

**LARGE SCALE PORT EXTENSION,  
CRUCIAL IMPACTS AND CHOICES.  
THE CASE OF ROTTERDAM HARBOR AND NATURE  
COMPENSATION, POLICY AND PRACTICE\***

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**ABSTRACT:** Ports live by accessibility, both from the seaside and into the hinterland. How to choose your target group from the seaside is an issue. What is the depth you can handle, and what type of cargo do you want.. But maybe even more important is how to transfer the cargo into the hinterland. The modes of transportation (modal split) are important drivers. Extension of ports often fail due to lack of attention for the potential negative environmental impacts and a way to compensate them. But when these are incorporated in your project straight from the beginning, another discourse will develop. This discourse will be much more balanced, this is exactly what has been done in the case of the new extension of the port of Rotterdam. The Dutch government decided in 2003 to develop a policy which enabled a new harbor extension (called Maasvlakte 2), in order to receive and handle the world's largest containerships, starting from 2015. Maasvlakte 2 (net 1000 ha, which is 20% of the already existing harbor area) was built between 2008-2014 by reclaiming part of the North Sea with foreshore nourishment (365 Mm<sup>3</sup>), and by reuse of seawall blocks. It is expected that the new harbor will be in full operation by 2030. The presentations deal with these aspects. It is explained how the choices and the preparations of the new harbor construction were made, both technically and politically, so that realization of the plan would take place in an efficient, smart and well-timed way. The case of Rotterdam is of importance to mirror with harbor development worldwide to achieve innovative smart solutions in a more sustainable way.

**Keywords:** innovative port development, smart port, environment, sustainable, modal split

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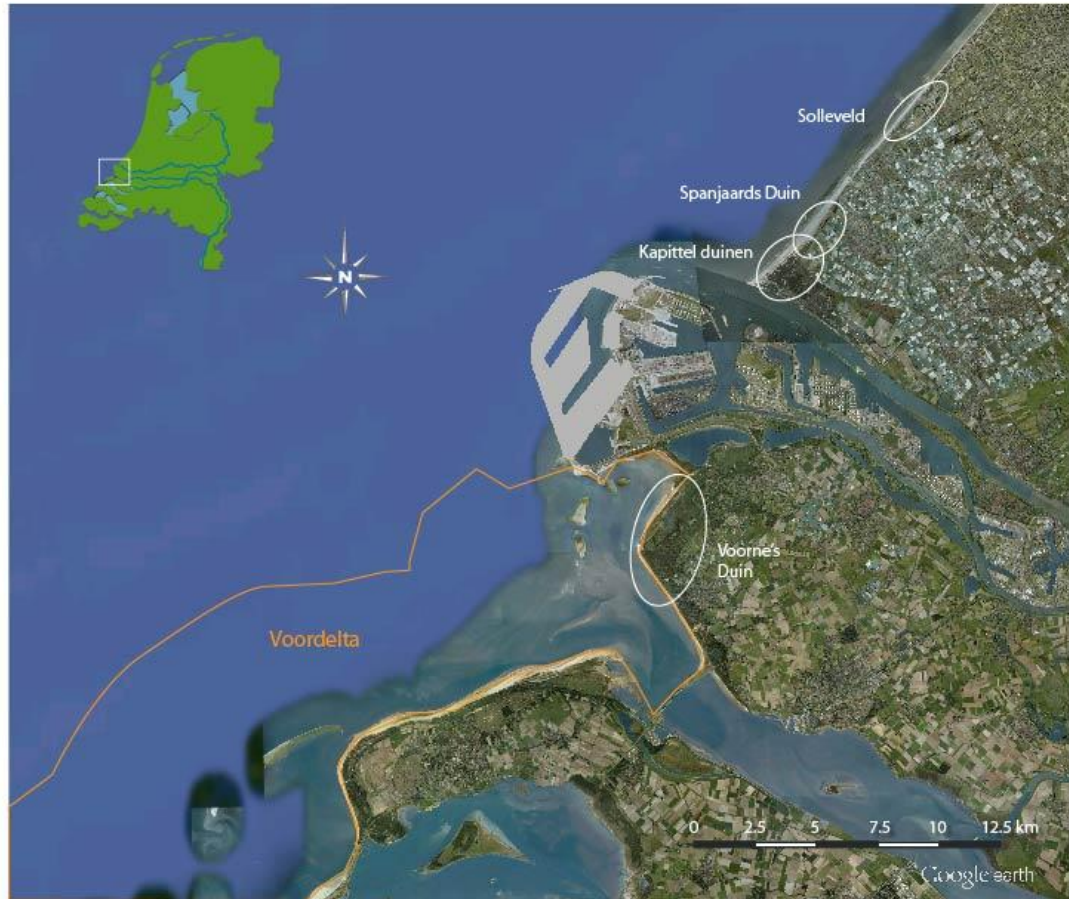


