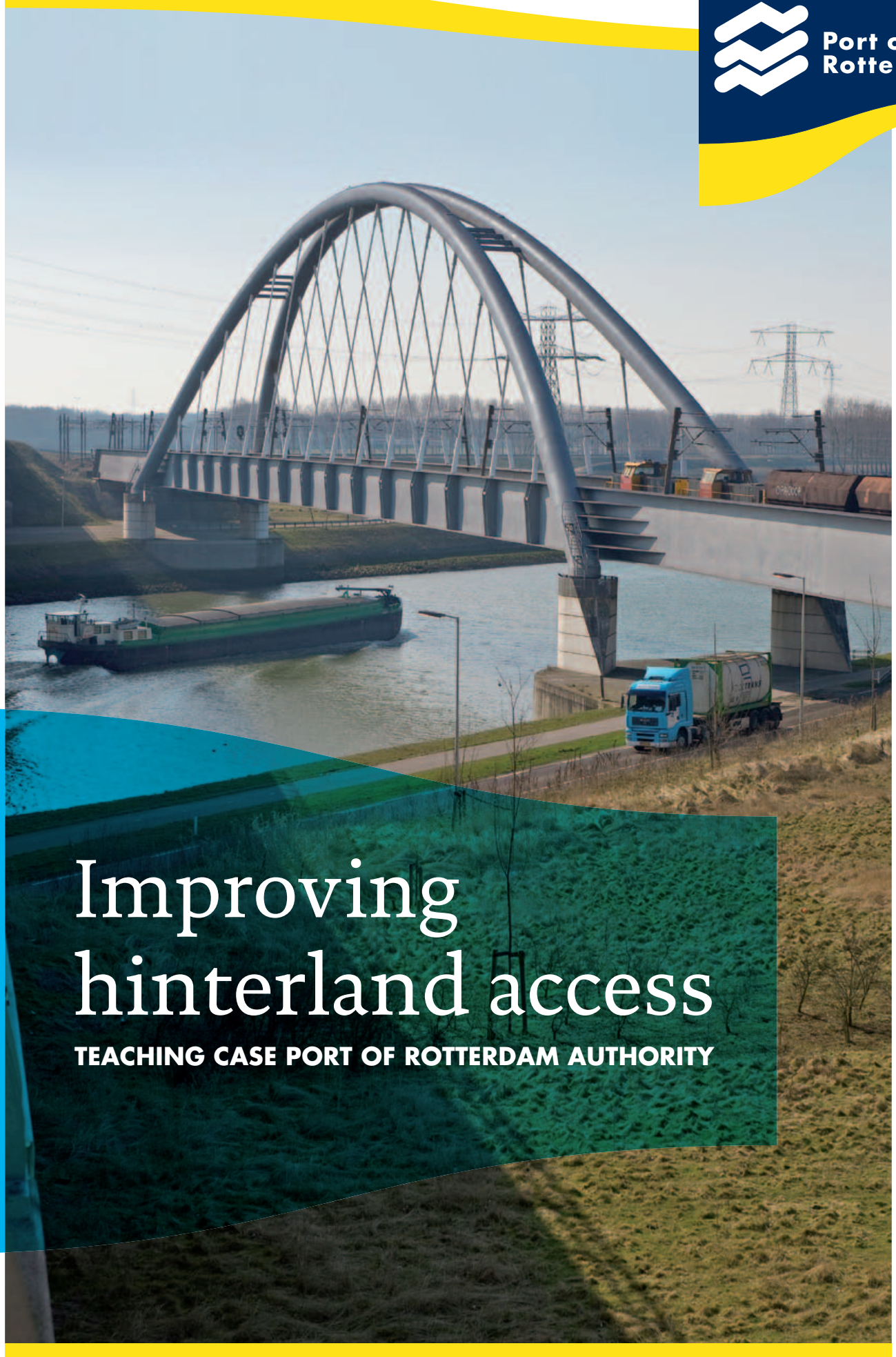
Port of Rotterdam



# Improving hinterland access

## TEACHING CASE PORT OF ROTTERDAM AUTHORITY

# Introduction

**Ports are important parts of international supply chains. Ports compete to attract transport flows, and aim to provide efficient, sustainable, safe, secure and well priced services. The 'port product' is not provided by one company, but by a variety of companies together, including terminal operating companies, pilotage companies, hinterland transport companies and the port authority. The port authority has a special position: it generally does not provide transport services but focuses on port planning and development. Furthermore, it generally is a not-for-profit organisation that aims to enhance the competitiveness of the port as a whole.**

**Port of Rotterdam Authority is an example. It manages the port of Rotterdam, Europe's largest port complex. Throughput volumes have grown from roughly 300 mln ton per year in 1997 to more than 430 mln ton in 2010. This growth is for a substantial part due to a huge growth of container volumes, not only in Rotterdam, but worldwide.**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# Port of Rotterdam Authority


Port of Rotterdam Authority (PoR for short) positions itself as a 'port developer' with an active involvement in the port. In 2004, the institutional position of PoR has changed from a municipal department to a public corporation. The management (Executive Board) of PoR is no longer controlled directly by the municipality but by a Supervisory Board. Supervisory board members have experience in managing (public) corporations, especially in transport and energy industries. The shareholders (the municipality of Rotterdam and the national government) have a formal influence at the annual shareholders meeting. The organization chart is given in appendix 1, a broad overview of the performance of PoR since corporatisation in 2004 is given in appendix 2.

The core activity of PoR is to develop the port area and lease sites in port of Rotterdam to companies, often multinationals, such as Shell, Exxon, Vopak, BASF, Hutchinson Port Holdings (HPH) and APMT. From 2001-2007 (last year for which data are available), private companies in the port have invested roughly €1.5 billion per year in the port area. These investments (terminal equipment, new plants, expansion of terminals and storage facilities, and so on) are crucial for the long term competitiveness of the port. PoR has two principal revenue streams: port dues and land rents. Port dues are charged to ship-owners of all ships that visit Rotterdam's port. The port dues are publicly available tariffs, and mainly related to the size of the ship. Land rents are paid by tenants. Virtually all port land is owned by the municipality of Rotterdam that leases the land to PoR, which in turn leases the land, in different plots, to companies. These lease contracts generally are for long periods (30-50 years) and specify the annual land rents.
Over the least decade, PoR has invested around €150 million in the port. The major investments of PoR are in public (around 30 to 40%) and user specific infrastructure (around 60 to 70%). PoR investments in public infrastructure are mainly in roads in the port area and (depth of the) port basins. Examples of user specific infrastructure investments include quay walls and jetties. Investments in user specific infrastructure are based on a business case; the revenues (land and port dues resulting from the investments) have to outweight costs.

