his declaration for consideration.

- **The simplified declaration**: In this case it can leave out even more details than filing an incomplete declaration. This procedure has two forms, when it is filed an incompletely filled-in form Single Administrative Document or an incomplete electronic return with Customs, or when it is filed a commercial or administrative document (such a invoice or a consignment note), which takes over the function of the Single Administrative Document. Afterwards, a supplementary declaration must be filed and it may have a general, periodic or summarising nature. In order to file simplified declarations, an authorisation is needed which must contain the term within which the supplementary declaration should be filed.

- **The local clearance procedure**: In this case, it is possible to place the goods under customs procedure without immediately having to file a declaration with Customs. There are several local clearance procedures for placing goods under the various customs procedures. Under the local clearance procedure for release into free circulation, for instance, it is possible to enter the wished goods to release for free circulation in the own accounts. This means that the person who is presenting the procedure is not required to file a separate declaration or present the goods to Customs at that moment. Instead, it is used a system of notifications and it should be reported the arrival of the goods on the business premises of the person who is presenting the declaration to Customs. Customs then decide whether or not it wants to carry out an inspection. In order to apply the local clearance procedure, it is needed an authorisation. Customs only grant this authorisation if the accounts are well organised. The supplementary declarations can be made either electronically or in writing.

**Written Declaration**

By using the form Single Administrative Document, it can be filed a written declaration for placing the goods under customs procedure. The Single Administrative Document must be submitted at the Customs declaration point where the goods are located.

Customs only consider declarations that have been fully completed, signed and furnished with the prescribed documents.
The Single Administrative Document is a form adopted at European Level. It is used in all the countries of the EU for making customs declarations. Most of the Single Administrative Document is completed by using codes. In this way, the form can be processed more easily by computers.

In case of written declaration, simplified procedures can be made (see Electronic Declaration Section). However, Customs prefers electronic declarations for simplified procedures.

**Verbal Declaration**

In most cases, the verbal declaration involves consignments of a non-commercial nature, like passengers’ baggage and returned goods.

In case of commercial goods, these can be declared verbally as well, but they have to satisfy the following conditions:

- the value of the consignment should not exceed 1000 euros
- the weight of the consignment should not exceed 1000 kilograms
- they should not be part of a regular series of consignments
- they should not be carried by independent transport companies

All this conditions make really difficult a verbal declaration in case of the container market.

Verbal declaration can be filed for “import goods temporarily” and “export goods” as well.

**The Declaration by a Different Act**

Sometimes it is possible to make a declaration to Customs by performing a particular act.
5.3 ANNEX C: SIMPLIFIED PROCEDURES TO EXPORT GOODS

This annex explains the different simplified procedures to export goods.

As it was mentioned in the import section, Customs may grant permission to simplify certain formalities and procedures. To make use of such non-standard procedures, the exporter need license form Customs.

The following simplified procedures may apply to export goods:
- Incomplete Export Declaration
- Simplified Declaration
- Local Export Clearance Procedure

Incomplete Export Declaration

This facility means that Customs accepts a declaration that does not include all required information or that is not accompanied by all the official documents necessary to export goods.

Customs only accepts incomplete declarations if the exporter has a valid reason for not being able to file a complete declaration. However, if such a required export documents is missing, Customs may nevertheless accept an incomplete declaration in some cases.

In this case, a license is not required, but the exporter must state that his declaration is incomplete. He must be able to prove that the document in question exists and is still valid, that it is not his fault that he cannot yet present the document and, that the non-acceptance of the declaration by Customs would make it impossible to export the goods or would mean that the tax on the goods would be higher.

The exporter must submit the missing information and/or official documents within one month after Customs accepts the incomplete export declaration.

Simplified Declaration

A simplified declaration means that instead of filing a normal declaration the document submitted describes the goods as one of the following:
- a partially completed Single Administrative Document,
- a commercial document,
- an administrative document.

The exporter then files an additional declaration afterwards, stating the missing information.

If it is made use of the simplified declaration facility, it must present the goods to a customs office, where it is submitted a request to export the goods using a simplified declaration.
For this procedure, a licence for Simplified Declaration is needed, so, when granting the licence, Customs determine with the exporter’s cooperation, what documents may be used for the licence and what information have to be submitted. This, in any case includes the following information:
- the description and quantity of the goods
- the 8-digit CN code for the goods
- the number, types and brands of packing materials
- the country of importation
- the code indicating simplified export

Local Export Clearance Procedure

With a local export clearance procedure, the exporter carries out all export formalities within his own firm. He does not need present the goods to a customs office. Customs carry out random inspections of his exports.