figure 1: *The Netherlands (inset) and part of the south western Delta coast of the North Sea. In the middle – in grey- the new harbour extension (Maasvlakte 2) in outline.*

*The dunes of Voorne's Duin, Kapittelduinen and Solleveld are Natura 2000 areas that will suffer expected environmental damage. Spanjaards Duin is the terrestrial compensation area. In the south is the area (yellow boundaries) where the marine compensation measures are taking place. It is part of the Voordelta, a shallow sea in front of the coast. Image: Google Earth.*

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### **Need and urgency for space needs to be underpinned**

Ports live by accessibility, both from the seaside and into the hinterland. Rotterdam has unrivalled entrance possibilities from the seaside. That's why it is a successful port for centuries. That's also why the port has a sharp increased speed of extension since the mid of the last century. Because the modes of transport have shifted towards more containers, and more accent on energy it became

clear that the port needed further room for extension and picking its share from the growing market worldwide. This process has started in the early nineties of the last century. To maximize the advantage of the accessibility new harbor area needs to have free and direct entrance from the sea and a depth in which the new designed container-giants can be received. With regard to Alexandria: what are your advantages on your rivals? Make them smart and striking.

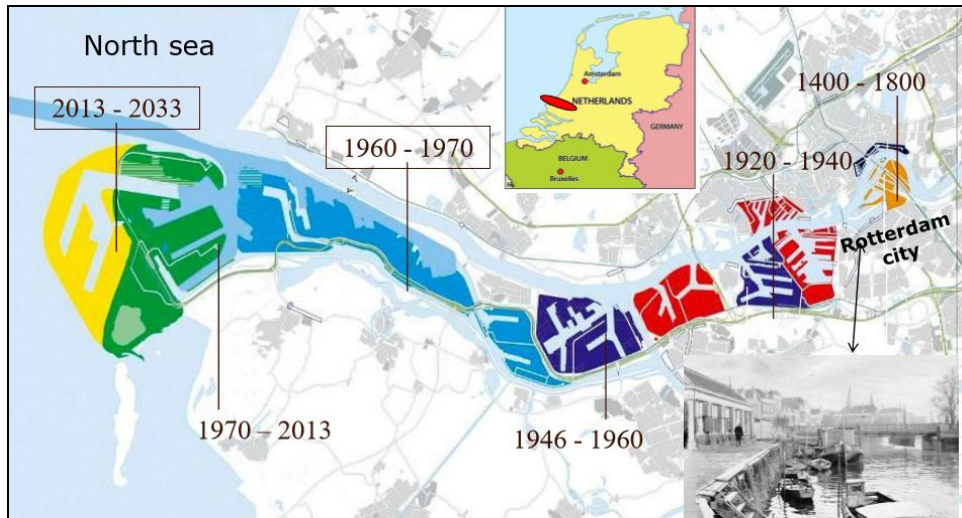


Figure 2: location Maasvlakte 2 and development of industrial area of Rotterdam over time.

The dispatch towards the hinterland is also of crucial importance. Since most harbors are linked to big cities, there is a lot of traffic generated by the citizens and by the industrial sector. To avoid queues all day there is a need for different modes of transport towards the hinterland, the modal split. It is of utmost importance to have different routes and modalities to reach the hinterland. The fastest way is via road, but this is also vulnerable to disturbances. The more possibilities can be offered, the more flexible you are. That's why logistic partners in Rotterdam also have to bid on the modal split, in which they have to decrease transport via roads and increase transport by train and boat. With regard to Alexandria: how can you bring the cargo the fastest to its destination?

