

## Afsluitdijk climate resilient with XblocPlus

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### Abstract

The Afsluitdijk forms 32 km of the primary sea defence of the Netherlands. The Afsluitdijk was built as a closure dam in 1932 and separates the IJsselmeer from the Wadden-Sea and North Sea. Because of climate change the Afsluitdijk needs to be strengthened. A higher crest height is required to limit overtopping at higher water levels due to sea level rise. Heavier armour is required to protect the Afsluitdijk from higher wave heights. Because of the historic value of the Afsluitdijk, stringent architectural requirements are in place on the visual appearance of the dam after strengthening [1]. Therefore, a new concrete armour unit was developed to provide protection of the seaward side of the Afsluitdijk. This armour unit is called XblocPlus. The development of the armour unit is based on the breakwater armour unit Xbloc which has been applied since 2004. A saving of 56% on CO<sub>2</sub> footprint was achieved compared to the Clients reference design.

**Keywords:** Afsluitdijk; concrete armour unit; climate change; sea level rise; dam; dike; sea defence; seawall; CO<sub>2</sub> footprint.

### 1 Introduction

The Afsluitdijk was built in 1932 to close off the Zuiderzee, as severe flooding had occurred around this estuary due to storm surges. A 32 km dam was designed by the engineer Lely. This dam consists of a core of glacial till and an armour layer of natural basalt columns on a gentle slope of 1:3.5. The dam was designed for a significant wave height of approximately 2.5 m and has a height of 8 m above mean sea level. Figure 1 shows the location of the Afsluitdijk in the Netherlands. During the past 90 years, almost all of the basalt columns have been replaced because of storm damage. The natural basalt columns weigh less than 100 kg and their hydraulic stability depends on friction between the individual blocks. Because of future increasing water levels and wave heights it is necessary to strengthen the dam. Therefore Rijkswaterstaat started a tender procedure in 2017, which was won in 2018 by Levvel (Bam/Van Oord/Rebel)



Figure 1: Location of the Afsluitdijk