As a second core activity, PoR acts as harbour master in the port and has a large harbour master department with activities such as vessel traffic management and ship inspections. For this purpose PoR has a small fleet of vessels that operate 24/7 in the port.
The port authority invests substantially in activities that have benefits for the port community. Examples of such investments include ICT infrastructure (through the establishment of Portbase, a subsidiary of the port authorities of Rotterdam and Amsterdam), port marketing and promotion and port related training and education. Some key figures of Rotterdam's port and PoR are provided in table 1.

**TABLE 1:** SOME KEY FIGURES OF ROTTERDAM AND PORT OF ROTTERDAM AUTHORITY

**Port of Rotterdam Authority (2010)**

| | | | |
|---|---|---|---|
| Total revenues PoR | € 551 mln. | Total investments | € 445 mln. |
| - Of which port dues | € 288 mln. | Net result | € 154 mln. |
| - Of which land rents | € 249 mln. | Employees PoR | 1224 |



**Port of Rotterdam (2010)**

| | |
|---|---|
| Size of total port areas | Ca. 10.500 hectares |
| (incl. port basins roads, rail etc) | (roughly equivalent to an area of 10km by 10km) |
| Of which commercial plots | Ca. 5.000 hectares |
| Market share HLH range, all commodities | 36.8% |
| Market share HLH range, containers | 28.0% |
| Ship visits (excluding barge traffic) | 33,352 |

*Source: Port of Rotterdam, 2011*

Table 1 shows that PoR has a solid net result. The amount of invested capital (over € 3 bln.) is substantial. The 'return of capital' is in line with the goal of roughly around 7-8.5%. PoR does not aim to maximise profits, but sufficient return is required to finance new investments in the port. In 2010 (see above), investments were higher than the free cash flow, so new loans were required. These are only given if PoR can show it makes sufficient profits to pay-off debts. The investments were 445 mln, including investments in the second Maasvlakte, a major port expansion project (see next section).

# Port expansion in Rotterdam: Maasvlakte 2

The existing port and industrial area is not sufficiently large to accommodate the forecasted transport volumes and economic activities. Since 2007, large sites are no longer available. Expansion is essential to continue to meet the rising demand for cargo transport and to maintain the leading role in North West Europe. That is why PoR invests in Maasvlakte 2. After years of planning and approval procedures, construction has started in 2008 and according to planning, the first containers can be handled at Maasvlakte 2 in 2013.


*Figure A: An overview of Maasvlakte 2*

Maasvlakte 2 will be a direct extension of the existing Maasvlakte. The total area is approximately 2,000 hectares, of which roughly 1,000 for commercial use (the rest public infrastructure, docks and the sea defense structure). Expected economic activities include container terminals, chemicals and energy, tank storage and distribution (see figure A). Projections, even though are always subject to changes due to unforeseen circumstances, suggest the container throughput in Rotterdam may grow to as much as 30 million TEU[1] in 2030, from slightly less than 11 million in 2010 (see appendix 3).

## Ports & port competition in North-West Europe

Rotterdam competes with other ports in the Hamburg Le Havre range. All these ports serve North West Europe and compete with each other. A map with the most important ports in this area is given in figure B and the throughput volumes of the large ports in this range are given in table 2 (in sequence of the coastline from North to South).

**FIGURE B:** THE 10 LARGEST PORTS IN THE HAMBURG LE HAVRE RANGE


1. *Containervolumes are measured in TEUs (Twenty-feet Equivalent Units), a standard size (20*8*8 feet). Most containers are actually forty feet long, so count as 2 TEU.*



**TABLE 2:** THROUGHPUT VOLUMES 2010 HAMBURG – LE HAVRE RANGE (GROSS WEIGHT X 1 MILLION METRIC TONS)

| Port | Dry bulk | Liquid bulk | Containers | Others | Total |
|---|---|---|---|---|---|
| Hamburg | 26.1 | 14.1 | 78.4 | 2.6 | **121.2** |
| Bremen | 7.8 | 1.4 | 51.6 | 7.9 | **68.7** |
| Wilhelmshaven | 3.0 | 22.6 | 0.0 | 0.0 | **25.6** |
| Amsterdam | 46.8 | 37.4 | 0.8 | 5.7 | **90.7** |
| Rotterdam | 84.6 | 209.4 | 112.3 | 23.7 | **430.0** |
| Zeeland Seaports | 11.8 | 11.9 | 0.2 | 9.0 | **32.9** |
| Antwerp | 19.8 | 41.0 | 102.5 | 14.8 | **178.1** |
| Ghent | 17.7 | 4.2 | 0.6 | 4.7 | **27.2** |
| Zeebrugge | 1.7 | 8.0 | 26.4 | 13.5 | **49.6** |
| Dunkirk | 22.7 | 5.6 | 1.7 | 12.8 | **42.8** |
| Le Havre | 3.4 | 42.4 | 23.0 | 1.4 | **70.2** |
| Total | **245.4** | **398.0** | **397.5** | **96.1** | **1.137** |

*Source: Port of Rotterdam 2011*

Table 2 shows that Rotterdam is market leader for liquid and dry bulk. The large market shares of Rotterdam for dry and liquid bulk are mainly explained by two factors. First, because of the large draft (depth of entrance channels and port basins) and open access to the sea (no locks), Rotterdam can accommodate the largest bulk tankers. This is not the case in Hamburg and Antwerp (draft problems for the largest bulk vessels) and Ghent and Amsterdam (behind a lock that the largest bulk vessels cannot pass).
Second, Rotterdam offers cheap transport possibilities to sites of 'bulk consuming industries' (oil refining for crude oil, the petrochemical industry for mineral oil products, steel production for iron ore and energy production for coal). Most of these industries receive goods by river and/or pipeline. Pipeline infrastructure connects Rotterdam to the main oil refineries in North West Europe. Dry bulk (especially coal and iron ore) is mostly shipped by barge to inland destinations. This gives the 'ARA ports' (Amsterdam, Rotterdam, Antwerp), that are well connected to the river Rhine, a competitive advantage over German and French ports. As most large users of bulk commodities have stakes in bulk terminals in seaports, bulk flows do not often switch between ports and hinterland transport is organised efficiently, often by vertically integrated manufacturing companies. Competition between ports is fiercest in the container segment, partially because of the growth potential in this market.

