Holland has always been struggling with water. The Dutch city agglomeration of the Randstad, with about 7 million inhabitants, lies under sea level for a large part, making the area extremely vulnerable for dangers that come with the rising sea level. This issue forms the basis of this graduation project. According to the latest predictions of the Intergovernmental Panel of Climate Change, the average sea level will rise with about 1.2 meters in the coming century. The Dutch government has asked the Delta Committee to give advice about the protection of the Netherlands against these effects of climate change. In the report 'Samen Werken met Water', the Delta Committee advises to strengthen the existing coastal defense by the suppletion of extra sand. The committee states that the coast should be broadened by about 1 kilometer of sand in the coming century. The Dutch sandy coast stretches out for about 60 kilometers. It protects the dense urban area of the Randstad against the North Sea. Since large parts of this area lie under sea level, a failure of the coastal protection would cause a large flood with catastrophic consequences.

In the meantime, the Randstad is constantly developing and forms the beating heart of the Netherlands. In the Randstad Strategic Agenda 'Randstad 2040', the government aims at developing the Randstad into a sustainable and economical top region. One of the strengths that are pointed out in the document is the coastal zone, giving the Randstad a strong identity, with charming seaside resorts, providing unique recreational, residential, economical and ecological qualities. Therefore, the goal of this graduation project is to design a new coastal defense that enhances the strength of the Randstad coastline.

**Coast as a Strength vs. Weakness**

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**Advantages:**
- The breakwater barrier is built-up of sand makes it flexible: on one hand the reef can differ in size, safety and appearance, depending on the particular part of the Randstad coast where it's located. On the other hand, the reef can be adjusted to the need for safety and space through the coming decades.
- The fact that the breakwater barrier is built-up of sand makes it flexible: on one hand the reef can differ in size, safety and appearance, depending on the particular part of the Randstad coast where it's located. On the other hand, the reef can be adjusted to the need for safety and space through the coming decades. The beach barrier will redirect the traffic flows from the town of Katwijk aan Zee to the hinterland. Also, its low geographical position causes pressure from the sea.
- The barrier-concept is designed in more detail for the coastal area of Katwijk aan Zee. The traditional seaside resort of Katwijk aan Zee experiences a lot of pressure from the continuous expanding hinterland. Also, its low geographical position causes pressure from the sea.
- The village will be protected from storm surge waves and the relation of the charming sea experience is not affected.
- The emerged barrier reef offers extra beach capacity.
- The view on an uninterrupted coastline stays untouched.
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**Disadvantages:**
- The changes in the longshore sand transport may cause local accretion and erosion of sand. By regular suppletion of sand, the changes in the coastal morphology can often be simulated in computer models.
- Creating a new reef of sand in an existing dynamic coastal system will have a large impact on the total system. Fortunately, the emerged barrier reef offers extra beach capacity.
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**Katwijk aan Zee**

The village will be protected from storm surge waves and the relation of the charming sea experience is not affected. The village landscape will be improved by improving the public access and the relation with the beach.

**Breakwater Barrier**

The breakwater barrier in Katwijk aan Zee will have a new urban character and a new beach/barrier zone. The barrier-concept is designed in more detail for the coastal area of Katwijk aan Zee. The traditional seaside resort of Katwijk aan Zee experiences a lot of pressure from the continuous expanding hinterland. Also, its low geographical position causes pressure from the sea.

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