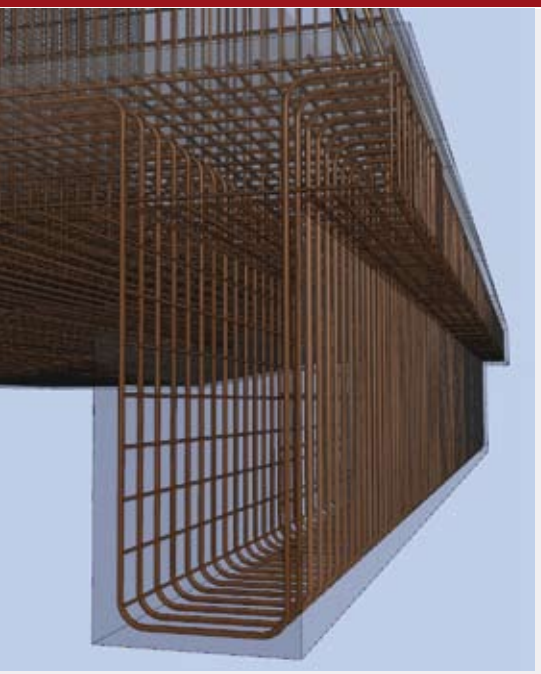
NEMETSCHEK Allplan

Dry Dock in Duqm Port, Oman | Daewoo Engineering & Construction (Daewoo E&C)

Titans in the desert sands

The construction boom on the Arabian Peninsula has reached another country: Oman. The Sultanate, from which Sinbad the Sailor once set off on his famous journeys, wants to revive its seafaring tradition and is developing several coastal areas into new port zones. One of these is Duqm Port, in the south of the country. Close to international shipping lines but also far from the notorious Strait of Hormuz, this desert-like region is to be developed into a new port with an adjoining industrial zone. The core of the new development will be two gigantic, 1,350-foot (410 meter) dry docks capable of servicing supertankers with a load capacity of up to 350,000 metric tons.



General arrangement and reinforcement drawings as well as bending schedules are derived from a 3D model.

Huge dimensions

They represent a formidable feat of engineering and a challenge for all those involved in the project. These include the Korean construction group Daewoo Engineering & Construction (Daewoo E & C), which has the responsibility for the construction project as the general contractor; Daewoo Shipbuilding & Marine Engineering, which has taken on the design work; and Korean service provider BasisSoft, which provides software support for the project.

The gigantic dimensions of the project alone make it a real challenge. The two mighty dry docks and an appropriately large pump station are just one part of the project. The 250-acre (100-hectare) area will also have various dockyard and crane installations, deep water anchorages, storage areas, accommodation and office buildings, a quay wall nearly 2 miles (3 kilometers) long and an offshore breakwater.

The project is also challenging because it must be completed particularly quickly. According to the Omani government, the entire installation needs to be ready in just three years. Construction began in January 2009 and the planned completion date is December 2011. This means construction times are so tight that there is no room for any complications during the implementation phase. The design documents must therefore be extremely high quality in order to avoid delays. At the same time, a period of just three months was allocated to the design phase (November 1, 2008 to January 31, 2009).

Cutting-edge methods

So a particularly large project had to be planned with no errors in a very short period of time. The experts at Daewoo E & C agreed that this could only be achieved using the most up-to-date methods: using Building Information Modeling as an efficient design method – and with Allplan Engineering from Nemetschek Allplan as the best tool for the job.

The system for three-dimensional general arrangement design and reinforcement detailing enables an integrated approach with a virtual structure model. The 3D model serves as the basis for the general arrangement design and reinforcement detailing from which all the other designs and schedules are derived. This enables a very efficient working method, avoiding duplicate data entries and data redundancy. Also, design and reinforcement are perfectly coordinated. All derivations, such as floor plans, views, sections, as well as quantities and schedules can be derived automatically from the building model and are then always reliable and up-to-date.

These features made Allplan Engineering the perfect tool for designing Duqm Port. This is why Daewoo E & C decided to use the Nemetschek solution for this project, even though they had no previous experience of using the software. This time-critical and complex project therefore functioned more like a pilot project in this respect.

Success with Allplan

This was an altogether unbelievable endeavor that had to be accomplished with flair. Thanks to the integrated design methods in Allplan Engineering, and with support from the software experts at BasisSoft, engineers were able to remain on schedule while still achieving extremely high design quality. “We had to create thousands of drawings for all the structures – all in a very short period of time”, explains Chris Kim, Senior Manager of BasisSoft. “We only managed it because we were able to work effectively with Allplan Engineering from the very beginning. Thanks to integrated design, we delivered all the documents on time and error free. The Nemetschek software is simply the best solution when it comes to 3D reinforcement detailing.”