There are two types of local export clearance procedure:

1) Local export clearance procedure by administrative registration: In this case a local export clearance procedure licence is needed. The exporter registers the goods in his accounts, stating the date on which he registers the goods in his account and the information needed to identify the goods. He ensures that he has all official documents concerning the goods available in the case of a Customs inspection. He himself issues a certified copy of the Single Administrative Document, confirming the administrative registration. A certified copy bears a stamp and a signature to confirm the accuracy and authenticity of the information presented in the Single Administrative Document.

2) Local export clearance procedure using electronic declaration: In this case, a licence is needed as well. With a local export clearance procedure using electronic declaration, the exporter does not need to present the goods to a customs office, but rather performs all export formalities from within his owns business. Customs performs random inspections of his exports.
5.4 ANNEX D: EXPLANATORY TERMS OF “STORAGE OF GOODS”

In this annex all the necessary terms to understand the section 2.2.4, “Storage of goods”, will be defined. They will be arranged alphabetically.

**APPROVAL:** The act when Customs authorize locations or premises accommodating the customs warehouses, free warehouses, free zones or temporary storage premises is called approval. A type E customs warehouse consists of several locations which together constitute the customs warehouse. This customs warehouse does not involve approved premises. Customs only has to know the storage locations.

**CUSTOMS WAREHOUSE:** A storage area supervised by Customs but where the responsibility of the goods is of the depositor is a Customs warehouse.

**DEPOSIT:** The moment when goods are stored in a customs warehouse or entered in the stock accounts is the deposit. The party involved is responsible of the goods kept in storage between the moment of deposit and the moment of removal.

**DEPOSITOR:** A depositor is the person who should fulfill the obligations arising from the declaration for placement of the goods under the customs warehousing system. So, he will be liable for the disparities. In case of an authorization for free zone of control type 2, the depositor is known as the operator.

**PRIVATE WAREHOUSE:** A private warehouse is a storage area supervised by Customs where the responsibility for the storage of the goods rests with the warehouse keeper. In the case of The Netherlands, type B customs warehouse can be used by anyone who wants to store the goods, so it is not a private warehouse. On the contrary, type C, D and E customs warehouses are private warehouses because they can only be used for the storage of goods by the authorization warehouse keeper himself.

**PROVISION OF SECURITY:** The duties and other import taxes only become payable at the moment when goods are removed and released into free circulation. Therefore, while goods are stored under customs control these levies do not have to be paid. However, Customs wants to be certain that the import duties and taxes becoming due at the moment of release into free circulation will actually be paid. This is the reason why Customs asks a financial guarantee, for instance in the form of a bank guarantee.

**PUBLIC WAREHOUSE:** A public warehouse is a storage area supervised by Customs where the responsibility for the storage of the goods rests in principle with the depositor. This is the type B customs warehouse, where anyone who wants to store goods can do it.

**REMOVAL:** Removal is the moment when the goods leave the customs warehouse or are deleted from the stock accounts because they are assigned a different customs-approved treatment or use.
STORAGE FACILITY: When we want to refer to temporary storage premises, type B, C, D and E customs warehouses, and free warehouses and free zones at the same time we call the storage facility.

SUPERVISION: With the term supervision, both physical control and administrative control are included. Customs not only exercises supervision over customs goods, but also goods which are stored under customs control.

Concerning to physical control, Customs is present when customs goods are deposited and removed, and it inspects the deposits and removals of the goods. In addition, Customs regularly checks the goods kept in storage.

Concerning to administrative control, pre-approved accounts constitute the basis for the Customs inspection. Based on these accounts, Customs checks deposits and removals and the stock of goods kept in storage.

WAREHOUSE KEEPER: The natural or legal person to whom the authorization to administer a customs warehouse is granted is the warehouse keeper. This is the authorization holder. In the case of free zone of control type 2, the warehouse keeper is known as “administrator”.
5.5 ANNEX E: NEW COMPUTERISED TRANSIT SYSTEM

To file a declaration is compulsory to place the goods under the customs transit procedure.

Since 1\textsuperscript{st} July 2005, it is obliged to file this declaration electronically, although in exceptional cases a written declaration can still be made, as it is mentioned in previous sections.

Customs processes the electronic transit declaration by means of the Transit system, short for the New Computerised Transit System (NCTS). In transit, filing a declaration comes down to sending an electronic message to Customs. It is only allowed to do so if the declarant is in possession of an “authorisation to file electronic customs transit declarations”.

The system offers traders many advantages. These are:
- Improved quality of service:
  - Less time spent waiting at Customs, because the declaration is sent electronically beforehand;
  - Greater flexibility in presenting declarations;
- Earlier discharge of the transit procedure because an electronic message is used instead of the return of the paper copy by mail, leading to a faster release of the guarantee.
- The high costs incurred in relation with the paper-based system of declaring goods are reduced.
- A greater clarity of the transit operation, for the benefit of trade.
- Because customs decide well in advance of the arrival of the goods at the office of destination whether or not they want to check the consignment, the trader does not lose valuable time at the office of destination waiting for a decision.

