Infrastructure

A16 De Groene Boog: the perfect sustainable and innovative fit in the environment

In northern Rotterdam, BESIX is participating in the A16 project as part of the 'De Groene Boog' consortium. It includes connecting the existing A16 and A13 by constructing a new motorway. This new 11-kilometre-long A16 will be the world's first energy-neutral motorway with a tunnel and will significantly improve the accessibility of Rotterdam. Sustainable, innovative and a perfect fit in the environment, that's what A16 is about.

Consortium De Groene Boog

To improve quality of life and access to the Rotterdam region, Rijkswaterstaat (RWS) decided to construct a new motorway, the A16, along the northeast periphery of Rotterdam. A joint venture composed of BESIX, Dura Vermeer, Van Oord, Croonwolter&dros and Mobilis named 'De Groene Boog' is responsible for designing, building and financing the project as well as managing a twenty-year maintenance period.

The project includes several infrastructural elements, such as a semi-sunken energy-neutral tunnel and a 400-metre-long viaduct across several important traffic axes. In November 2021, the construction of the viaduct was officially launched and by the end of 2022, the first part had all but reached the other side of the Terbregseplein. The tunnel also progressed well, with the last underwater concrete having been poured in September 2022. The entire A16 will be ready in 2025.

Project details

A16 De Groene Boog

Location
Rotterdam (The Netherlands)

Client
Rijkswaterstaat

Partners
Mobilis, Croonwolter&dros, Dura Vermeer, Van Oord

Contract type
Design, Build, Finance & Maintenance

Construction period
2019 - 2025

Maintenance period
20 years

Sustainable fit

The project sets the bar high to be as sustainable as possible to deliver an energy-neutral A16. To achieve this, solar panels (20,000 m²) are installed to naturally generate all the energy needed for the roads and the tunnel. In addition, the latter includes energy-efficient LED lighting and smart solutions for the electricity, heating and lighting. Natural light is maximised by the use of grilles and fibre-glass panels. At the entrances, the lanes and walls are painted in a light colour to maximise reflection and residual heat will be stored in the ground and released when required.

Elsewhere on the project as well and already during construction, measures are being taken to keep the CO_2 emissions as low as possible. For example, Hydrotreated Vegetable Oil (HVO) fuel, which has 90 % fewer emissions than diesel, is used on a large scale on the project.

In November 2022, the teams successfully tested an electrical crawler crane which can operate unplugged for 10 hours. It is the first time in the world that heavy equipment like this operates on a jobsite with such a high level of autonomy. The successful test led BESIX to the decision to invest in this top-notch equipment, the Sennebogen 653E.

The essential role of BESIX Engineering in the A16 project

Playing an essential role in the project is BESIX Group's in-house engineering department, BESIX Engineering. Their indispensable contribution to the project is thus worth a more detailed look in this activity report.

The Incremental Launching Method across the Terbregseplein

One of the engineering masterpieces is the viaduct across the Terbregseplein that passes over a railway line and motorway interchange. As closing these busy traffic lines was out of question, the consortium opted for the Incremental Launching Method, which includes gradually pulling the structure across the Terbregseplein, enabling traffic at all times.

A temporary production line was set up behind the northern abutment. There, each segment – about 30 metres long – is cast in relation to the previous one and gradually pulled over the Terbregseplein, until the whole structure reaches the southern abutment. This happens at a low pace, i.e. 4 m/h, and cannot be observed by the vehicles driving under the viaduct.

This imposing blue steel structure is the launching nose of the flyover. It was installed at the front of the first segment to balance out the weight equally and covers the distance between the different piers. In addition, it limits the internal stresses as the structure cantilevers over the existing infrastructure, ensuring a safe operation.

The energy-neutral Rottemeren tunnel

The project uses underwater concrete to minimise disturbance for the environment and to reduce the use of materials. Reinforcement and concreting of the floor are carried out underwater. Then, the water is pumped out to create a dry construction pit in which the rest is built. Less concrete is required, thus reducing CO_2 emissions.

A BIM model was created which integrates all elements and is used to automatically generate drawings. It was then turned into a VR model, TWIN-16, which includes the functional behaviour of the installations, enabling virtual testing of all system behaviours. This creates trust towards compliance of requirements in an early phase, which saves time and money for long-term maintenance.

Parametric design involves automating digital design processes through algorithms and computer programming. Thanks to this, the design of a single segment could be automatically reproduced along the entire length of the tunnel, which reduced the risk of errors and saved the engineers time to study alternative design solutions.