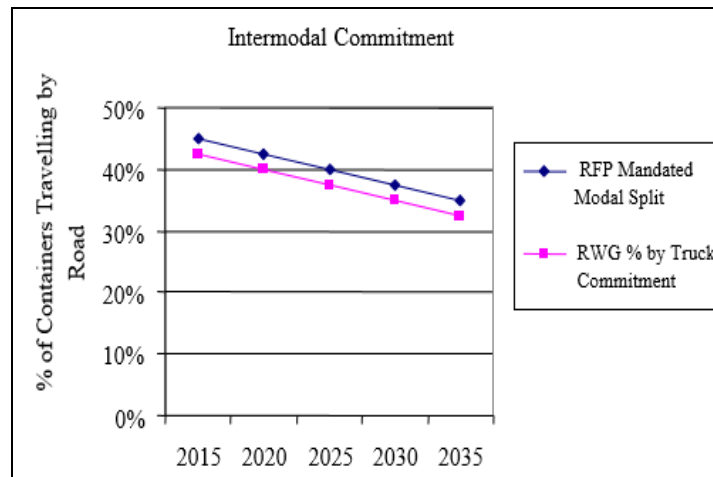


Figure 3: the decreasing percentage of transport by road. Contracted is the lowest level and penalties are set if this is not reached.

Extension of ports often fail due to lack of attention for the potential negative environmental impacts and a way to compensate them. But when these are incorporated in your project straight from the beginning, another discourse will develop. This is exactly what has been done in the case of the new extension of the port of Rotterdam. The Dutch government decided in 2003 to develop a policy which enabled a new harbor extension (called Maasvlakte 2), in order to receive and handle the world's largest containerships, starting from 2015. Maasvlakte 2 (net 1000 ha, which is 20% of the already existing harbor area) was built between 2008-2014 by reclaiming part of the North Sea with foreshore nourishment (365 Mm<sup>3</sup>), and by reuse of seawall blocks. It is expected that the new harbor will be in full operation by 2030. Although this new area was built in a nature protected area (so called Natura2000, which covers the most vulnerable nature habitats and species in the whole EU), it is designed and build without strong opposition of the traditional nature protection organizations. To get this done implies a very thorough underpinning of need and necessity, including the exclusion of alternative locations and full compensation of all possible harm to nature and environment. The way this is approached is illustrative: instead of preparing a plan for harbor extension, a plan is developed with a double goal: both economy and ecology should get a boost from this initiative. And in order to convince the opponents and people or organizations who hesitate: the projects to improve nature started before the construction of the new industrial area. With regard to Alexandria: make a clear scope for your project, in which the balance between economy and ecology is well defined.

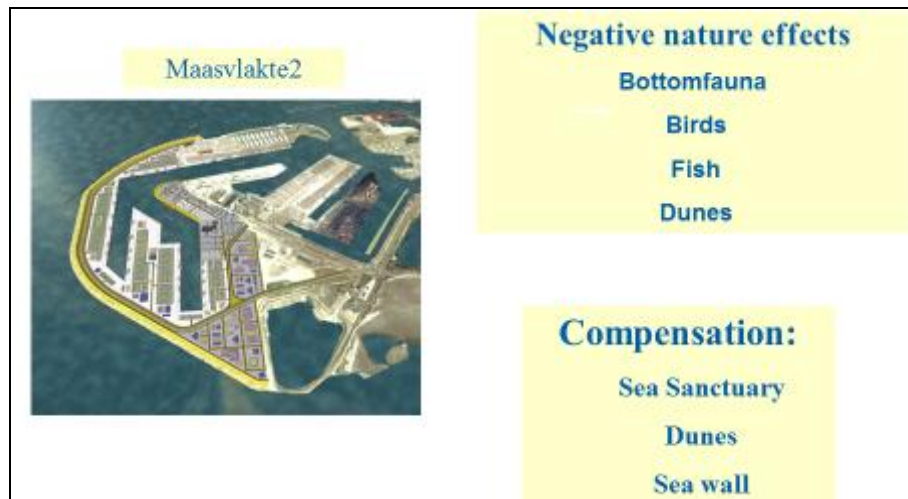


Figure 4: types of negative impacts and possible ways of compensation.

