Witteveen+Bos

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Witteveen+Bos provides consultancy and engineering services for projects in the following areas: water, infrastructure, environment and economics. A multidisciplinary project approach characterises our way of working. Our clients are governmental, commercial, and industrial, including various types of joint ventures and public private partnerships. We serve them from eight offices in the Netherlands and four offices abroad.

For our 750 employees partnership is the key word: partnership with their clients and with Witteveen+Bos. Personal development is also a key issue because our work constantly demands new expertise and new responsibilities. Accountability to our clients is important to us. Our employees (at the same time our shareholders) share this sense of responsibility.

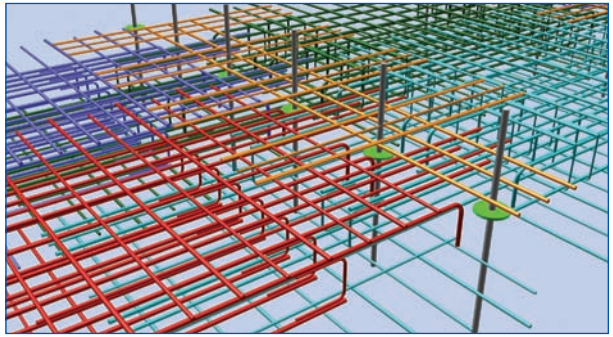
High-profile projects

Examples of high-profile projects where Witteveen+Bos has been involved are the north-south metro line in Amsterdam, the development of man-made islands for oil and gas winning in the Caspian Sea, a 350 hectare land-reclamation project in Sochi, an island in the shape of Russian Federation, known as Federation Island, the Amsterdam-west sewage water purification project, construction of the Delft railway tunnel, development of systems to allow the passage of fish alive at pumping-stations, the master plan for the centre of Amsterdam International Airport, various large and divers contracts in Central and Eastern Europe and al large number of projects in the Netherlands and abroad.

Innovation

Innovation in projects has been one of the most important foundations of the success of Witteveen+Bos.

A few examples of innovative developments are the social costs and benefits analysis, ‘Charted Dutch safety levels’, ‘Partners for Roads’, UV water treatment in Andijk and Berenplaat, the decontamination of soil at railway yards and the first Reinforced Underwater Concrete Floor a permanent function.



Short Description

Tunnel ‘Ringvaart’

The project regards a tunnel consisting of two traffic tubes, separated by an emergency tube. Each traffic tube is provided with a two lane road. The sections are constructed in an open pit consisting of sheet pile walls and an underwater concrete floor. However this construction principle is well known as ‘cut and cover’, some innovations are applied as well. Instead of a traditional (temporary) underwater concrete floor, a reinforced underwater concrete slab is applied. This structure has a permanent function and will not be provided with a separate concrete slab on top of it. As a result of this construction method, construction time is shorter, the number of foundation piles is reduced by half and construction costs are lower.

Project Information

Owner: n/a
Architect: m. Izendooren
General Contractor: Alliantie-N201
Engineering Office: Witteveen + Bos

Construction Start: 01/01/2007
Construction End: 01/01/2011
Location: Aalsmeer, Netherlands

Introduction

In the vicinity of the Dutch national airport ‘Schiphol’, local economic growth already leads to congestion of traffic on both highways as provincial roads. In the near future, the area will be used for further development as European ‘Greenport’, which will lead to further increase of traffic.

The present provincial road N201 crosses the villages Uithoorn and Aalsmeer. By the foreseen traffic growth, the road becomes increasingly a barrier for both villages. This is unacceptable, regarding the living conditions of the inhabitants. Therefore, the provincial road will be diverted around both villages, and be suited for future economic development.

In 2005, the Province ‘Noord-Holland’ launched a ‘Design and Construct’ tender for the mayor part of the project. It comprises 8 kilometres provincial road, several viaducts and a tunnel, length 1400 metres, crossing the drainage and shipping canal of the Haarlemmermeer-polder, in which Schiphol Airport is located.
Originally, Witteveen+Bos advised the contractor (Heijmans and Boskalis) for the tender design. Since the contract is awarded, the contractor and the client started an Alliance in order to optimise both process as design. From start, Witteveen+Bos is involved in the Alliance and provides design works for all construction stages of both tunnel, road works and viaducts.

Tunnel ‘Ringvaart’

The tunnel consists of two traffic tubes, separated by an emergency tube. Each traffic tube is provided with a two lane road. Due to its covered length, safety installations such as ventilation equipment, camera surveillance and lighting will be installed. Also the tunnel will be equipped with an operating facility.