**The container market**

Between 1995 and 2005, Rotterdam has lost market share in the container market, especially to Antwerp and Hamburg (see table 3 and 4). Hamburg has grown rapidly because of its good rail connections, its proximity to Eastern Europe, where traffic growth has been relatively high, and the position of Hamburg as a large transhipment port for cargo destined to Scandinavia and the Baltic. Antwerp has grown because it's competitively priced and productive terminals and strong presence of forwarders.

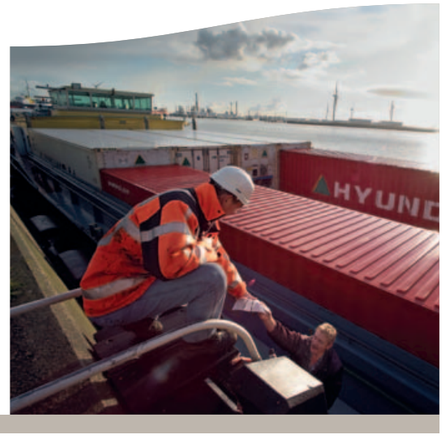





**TABLE 3:** DEVELOPMENT OF CONTAINER VOLUMES IN THE HLH RANGE (TEU'S X 1.000)

| Port | 1990 | 1995 | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|
| Hamburg | 1,969 | 2,890 | 4,248 | 8,088 | 7,896 |
| Bremen | 1,198 | 1,524 | 2,737 | 3,735 | 4,888 |
| Wilhelmshaven | 0 | 0 | 29 | 3 | 0 |
| Amsterdam | 64 | 91 | 53 | 65 | 60 |
| Rotterdam | 3,666 | 4,787 | 6,290 | 9,288 | 11,145 |
| Zeeland Seaports | 0 | 0 | 0 | 40 | 22 |
| Antwerp | 1,549 | 2,329 | 4,082 | 6,488 | 8,468 |
| Ghent | 10 | 6 | 10 | 30 | 83 |
| Zeebrugge | 334 | 528 | 965 | 1,408 | 2,500 |
| Dunkirk | 71 | 71 | 148 | 204 | 200 |
| Le Havre | 860 | 970 | 1,464 | 2,058 | 2,356 |
| **Total** | **9,721** | **13,196** | **20,026** | **31,407** | **37,618** |

*Source: Port of Rotterdam 2011*

**TABLE 4:** DEVELOPMENT OF MARKET SHARES OF CONTAINER THROUGHPUT IN THE HLH RANGE (IN %)

| Port | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|
| Hamburg | 21.9 | 21.2 | 25.8 | 25.8 | 25.3 | 24.3 | 20.8 | 21.0 |
| Bremen | 11.5 | 13.7 | 11.9 | 13.0 | 12.6 | 13.8 | 13.6 | 13.0 |
| Amsterdam | 0.7 | 0.3 | 0.2 | 0.9 | 1.0 | 1.1 | 0.6 | 0.2 |
| Rotterdam | 36.3 | 31.4 | 29.6 | 28.1 | 27.6 | 26.9 | 28.9 | 29.6 |
| Antwerp | 17.6 | 20.4 | 20.7 | 20.4 | 20.9 | 21.6 | 21.7 | 22.5 |
| Ghent | 0.0 | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| Zeebrugge | 4.0 | 4.8 | 4.5 | 4.8 | 5.2 | 5.5 | 6.9 | 6.6 |
| Dunkirk | 0.5 | 0.7 | 0.6 | 0.6 | 0.5 | 0.5 | 0.6 | 0.5 |
| Le Havre | 7.4 | 7.3 | 6.6 | 6.2 | 6.7 | 6.1 | 6.6 | 6.3 |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

*Source: Port of Rotterdam 2011*

Rotterdam has suffered from capacity shortages and a lack of intra-port competition. Both shortcomings can be overcome once the port expansion project, Maasvlakte 2, becomes operational.

## Hinterland transport

Three different kinds of container flows can be distinguished: transhipment flows (containers that move in Rotterdam between a deepsea vessel (mainly to/from Asia) and a feeder vessel (mainly to/from smaller ports in Ireland, the North of UK and ports in the Baltic sea), shortsea flows (between European ports and Rotterdam) and 'direct deepsea' flows. These direct deepsea flows are between a port outside Europe and Rotterdam's hinterland. The Shortsea flows are around 1.6 million TEU, and the transhipment flows amount to around 3 mln. TEU, keeping in mind that containers are counted twice in container statistics (so the number of containers transhipped in Rotterdam is 1.5 mln TEU). The largest part of the containers handled in Rotterdam, around 6.7 mln TEU are 'direct deepsea flows'. Some of these containers are opened in distribution centers in the port area, but the vast majority is destined to the hinterland, both in the Netherlands and in countries such as Germany, Austria and Belgium.

A distinction can be made between captive and contestable hinterlands. All regions where one port has a substantial competitive advantage because of lower generalized transport costs to these regions belong to the captive hinterland of this port. Contestable hinterlands consist of all those regions where there is no single port with a clear cost advantage over competing ports. As a consequence, various ports have a share of the market. Various factors other than distance influence the level of 'generalised transport costs' to locations in the hinterland, such as quality of infrastructure, frequency of services and natural or political barriers (e.g. borders). Figure C shows that a large part of Europe is a contestable hinterland: various ports compete for cargo to/from this area. For Rotterdam, important contestable markets include the Ruhr area, South Germany, Austria, Switzerland and the Czech Republic.

**FIGURE C:** CONTESTABLE HINTERLAND IN EUROPE




## Hinterland transport modes and modal split

Containers move from the port to hinterland destinations with three transport modes: road transport, rail transport and inland waterway transport. Some important characteristics of these hinterland transport modes are given in table 5 and discussed below.