To handle all modes of transport, both coming from the sea and from the hinterland, it is crucial to design a port in which the speed of handling is set on the highest level, and in which storage is minimized. So where inland ships can be loaded directly from the seagoing vessels, handling time will be minimized. Railways also need to start on the container handling terminals, including marshalling-locations and trucks have no waiting time when they have entered the terminal. With this in mind the length of the quays and the structure of the plots can be designed.

### **Optimizations in the Rotterdam concept**

An important factor is the time during which the investment costs are made in relation to the period during which these costs can be reimbursed. The previous extension of the Rotterdam harbor (Maasvlakte) was constructed in the nineteen seventies. It was partly designed in the expectation to house melting furnaces, but none ever appeared there. Moreover, the whole area was built and developed in one time span. This means that in the early years only a part of the investment generated income to the Port Authority. In the case of Maasvlakte2, the sea defense wall at the outside is build first, including the advantage of reduction of sand loss during the execution phase, creating a safe location for building container terminals. The container plots will be filled once the contracts are signed. This means that the industrial area is delivered successively in time, on request and that investments are made shortly before the return on investment starts. The costs for the financier remain relative low and the risks are well controlled. At this moment 40% is sold and

build, which is according to the expectations. This area should be enough until approximately 2030/2035.

The main reduction both in effects and in costs is to minimize the area you need for the expansion. In the case of Rotterdam there is a need for 1000 ha net new industrial area. To create this originally an area of 2500 ha was designed. During optimization sessions this has been reduced to only 2000 ha needed area. Every ha you don't need to build saves sand and infrastructure, does not cost you money and you also don't have to pay for compensation. So this knife cuts on both sides.

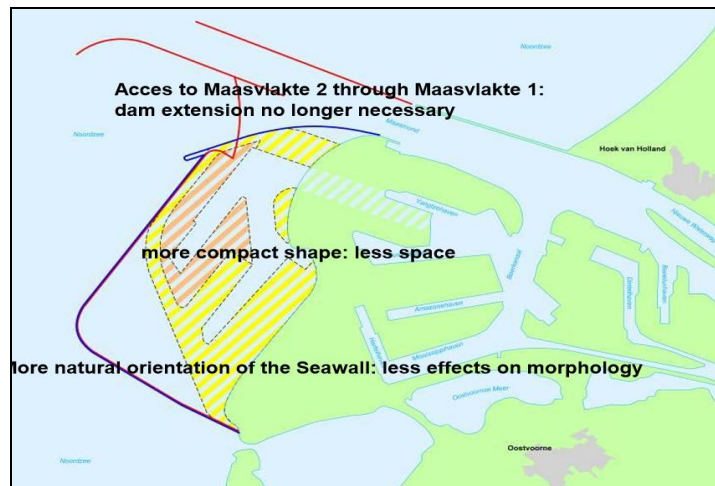


Figure 5: optimization of space and minimization of effects

The purpose of the industrial area is very clear: only harbor bounded deep sea companies are welcomed. Apart from the container sector, the energy sector is also of great importance. Even since the fifties coal transito is of great importance. Due to CO2 emissions this is no longer prevailed. Since the western world is trying to become less dependent of fossil fuels, investments on wind, wave and solar energy are sharply increasing. Many wind turbines can be placed on the sea wall, that has been made as both sea defense wall, shaped as an artificial dune for nature development and for recreational purposes.

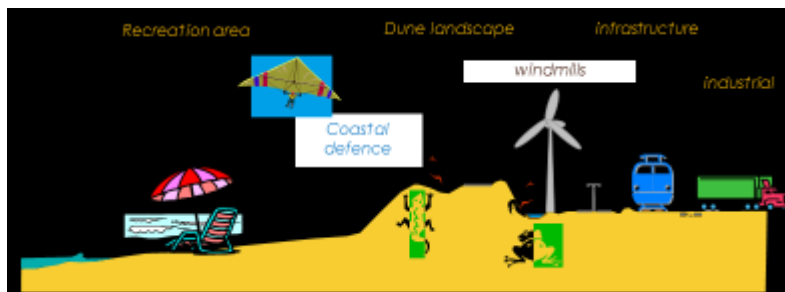


Figure 6: multifunctional sea defence wall.