Design and detailing was carried out at two locations. One workstation was set up directly at the construction site in Oman, others were at BasisSoft in Korea. They were connected via the Workgroup Manager, which managed the project data centrally and made it available to each workstation. This allowed all the designers involved to access the same central building model and draw on the data they needed for their general arrangement design and reinforcement detailing. Structural analyses were performed separately by external structural engineers in Korea.

Complexity made easy

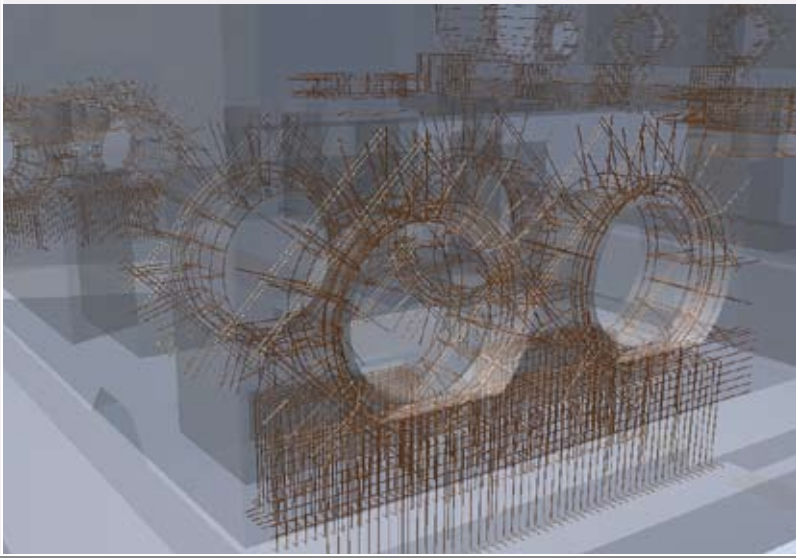
All building structures were designed in 3D using Allplan. This allowed workers at Daewoo and BasisSoft to understand every detail of all the building structures, including those with unusual shapes – a common occurrence in this construction project. The pump station is one example: to accommodate its flow openings, this building has some extremely unusual structures making reinforcement design extremely complicated. Using a conventional 2D design, it would have been very difficult and time-consuming to define the dimensions and positioning of the steel bars.

Using Allplan Engineering, the engineers were able to reinforce these building structures quickly and precisely. The formwork edges were adopted automatically from the model and formed the reference point for the spatial alignment of the reinforcement. “This significantly speeds up the design process”, says Chris Kim. “Using traditional methods in 2D, an engineer can finish around two layouts a day. An engineer using 3D works almost twice as fast and can create three to four layouts.”

Quick and concise

All the project documents were automatically generated. “The 3D method is not an end in itself, it is actually extremely useful because the 3D model can be used to derive all the required information directly and consistently,” explains Chris Kim. This does not just apply to general arrangement and reinforcements drawings with floor plans, elevations and sections, but also analyses such as reinforcement and bending schedules. The designers did not need to spend time creating any of these documents carefully by hand; they were able to derive them directly from the intelligent structure model. The same is true for the volume of ready-mix concrete, which was also generated automatically via quantity takeoff.

Flow openings with challenging reinforcement design.



Integrated design using a common structure model also made revision management significantly easier. The Korean engineers entered all adjustments and modifications directly in the model so that new, up-to-date design documents and schedules could be generated again automatically. This avoided delays that might have endangered the schedule for the entire project.

Early error recognition

The engineers could check the 3D model to ensure everything was still correct despite any changes. They used 3D PDF files to assess the entire building structure in detail and check for errors and collisions. This made it possible to recognize critical points early on before construction started – at a time when changes do not represent a serious problem.

An important advantage of 3D design was also improved communication, not just during the design phase but also during construction. “The visualization functions in Allplan Engineering are an enormous help when it comes to explaining the design of a structure and how it is reinforced – especially on the construction site”, explains Chris Kim.

Workers from very different countries are involved in the Duqm Port construction project. Many of them do not even have a shared language. 2D PDF documents have proved effective as a means of communication. In addition to standard layouts, they also have explanatory isometric or exploded views, making them easy for everybody to understand. Whether you’re Filipino, Indian or Pakistani – everybody understands a spatial representation and knows how to apply it. This guarantees that error-free designs also translate into error-free construction – creating a new port for large ships.

Due to the tight schedule, concrete pumps are operated day and night.