**TABLE 5:** CHARACTERISTICS OF TRANSPORT MODES THAT SERVE THE HINTERLAND OF SEAPORTS

| Hinterland modes | Size | Speed | Market position | Environmental & societal acceptance |
|---|---|---|---|---|
| Inland shipping | Depending on the characteristics of the river, in Europe, inland barges can have a capacity of up to 3,000 DWT*, or about 600 TEU. | About 15/20 km/h | Attractive in case of huge transport volumes of non time critical cargo, if the destination can be reached by river. | Environmentally friendly (even though engines are not very clean) and well accepted. |
| Road | About 15-25 ton or 2 TEU per truck | About 50-70 km/h | Attractive for door to door distribution of cargo in the immediate hinterland (roughly within 300 km) of the port. | Environmentally unfriendly and not well accepted due to road congestion |
| Rail | About 60 wagons/ 120 TEU | About 25-40 km/h | Attractive for long distance transport, if speed, frequency and reliability criteria are met. | Environmentally friendly and accepted unless freight trains move through urban areas. |
| Pipeline | Capacity of millions of tons/year | - | Dedicated for oil and huge flows of chemicals | Very environmentally friendly and accepted |

* = deadweight tonnage

**Inland shipping**

Inland shipping is only relevant for those ports that are connected by waterway to the hinterland. In Europe, inland shipping is very large on the Rhine, and to a much lesser extent on the Elbe and Seine. Appendix 4 provides estimates of container volumes of the ports in North West Europe. Inland shipping is used for containers, but due to the fact that containers generally are more time critical than bulk, in the container market, inland shipping faces competition from road and rail.

**Road transport**

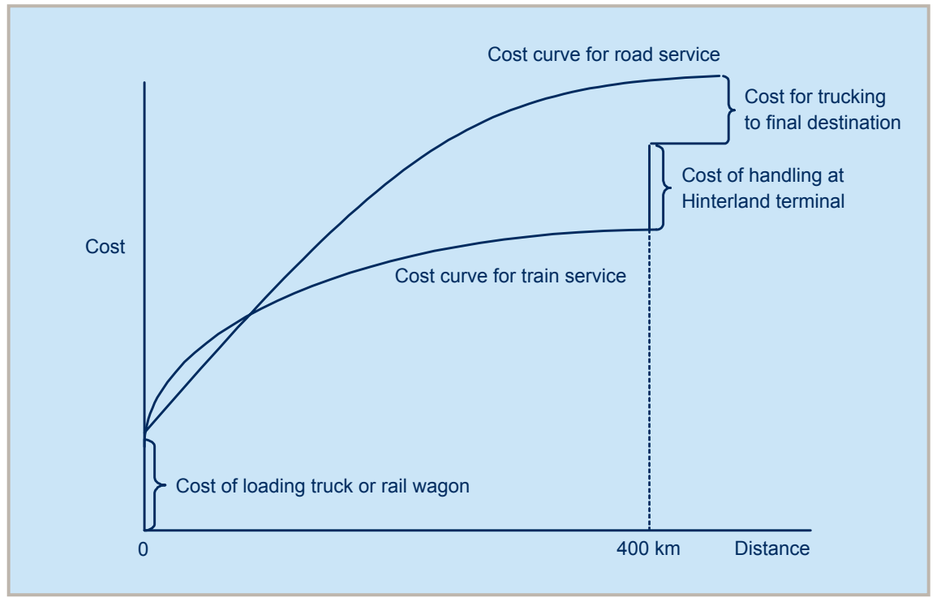
In most ports, road transport is the most important transport mode to the hinterland. The advantages of road transport are its flexibility and the fact that all destinations can be reached. The major disadvantage of road transport is the fact that there are hardly any scale economies involved. Trucks are relatively small.

Furthermore, due to the fact that most trucking companies have a similar arrival pattern, congestion in and around the port frequently arises. Due to the fact that trucking is relatively environmentally unfriendly and leads to congestion, in most port regions efforts are made to shift cargo from the road to other hinterland transport modes.

**Rail transport**

Most ports are connected to the hinterland with railways. Railways are especially competitive for serving a distant hinterland (e.g. more than 200 km from the port). Figure D shows in stylised form the competitive position of rail compared to road for destinations with a different distance from the port [2].

**FIGURE D:** COSTS STRUCTURES OF ROAD AND RAIL SERVICES




*2. In this figure, it is assumed that the costs of loading in the port are the same for both modes of transport. The figure shows that average rail costs diminish substantially when the distance increases, while average road costs per km. only decrease to a limited extend. This is explained because once a train is running, additional costs are low, while the vast majority of trucking costs are variable (e.g. labour and fuel). In the figure, the 'break even point' is reached by 400km. This is arbitrarily chosen and depends on a variety of issues such as volumes, infrastructure charges for rail & road, balance between import & export cargo, and so on.*



**Modal split**

With regard to hinterland transport, the term ‘modal split’ is important: it indicates the share of different hinterland modes as a percentage of the total hinterland transport volume. Table 6 shows the modal split for containers in Rotterdam, Antwerp & Hamburg.

**TABLE 6:** MODAL SPLIT FOR CONTAINERS IN 3 LARGE EUROPEAN PORTS 2010

| Port | Share rail | Share Road | Share barge |
|---|---|---|---|
| Rotterdam | 10 | 57 | 33 |
| Antwerp | 10 | 56 | 34 |
| Hamburg | 36 | 62 | 2 |

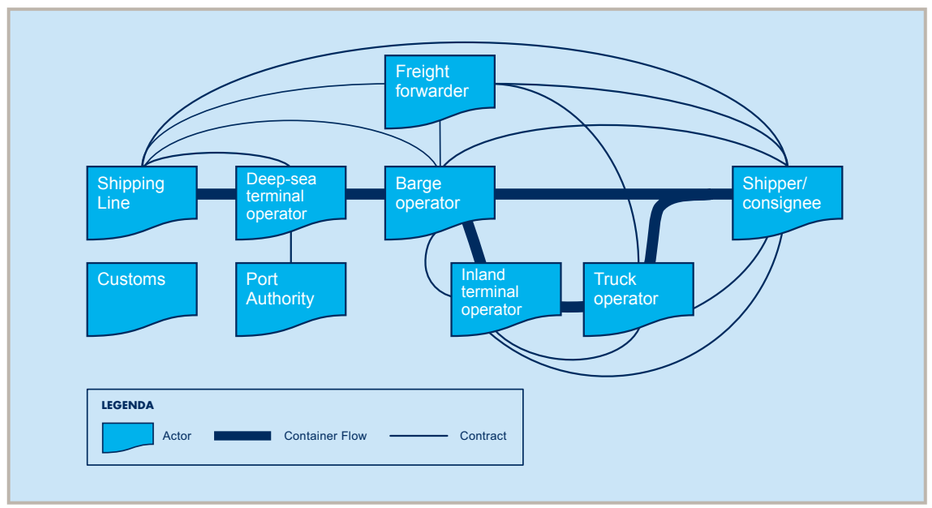
*Source: Port of Rotterdam (2011), Port of Antwerp (2011) and Port of Hamburg (2011)*

