



## Introduction

With the expansion of the port of Antwerp, a second sea lock is being constructed in the Waasland-port. This is the complex of docks on the left bank of the river Scheldt. The works started on 24 October 2011, with the finishing date scheduled for 2016. The “Deurganckdoksluis” is 500 m long and 68 m wide. It is a huge undertaking. The construction involves an enormous number of excavations, and huge amounts of concrete and reinforcement steel.

## Assignment

For the building of the concrete retaining walls, we were asked to design a reusable steel formwork for the bottom-part of the L-shaped retaining walls.

For the retaining walls on the side of the “Deurganckdok”, the formwork needed to be 26.5 m long, for the “saskolk” 25.5 m long and for the retaining walls on the other side of the Waasland-port, 16.5 m long.

Furthermore, for each formwork-length there had to be 3 formworks available, while each had to be easily transformable from a female formwork into a male formwork. Since the concrete of the retaining walls had to be made in parts of 20 m, the individual parts could not move, so they were designed with male and female parts that fit to each other.

It's clear that a classic formwork could not be used because of the huge pressure of the concrete. To fulfill the assignment as economically as possible, only three formworks were made. These were assembled with steel profiles and steel plates on the concrete side. The formworks were assembled as female formworks and in the cutouts “male fitting parts” were inserted and firmly fixed. Each formwork is a 3D-frame of 16.5 m (Waasland-port), onto which on one side a 3D-frame of 9 m (for Saskolk) and on the other side a 3D-frame of 1 m can be assembled (to become the longest formwork for the “Deurganckdok”).

Moreover, on top of the formwork the necessary platforms and stairs needed to be installed in order to enable work on the reinforcement and the concrete.

Furthermore there was a limitation on the horizontal displacements of a maximal 30 mm on the total formwork of 26.5 m and we had to consider that the steel formwork was supported on the sheet piling by jacks and that the position of these jacks had to be adjustable at random.

## Application of Scia Engineer

The specific construction of these steel formworks taught us that a complete 3D-model in Scia Engineer was necessary. Scia Engineer made it possible to calculate the 3D-frames in a global way in detail. The exact positions of the jacks on the sheet pilings and the side-profiles of the steel formwork had a significant influence on the horizontal displacement in the middle of the formwork under the hydrostatic pressure of the fresh concrete. The 3D-modelling ensured that this influence was monitored in detail, which made it possible to design the side of the 3D-frame in an efficient way. We had some freedom to design the frame behind the steel plates of the formwork and because it was important to tune the design to the position of the working-platforms and stairs, it was a good thing that we could easily adjust the geometry of the frame in the Scia-model to evaluate the consequences. Scia Engineer proved to be a high-performance tool in addressing this.

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Stabilogics is an engineering bureau with great experience in stability-calculations. Since its foundation in 2000 we are growing and are now a team of 13 people. This makes us very flexible and able to anticipate very fast what the best solution for requested projects is. With this team of experts we are also able to design and calculate very big projects. We have experience all over the world and are able to produce designs in accordance with most standards and codes: Eurocode, with all European national annexes, British standards and others. We have always put the execution of the building as the top priority. We work from design to execution, producing workshop-drawings of steel and concrete-structures. To avoid problems on the building-site we ensure that the structure can be assembled and erected as we have designed. The strict preparation and further processing along with the great eye for details lead to efficient and smooth execution on site. With the help of Scia Engineer (all modules), complemented with self-written calculation-programs, our calculations are supported with accuracy and speed.

## Project information

Owner	Vlaamse overheid
General Contractor	THV Waaslandsluis
Engineering Office	Stabilogics
Location	Antwerpen, Belgium
Construction Period	10/2011 to 12/2016

## Short description | Sea Lock Waasland-Port

The construction of a second sea lock in Waasland-port was indispensable to the expansion of the port of Antwerp. The "Deurganckdoksluis" is a huge project with a length of 500 m and a width of 68 m. For the construction of the L-shaped side walls of the lock, a formwork had to be designed. This formwork had to meet a number of specific requirements. Three different lengths of formwork were needed for the different parts of the sea lock (16.5 m, 25.5 m and 26.5 m), and for each of these lengths a 'male' as well as a 'female' form was needed. Another requirement was a maximal horizontal displacement of 30 mm for the longest part, while the position of the jacks had to be adjustable at random for adequate horizontal support to the sheet piling. Scia Engineer 3D models proved to be high-performance calculation models for this task and very clear control models for the construction consortium THV Waaslandsluis.