Furthermore, the system offers Customs advantages as well. These are:
- The communication and coordination between the customs administrations involved have improved;
- Repetitive activities only have to be performed once. This saves time and eliminates the risks involved in the duplication of information;
- Creation of a more coherent system, which speeds up the processing of data and at the same time making the system more flexible.
5.6 ANNEX F: EU CUSTOMS TERRITORY

The EU customs territory consists of the EU countries basically (see annex G), but the following areas or EU countries are not included:

- Faroe Islands (Denmark)
- Greenland
- Helgoland (Germany)
- Busingen (Germany): it is geographically in Switzerland, but it is Germany national territory and it is regarded in practice as part of German’s customs area.
- Territoires d'Outre-Mer (France): France’s overseas territories, called as TOM, are: New Caledonia, Wallis and Futuna, Mayotte, Saint Pierre and Miquelon, French Southern and Antarctic Territories.
- Departments d'Outre-Mer (France): France’s overseas departments, called DOM, are: Guyana, Guadeloupe including Martin, Martinique, Reunion.
- Campione d'Italia (Italy): it is geographically in Switzerland.
- Livigno (Italy)
- Lake Lugano (Italy): This only applies to the Italian waters of Lake Lugano, from the shore to the political border of the zone between Ponte Tresa and Ponte Ceresio. The remaining area is Swiss territory.
- San Marino: it constitutes a customs union with the EC
- Vatican City (Vatican)
- Kaliningrad
- Macao (third county, China)
- Andorra
- Ceuta (Spain)
- Melilla (Spain)
- Gibraltar (Spain)
5.7 ANNEX G: STATES MEMBERS OF THE EU

The EU customs territory consists of different parts, but foremost of the Member States, their airspace and their territorial waters. The Member States are:

- Austria
- Belgium
- Bulgaria*
- Cyprus
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Ireland
- Italy
- Latvia
- Lithuania
- Luxembourg
- Malta
- Netherlands
- Poland
- Portugal
- Romania*
- Slovakia
- Slovenia
- Spain
- Sweden
- United Kingdom

* This country is a state member since 2007; special measures could be applied to it.
5.8 ANNEX H: SPECIAL CONDITIONS

In case of export of Community goods to an EFTA country or to a non-EU via the territory of an EFTA country, the external customs transit procedure may be if the following conditions are satisfied:

- The party exporting the goods has fulfilled all the customs formalities required for the grant of export refunds under the common agricultural policy.
- The goods originate from intervention stocks and are subject to measures to verify the use and the destination. The customs formalities upon export to non-EU countries under the common agricultural policy have been fulfilled in respect of the goods.
- The goods will eligible for a refund or waiver of the import duties when they are re-exported from the EU customs territory.
- The goods are exported pursuant to the inward processing procedure, in order to obtain a refund or waiver of the import duties that were suspended on account of this procedure.
5.9 ANNEX I: EFTA COUNTRIES

There are four EFTA countries:
  - Norway
  - Iceland
  - Switzerland
  - Liechtenstein
5.10 ANNEX J: TARIFF COMPARISON BETWEEN ROAD AND INLAND WATERWAY TRANSPORT

The aim of this annexe is to show the differences between the prices of transporting a container from the DIT, 50 km far from Maasvlakte to other different destinations by truck or by barge.

It should be mentioned that all these tariffs were seek advice from different transport companies for a 20 feet standard container. The tariffs are:

<table>
<thead>
<tr>
<th>Destination</th>
<th>Road Transport</th>
<th>Inland Waterway Transport</th>
<th>Subtraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIT-Antwerp</td>
<td>250 €/TEU</td>
<td>204 €/TEU</td>
<td>46 €/TEU</td>
</tr>
<tr>
<td>DIT-Duisburg</td>
<td>343 €/TEU</td>
<td>217 €/TEU</td>
<td>126 €/TEU</td>
</tr>
<tr>
<td>DIT-Strasbourg</td>
<td>954 €/TEU</td>
<td>293 €/TEU</td>
<td>661 €/TEU</td>
</tr>
</tbody>
</table>

*Table J-1: Tariffs from the DIT to different destinations by truck and by barge*

For calculating these tariffs it was accepted a Bunker Adjustment Factor of 183 Euro per TEU, corresponding to February 2007.

As it is shown in the table J-1, the difference between both means of transport is favourable to the barge even for a distance like between the DIT and Antwerp. This difference becomes a huge amount of money when the terminals are more separated.
6 REFERENCES

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