Inland shipping has a relatively large share in Rotterdam and Antwerp, because the good access to the Rhine. Road is the dominant mode for containers, because of its high flexibility and because the majority of containers is destined within 200 km from the port. Hamburg is clearly a ‘rail port’.

## Firms in intermodal supply chains

A variety of firms are active in the hinterland transport chain. Figure E shows a stylized barge hinterland chain, and the various actors in that chain. In reality, the distinctions between these companies are not so clear cut: some of them pursue policies of vertical integration and thus become active in various parts of the chain (e.g. a terminal operator that also operates an inland terminal).

**FIGURE E:** AN OVERVIEW OF THE BARGE HINTERLAND TRANSPORT CHAIN




*Source: Douma (2008), adapted from Van der Horst and de Langen (2008).*



- **Shipper or Consignee:** In the container shipping supply chain, the shipper or consignee is the most important player, since it is the end-customer. Smaller shippers tend to let a freight forwarder handle their shipments, larger shippers have direct contracts with several transport operators.

- **The Port Authority:** The port authority is responsible for leasing sites to port-related businesses and for efficient and safe vessel traffic in the port. Next to that, the port authority invests in port infrastructure other port facilities.

- **The Container Shipping Line:** The container shipping line is responsible for shipping the container for a specific shipper from one port to the other. Shipping lines increasingly offer the shipper comprehensive door-to-door services and integrated logistic packages.

- **The Deepsea Terminal Operator:** The terminal operator in the port is in charge of all terminal handling activities. It is in control of the loading/unloading of seagoing vessels, but also for moving containers from the stack to inland transport modes (truck, barge and rail). Next to terminals in the port, also inland terminals exist. These terminals handle the container flow carried by barges via inland waterways and handle trucks for the last part of transportation between the terminal and the shipper/consignee.

- **Freight Forwarder:** The freight forwarder is an external logistics provider. They provide integrated logistic packages to shippers. The freight forwarder is responsible for the door-to-door delivery of a container. Generally, the freight forwarder does not own any ships, terminals, trains or trucks, but acts as an agent between the shipper and transport operators.

- **Barge Operator:** The barge operator is responsible for the transport of containers using inland waterways. Barge operators use ‘small’ vessels to transport containers from the port terminals to inland terminals. These companies do usually not own barges themselves, but contract barge companies, which do own barges and operate them.

- **Trucking companies:** Trucking companies are responsible for transporting the containers by land, using trucks to carry the containers. In many countries, they have become professional service providers with whom the shipping line can out source part or all of its inland distribution operation.

# Assignment

## CHALLENGE OF ACCESSIBILITY

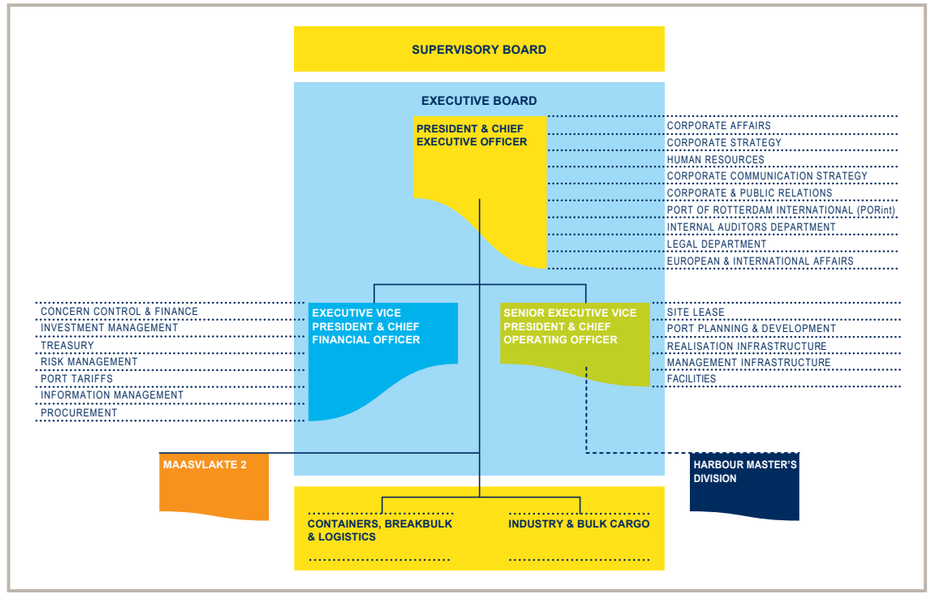
Given the past growth, expected future growth, congestion of roads and increased pressure on the transport sector to move traffic from the road to other, more sustainable, transport modes, hinterland accessibility is one of the main challenges for Rotterdam's port. While there is substantial additional capacity in the inland shipping system, and also additional capacity for rail transport, after completion of the Betuwe Line, a dedicated railroad that connects Port of Rotterdam to the German rail system, the highway infrastructure is congested, and capacity expansion is problematic given lack of space and limited societal support for new highway infrastructure, especially in the densily populated Rotterdam region. Hinterland access has become a crucial 'board room issue' for Port of Rotterdam Authority.

