

BESIX Engineering

A CENTRE OF EXCELLENCE AND KNOWLEDGE AT THE GROUP'S CORE

BESIX ENGINEERING IS THE IN-HOUSE DESIGN OFFICE OF BESIX. THE CONTRIBUTION OF THIS DEPARTMENT IS TO A LARGE EXTENT WHAT ENABLES THE GROUP TO DELIVER FIRST-CLASS PORT TERMINALS, CUTTING-EDGE CIVIL ENGINEERING WORKS AND DEMANDING BUILDINGS.

THE INTEGRATION OF A DESIGN OFFICE WITHIN A CONSTRUCTION GROUP, ALTHOUGH RARE, IS A KEY ASSET FOR CLIENTS. IT ENABLES BESIX TO OFFER TAILOR-MADE SOLUTIONS AND OPTIMISE PROJECTS, WHILE GUARANTEEING MAXIMUM REACTIVITY. BESIX ENGINEERING'S SERVICES RELY ON 150 ENGINEERS IN BRUSSELS, DUBAI AND BRISBANE.

IN 2020, FABIAN BOUCHER WAS APPOINTED AS ITS NEW DIRECTOR – INTERVIEW.



How would you describe the role of BESIX Engineering?

We work exclusively for the Group, which sets us apart from traditional design consultants. Our mission hinges on two main axes. The first is to protect the Group from design-related risks. This varies from the role of a supervisory committee, to taking full responsibility for a design. The second is that of the trusted partner for all BESIX project teams. This implies a constant dialogue between design engineers and their BESIX colleagues throughout the different stages, from tendering to design and execution. We contribute to set up strategies to optimise a design, maximise a project's functional objectives, reduce costs, define the planning and construction methods.

BESIX Engineering is also a knowledge centre within the Group, both by making its expertise available for projects and by being a community and platform for exchange.

What are the disciplines available at BESIX Engineering and its key sectors?

BESIX Engineering designs projects for all BESIX sectors, with particular experience in high-rise buildings, marine works and infrastructures. We provide



THE 2.2 KM LONG TUNNEL ON THE A16 IS AN OUTSTANDING EXAMPLE OF BESIX ENGINEERING'S CAPABILITIES IN PARAMETRIC DESIGN



BESIX ENGINEERING IS A KNOWLEDGE CENTRE WITHIN THE GROUP, BOTH BY MAKING ITS EXPERTISE AVAILABLE FOR PROJECTS AND BY BEING A COMMUNITY AND PLATFORM FOR EXCHANGE. //

**FABIAN BOUCHER,
DIRECTOR BESIX ENGINEERING**

experts in all disciplines with a particular knowledge in geotechnics and structure. We also have centres of expertise, which intervene depending on the project, specialising in methods and planning, Building Information Management (BIM), computational design (parametric, automation, AI), sustainability, façades and concrete technology. Several of our engineers are world references and academics. By combining their expertise, we are able to fully design projects, including the most complex ones.

Could you further detail how you support the different engineering stages of a project?

In the tender phase, we assist our colleagues by identifying risks and ways to improve a project. Ultimately, we ensure that the right choices are made and that the BESIX offer is both optimal and reliable.

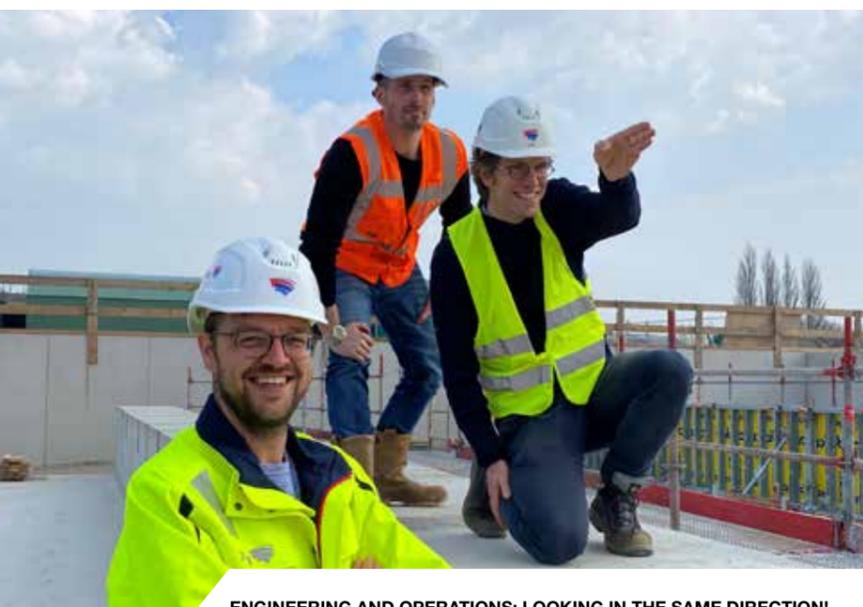
In the design phase, our scope varies. For Design & Build contracts, we do detailed engineering, developing a design from a concept. We also develop value engineering solutions, which consist of proposing an improved, alternative design benefiting the project's lifespan, its functional objectives and cost. For Build-only projects, we can simply develop shop drawings or create value to the client by proposing alternative designs. We can also work more upstream and support clients right from

the project's conceptual phase. It is in this case that the contribution of our know-how will be the most extensive.

With regard to execution, we proactively ensure constructability and reactively resolve errors quickly.

What about methods and planning ?

More and more, we partner with our projects by preparing, challenging and controlling the execution planning, including pre-planning. We also help



ENGINEERING AND OPERATIONS: LOOKING IN THE SAME DIRECTION!