Presently, the northern part, crossing the canal, is completed. By the end of 2008, the navigation channel of the canal will be repositioned in order to build the southern part. The sections are constructed in an open pit consisting of sheet pile walls and an underwater concrete floor. However this construction principle is well known as ‘cut and cover’, some innovations are applied as well. Instead of a traditional (temporary) underwater concrete floor, a reinforced underwater concrete slab is applied. This structure has a permanent function and will not be provided with a separate concrete slab on top of it. As a result of this construction method, construction time is shorter, the number of foundation piles is reduced by half and construction costs are lower.

Reinforced Underwater Concrete Floor

Because of its permanent function, the underwater concrete floor will be reinforced. Therefore prefabricated reinforcement cages are installed at a maximum depth of 10 metres below the water surface. Together, the reinforcement cages provide

the slab with sufficient strength and durability to withstand all possible loads during its lifetime of 100 years. To assure optimal interaction, each reinforcement cage laps with its ‘neighbour’.

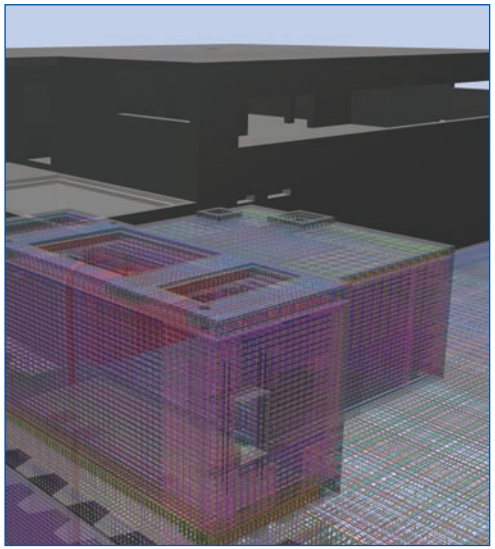
As a result of the construction method, it is important to provide room for several construction tolerances. The cages are installed on top of a steel frame, supported by sheet pile walls and tension piles. However this frame can be installed quite accurately, deviations such as the exact pile location (x,y), position of the reinforcement elements (x,y,z), excavation level (z) and concrete cover (z) must be taken into account.

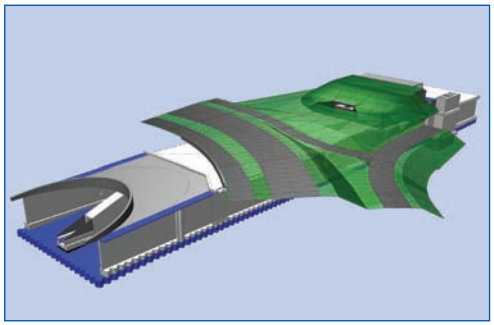
Regarding the tolerances and the necessary interaction, all reinforcement elements must fit like a puzzle. In co-operation with the contractor (Heijmans-Boskalis), it is decided to use Allplan for both cage design, prefabricated production and to arrange the exact construction sequence. The manufacturer of the reinforcement cages is using the digital Allplan model as well.

By the end of 2008, three compartments, each 75 metres long, were successfully built. In 2009 another three compartments will be constructed.

Use of Allplan Engineering

The tunnel is located in the western part of the Netherlands. The landscape consists of several





polders, about 4 metres below sea level. The tunnel crosses the drainage and shipping canal (Ringvaart) of the Haarlemmermeerpolder, which has a water level almost equal to sea level. Also, the tunnel connects the Haarlemmermeerpolder with an adjacent polder. Because of these important preconditions the tunnel acts as a water barrier during its lifetime and also during construction.

To ensure its water-retaining function, the design of the tunnel has to be checked for all types of contingencies, especially during construction. By designing the tunnel in Allplan 3D, it was relatively easy to find all possible leaks and adjustments of the design could be applied efficiently. All tunnelsections, 57 in total, the service buildings and the drainage sumps are added to the model. Also the 3D model of the roadworks is inserted in the Allplan model in order to check all interfaces with difficult roadcrossings (curved both horizontally and vertically). Finally, the reinforcement is added to the model and the construction-drawings are extracted. The digital model is also used by the reinforcement manufacturer for direct production of the reinforcement. As a result, mistakes by information transfer are being minimised.

Summary

- Total tunnel length: 1415 m
- Covered section: 800 m
- Open cut: 625 m
- Internal width: 20 m (2 x 9 + 1 x 1.35 service and safety gallery)
- Internal height: 6,1 m
- Number of drawings: 200 (general arrangement), 200 (reinforcement)