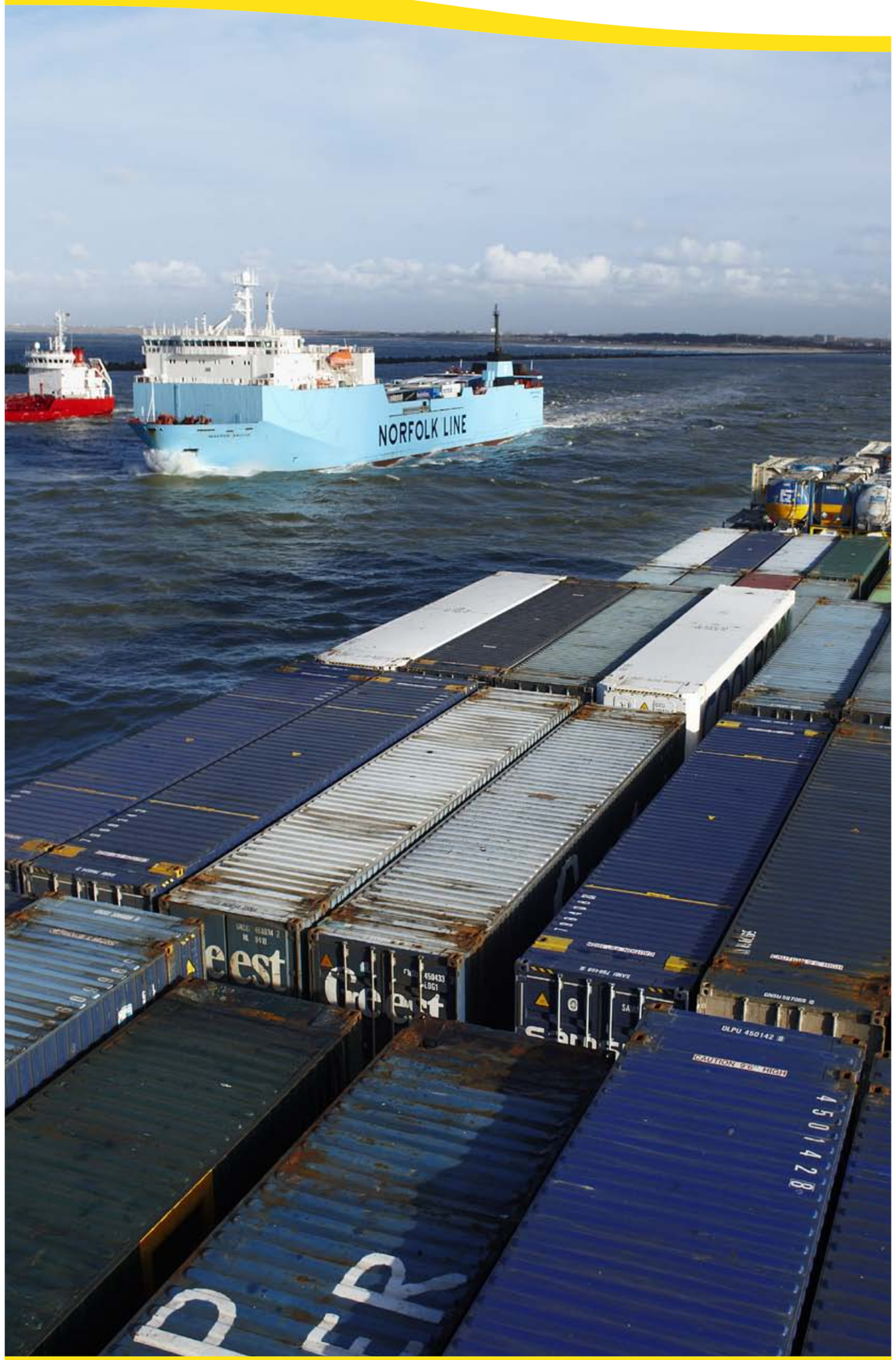
Developing a good strategy to improve hinterland access is not easy, given the fact that the PoR is not involved in port operations and thus has no direct control over -or even influence on- supply chain decisions. Furthermore, other public organisations, such as the public 'infrastructure owners and managers' and national and regional decision makers with regard to investments in infrastructure, as well as private companies, such as shipping lines, terminal operators and shippers deeply influence hinterland accessibility. Given the wide scope of the hinterland access challenge, a clear and well thought out strategy is needed. Thus, a small group of young executives is asked to develop a hinterland strategy, with clear recommendations on how to improve hinterland access. They are asked to give a short and to-the-point presentation of their analysis and strategy recommendations. More specifically are asked to address the following issues:

- **What should be the most important measurable goals (maximum 3) of PoR with regard to hinterland transport?**
- **Develop a longlist of activities PoR could engage in to improve hinterland access and develop a schematic overview of these possible initiatives of PoR to improve hinterland access. Analyse 'mode selection processes' as well as 'port selection processes' to identify possible initiatives. When developing this longlist, analyse specifically the possibility of concession clauses for terminal operators as well as incentives in port dues that favour intermodal transport.**
- **Make an argumented choice for maximum five initiatives that should be top priority for PoR to improve hinterland access. Make explicit what criteria you have used to select these initiatives, in relation to the goals identified in question one. Indicate how these initiatives are aligned with activities of different companies in the transport chain (such as terminal operators and shipping lines) and discuss to what extent and how a positive business case (e.g. sufficient return on investment) for these initiatives can be developed.**