// A16 Rotterdam

THE DECISIVE CONTRIBUTION OF BESIX ENGINEERING

THE A16 IS A NEW MOTORWAY THAT WILL GREATLY IMPROVE MOBILITY IN ROTTERDAM. THE 984 MILLION EUROS CONTRACT WAS AWARDED TO BESIX AND ITS PARTNERS BY RIJKSWATERSTAAT. IT INCLUDES FINANCING, DESIGN AND CONSTRUCTION, AS WELL AS MAINTENANCE FOR 20 YEARS. BESIX ENGINEERING PLAYS A DECISIVE ROLE IN THE PROJECT WITH THE DESIGN OF SIX CIVIL STRUCTURES AND A 2.2 KM TUNNEL. BELOW ARE THREE EXAMPLES.

A MOTORWAY BRIDGE

The “K52 A” bridge consists of two parallel structures, about 400 m long, accommodating two and three lanes respectively. It will span an existing interchange and a railway line, the use of which cannot be disrupted by the construction.

“This prompted us to opt for the incremental launching method. This consists of constructing the bridge segments behind the bridge abutment. Each segment is cast in relation to the previous one and pre-stressed. The superstructure is then pushed forward a distance equal to the length of the segment, a process that is repeated for each segment until the bridge reaches its final position”, explains Pierre Mengeot, Senior Project Manager for the design of the A16 bridges.

This requires an ultra-precise BIM model, a 3D digital replica, even more so as the bridge follows a curved trajectory. In addition to the quantities and structure, the model also takes into account the prefabrication of the slightly curved segments and defines all the intermediate phases of construction.

“We used a special calculation programme which, in the design, takes into account the construction phases and the effects on the concrete, hence a time factor”, continues Pierre Mengeot.

The construction will be carried out in close collaboration with BESIX Engineering, with the presence of a methods specialist on site.

A CIRCULAR PEDESTRIAN BRIDGE

In collaboration with the Block Research Group of the University of Zurich, BESIX Engineering is designing a circular pedestrian bridge.

“We favour principles of structural geometry and material efficiency, allowing us not to use reinforcement in this bridge. For its construction, we are designing a flexible formwork system, a textile made of recycled and natural fibres that is easy and quick to assemble”, details Pierre Mengeot.

The concrete itself is innovative. It is “green concrete”, i.e. made from recycled concrete.

“Thanks to its structure, the bridge will use less material, allowing us to reduce the addition of cement to the recycled concrete. Its design requires state-of-the-art calculations to guarantee first-class strength and quality”, adds Pierre Mengeot.

THE TUNNEL

The 2.2 km long tunnel crosses a green area and will form an artificial mound under the trees and the river Rotte. It is also an outstanding example of BESIX Engineering’s capabilities in parametric design, BIM, digital twin and sustainability.

“We used parametric design to optimise the entire tunnel structure,” explains Xavier Raucroix, Senior Project Manager responsible for the tunnel design.

Parametric design consists of automating the design process through the use of algorithms and computer programming. By focusing on segments of the tunnel, which are then replicated automatically, engineers save precious time, allowing them to concentrate on quality and material optimisation, while reducing repetitive manual calculations and the risk of errors.

“The parametric design allowed an extremely precise calculation of the forces, loads and control of the reinforcements on each segment, which gives the most optimised design and reduces the quantities,” continues Xavier Raucroix. “We also used it to optimise the 4.4 km of sheet piling and 7,000 piles, taking into account the soil data at each individual location”.

In addition to parametric design, a BIM model was created, integrating all the tunnel elements into a single 3D model. This model is used to automatically generate drawings and will then be used on site by the operations team.

“We have also created a digital twin of the tunnel,” says Xavier Raucroix. “This allows us to already test all the functionalities in a fictitious environment, for example the softwares that will control the light or ventilation. This saves time for subsequent test phases and long-term maintenance”.

Finally, the tunnel will be an energy-neutral structure, the first in the Benelux. This is the case thanks to solar panels that guarantee its independence for the supply of light and IT systems.

“All of this has also been integrated into the BIM model of the tunnel,” concludes Xavier Raucroix.

implement Lean Planning techniques, which are considered a key operational driver for our clients.

To what extent do you use cutting-edge technologies?

BESIX Engineering constantly embraces new technologies that improve the quality of our work, and remains a leader in this field. BESIX Engineering was a pioneer in Building Information Management. We are now reaching a maturity stage where a group-wide information management culture is being built.

Today we also are a pioneer in computational design. This is what we do with parametric design, which uses algorithms and artificial intelligence to improve design quality, reduce the risk of error, test more design alternatives and engage in ever more complex projects.

How is BESIX Engineering active in sustainability?

Our sustainability experts accompany the design, procurement and execution of our building to achieve environmental

certifications, such as BREEAM, LEED, Passive Buildings ... Here, too, we have often been pioneers.

We also support R&D, for example with green concrete, which consists of reusing old concrete.

A third area is circularity, in which we’ve won several awards in recent years. This involves, for example, keeping existing structures and reusing materials, thus minimising recycling or new production. This has a high environmental gain.

Since you took office, have you been impressed by other aspects than expertise?

There is an exceptional ‘professional camaraderie’ at BESIX Engineering. They are passionate colleagues who enjoy working together in a positive atmosphere. This is an important aspect of BESIX’s culture, which is particularly lively within BESIX Engineering. In 2020, despite Covid-19, they have remained united and efficient. This stems from their professionalism, the fact that they know each other well, and their human qualities. I also greatly value our strategy of hosting young engineers before they join construction sites. This allows us to update their technical knowledge and create links, which facilitates dialogue and knowledge sharing within BESIX.



THE DOUBLE BRIDGE ON THE A16 REQUIRES AN ULTRA-PRECISE BIM MODEL