The inland going shipping uses the rivers and canals. Canals have been extended to become connected with Maasvlakte2, opening the possibilities to load inland vessels directly from the deep sea ships.

The modal split is an important factor in the procedure for clients to get a plot on the new industrial area. There are goals set for reduction of the transport by trucks, which means an increase of transport by train and boat. Every year the truck rate is decreasing. If a client offers an even lower rate of transport by truck, and this is accepted, it also becomes the standard, and penalties are given in case the goal is not reached. This greatly stimulates the innovation and if it is done effective, it also reduces the handling costs.

The entrance of the harbor is also a very important factor. Originally the pilots opted for a new separate entrance to Maasvlakte2. (see reference design 2 in figure 6) This option has serious objections. In this option the jetties are enormous, more than one kilometer on both sides of the entrance channel into the North sea, which make them extra expensive. Large container ships need a long distance to slow down speed and meanwhile they need to have enough power to maneuver correct. The stop length of these big ships makes that they start stopping before they make the curve from the North sea towards the port entrance, which means that they are more difficult to handle. If the entrance of the port is more inland the stop way shifts towards the port, which is an advantage. Therefore the result of the investigations and simulations was to have no new entrance, but to use the existing one, and lesser long jetties, with lesser cost. The difference in costs for the jetties alone was already one billion euros.

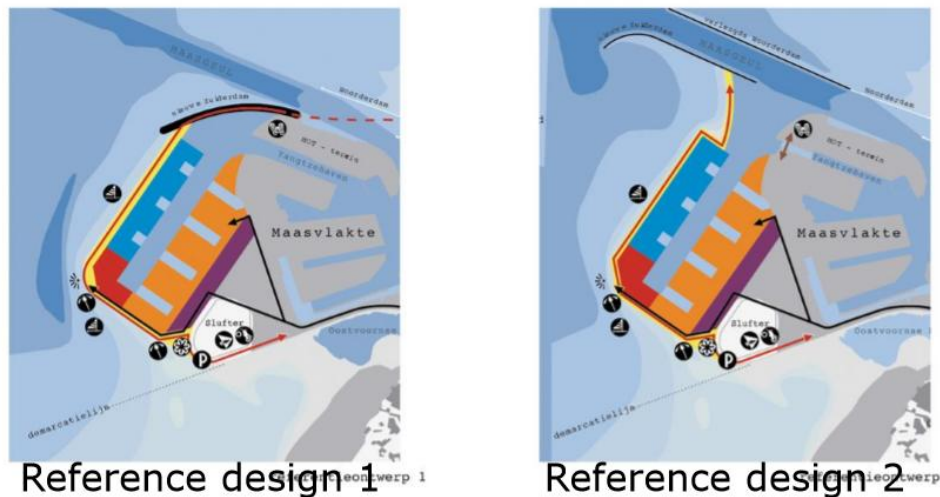


Figure 7: reference design with (no. 2) and without (no. 1) own entrance of the harbor.



Figure 8: simulation of the entrance of Maasvlakte2 by the largest container vessels.

### **Lessons from Rotterdam to Alexandria and harbors worldwide.**

Mirroring Rotterdam to Alexandria brings us the following conclusions for smart port development:

- a. Make a discourse right from the start that is not only focusing on the positive goals of what you want, but also incorporate solutions for the negative effects in your scope. This also means that you have to discuss the basic ideas with the people who live in the region, to incorporate their wishes and demands.
- b. Export the attractiveness of your specific location
- c. Develop a dynamic masterplan, but build only what you need, making adaptation to future developments easy. And before you conclude to change, you should make a new cost-benefit analysis of your masterplan.
- d. Set smart goals for environmental aspects in the future and bind the winning bid to this.
- e. Establish goals for economic and ecological development at the same time, in order to achieve a more sustainable balance before you develop your plan.

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