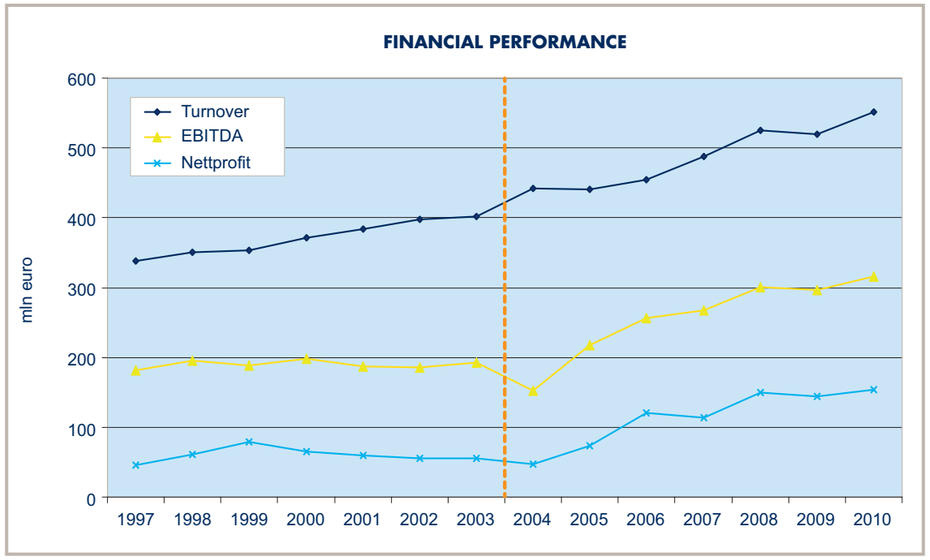
## APPENDIX 1: ORGANISATION CHART PORT OF ROTTERDAM

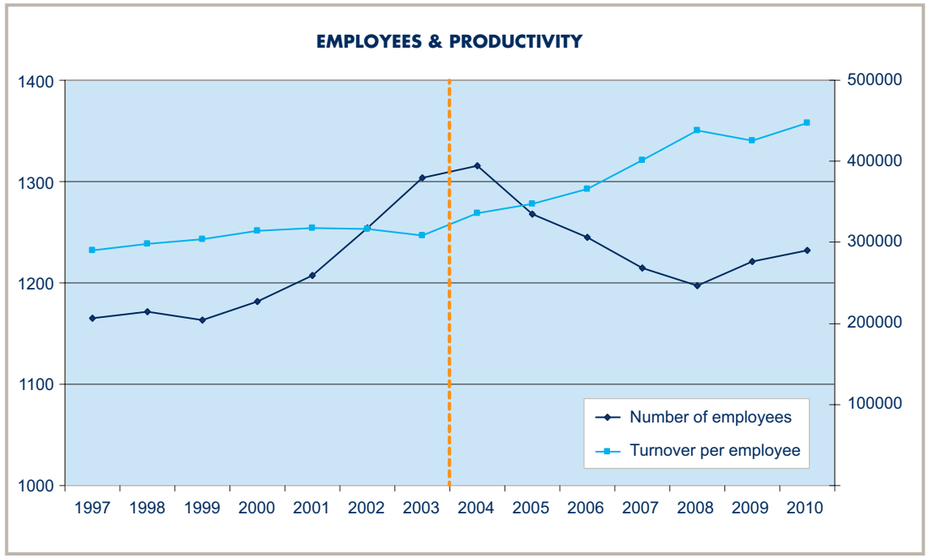







**APPENDIX 2:** SOME PERFORMANCE INDICATORS PORT OF ROTTERDAM AUTHORITY (WITH CORPORATISATION IN 2004 INDICATED BY DOTTED ORANGE LINE)



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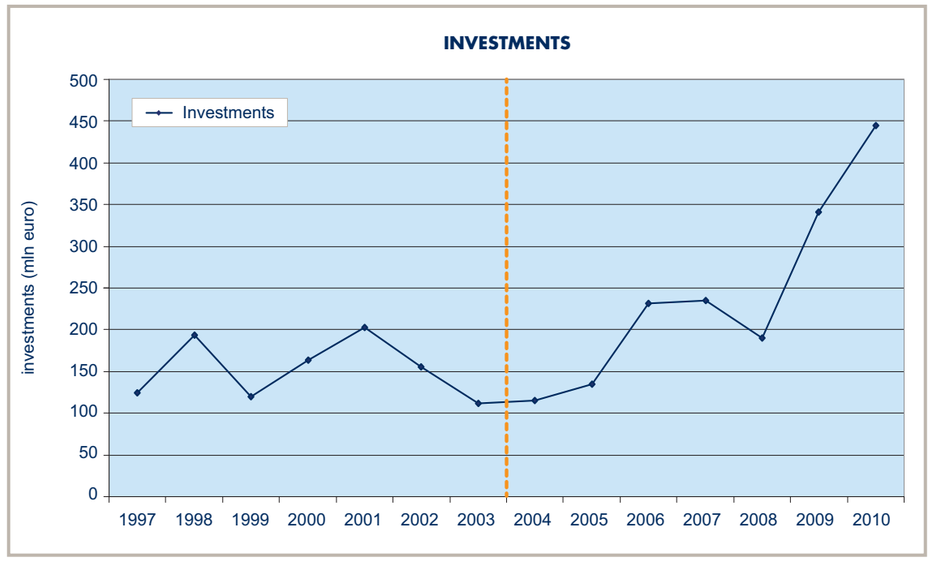
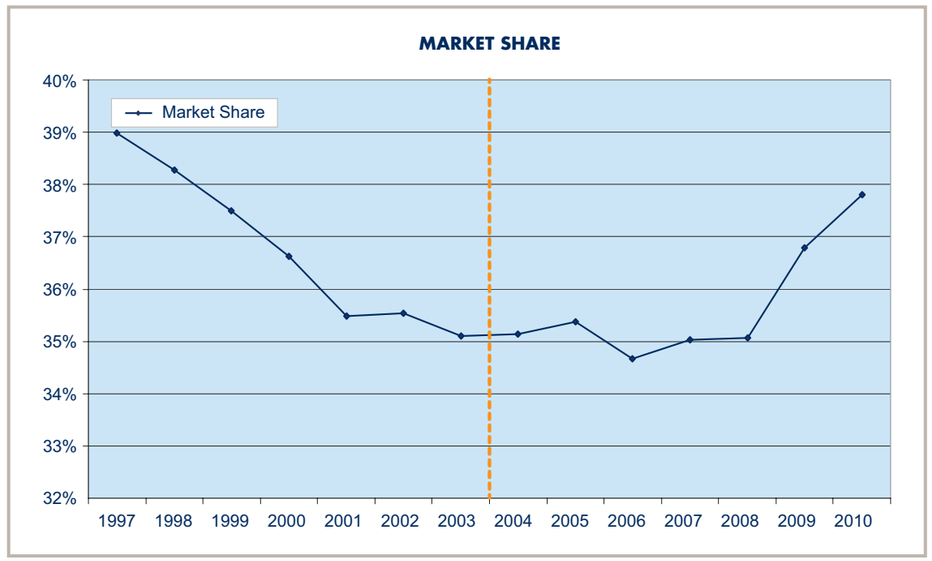
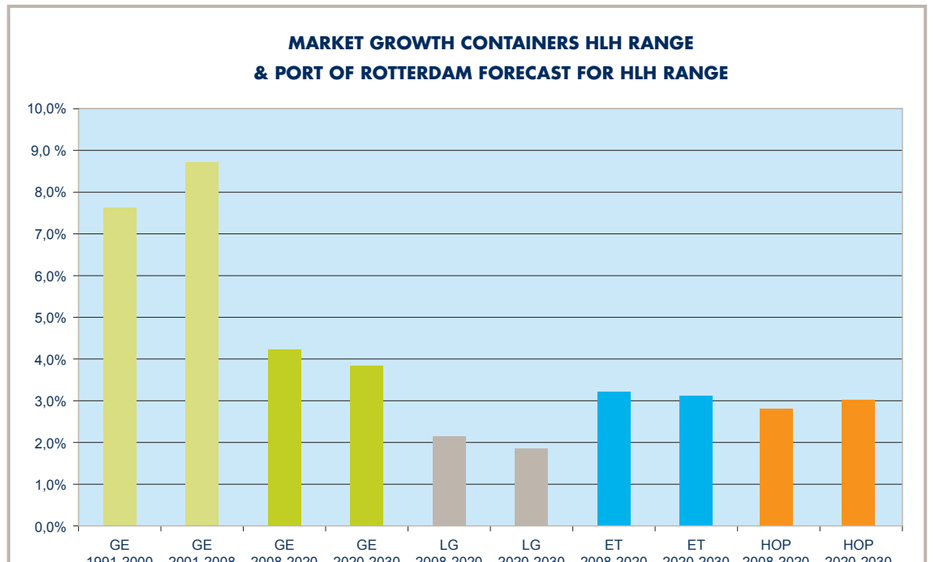





**APPENDIX 3:** PORT OF ROTTERDAM FORECAST OF AVERAGE ANNUAL GROWTH OF CONTAINER VOLUMES IN HLH RANGE




*Source: Port of Rotterdam Authority, 2010.*

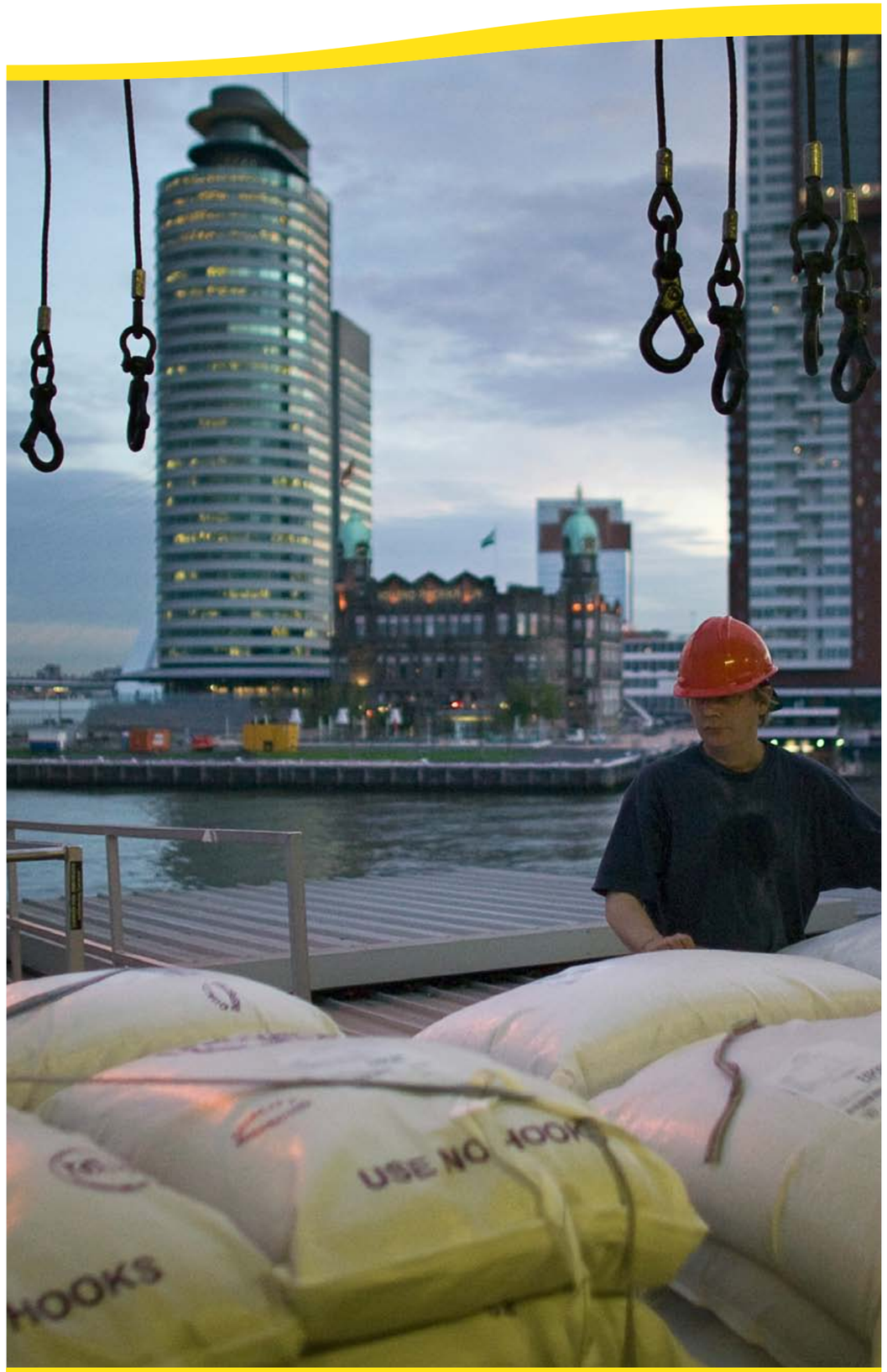
## **APPENDIX 4:** INLAND SHIPPING INFRASTRUCTURE AND CONTAINER VOLUMES IN HLH RANGE


INLAND SHIPPING CONTAINER VOLUMES (IN TEU)

| | |
|---|---|
| **Le Havre** | 159.000 |
| **Zeebrugge** | ca. 30.000 |
| **Antwerp** | 2.200.000 |
| **Rotterdam** | 2.440.000 |
| **Bremerhaven** | 53.500 |
| **Hamburg** | 92.000 |
| **Marseille** | 60.000 |

*Source: Notteboom 2010, available from www.porteconomics.eu*





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