



Steel plant in Jizan/Saudi Arabia

Mangart S.r.l., Udine/Italy

# A steel plant in 3D

Mangart S.r.l. used Allplan Engineering for the construction and planning of the new steel plant in Jizan, Saudi Arabia. Working with Allplan's parametric 3D modeler gave the engineering office better cost control as well as greater accuracy for the general arrangement and reinforcement design, while saving valuable construction time. Another advantage was provided by the 3D PDFs generated from Allplan, which made the entire project process transparent and very easy to follow. This facilitated the work of the architects and engineers, as well as the contractors. In turn, the client was able to benefit from the interactive viewing functionality.

In Jizan, Saudi Arabia, a new steel plant is under development. This ambitious project involves the creation of a “mini-mill” – a modern and innovative steel plant where scrap steel is smelted to produce new steel in just two hours, at a production rate of 100 tons per hour. Once completed, this new production center will have an arc furnace, which is considered better than the traditional blast furnaces because it offers greater flexibility. It will also be a rolling mill with high-performance rolling equipment using state-of-the-art automation technology. The design of the rolling mill support structure was entrusted to Udine-based company Mangart, who have many years experience in designing industrial plants and steel mills.

#### **Complex building geometry calls for absolute precision**

The “figures” for the support structure and the extremely multi-faceted and complicated structural geometry speak for themselves: 22,000 square meters of foundations for the machinery and superstructures, platforms and cabs, etc., which equates to the excavation of 120,000 cubic meters of earth (cut and fill), 30,000 cubic meters of concrete, 70,000 square meters of formwork and 2,600 tons of rebar steel for the reinforced concrete, as well as an additional 60 tons of light metal structures for railings, steps, covers, etc., and 3,500 tons of metal structures for warehouses. Mangart’s work was further complicated by having to design a solid construction-based support structure perforated by a wide variety of technology sections for the subsequent installation of various machines. In addition they had to create the recesses required for allowing access to the superstructures and create columns, bases and sloped surfaces while giving due consideration to the technical requirements and the removal of process water.

The complicated building geometry also had to be taken into account during planning. This required absolute precision in the general arrangement design with respect to the incorporation and fixing of the machinery and equipment that was to be installed. A tight schedule meant only minor corrections could be carried out on-site. With more than 1000 project plans, Mangart also had to deal with the issue of graphic design legibility. The

numerous project plans were created in A1 and A0 format under strict submission deadlines while taking into account the integrated approach between public, mechanical and civil engineering responsibilities, as well as interdisciplinary collaboration within various fields of competence.

#### **Ultimate certainty with Allplan Engineering**

In order to meet all these requirements, Mangart relied on Allplan Engineering, with its specially developed parametric 3D modeler for support structures. Easy to use with optimal control in every construction phase, Allplan allows editing of isometric displays, views, sections and layouts, and applies the changes immediately. Even with subsequent design changes, new general arrangement and reinforcement plans can then be derived without difficulty. This ensures the highest level of certainty when executing complex reinforcement tasks. Another advantage is the interaction between the virtual building model and the general arrangement technology. Predefined superstructure groups and intelligent fixtures save valuable time. Mangart took advantage of this facility and created individual wizards for the project. These were continually adapted and applied over the course of the project. As a result, members of the design team were able to focus on content instead of losing time on complicated and repetitive design tasks.

The support structure is accurately represented in the 3D model down to the last detail. Changes and optimizations can be incorporated retrospectively and adapted during the course of the project. Sources of error can be identified and eliminated immediately in the 3D model. This speeds up the design process and reduces the risk of conventional 2D design errors. Besides accurate cost estimating, the greatest challenge posed by projects like this is the implementation and execution of the individual construction phases. For example, with concrete support structures, the correct construction processes need to be taken into account whilst simultaneously avoiding errors that can arise due to the location of expansion joints, etc. With this project, the general arrangement and reinforcement design required particularly vigilant attention. “Allplan provided us with

excellent support in terms of the 3D representation of components and their reinforcements. This would not have been possible within the same timeframe using conventional design methods," explains Stefano Petris, technical and managing director of Mangart.

#### **Perfect communication with 3D PDF**

The 3D PDF function integrated in Allplan also played a key role. It represents a powerful tool that allows designs to be displayed in 3D, freely manipulated within surrounding areas and viewed with pan and zoom tools as used in conventional design programs. At the same time, it is very easy to use and the PDF can be clearly read with the conventional Adobe Reader. Furthermore, all visual display commands are already integrated in the application. The 3D PDF is therefore recommended not only as a basic tool for construction planning, but is also especially recommended for communication with customers. "We deliver it along with the usual construction plans," commented project manager and co-partner at Mangart, Sara Macor. "This makes it easier for the designers and the client to understand project plans containing visible elements such as walls, columns, foundations and openings for machine elements."

It is also very useful later on for construction firms and industrial equipment manufacturers. "One advantage for the design team is the ability to carry out objective assessments of individual components," explains Sara Macor. "In addition, the technical construction information can be transferred to a computer. The 3D PDF facilitates both design work and external communication work. Hence the specifics of the respective construction project are made clear, even for dialog partners who are not experts and for international customers who are used to different standards or terminology. Allplan Engineering," concludes Sara Macor, "allows sophisticated graphical computer representations of reinforcements and enables calculation, accurate down to the gram, of the quantities of material required for the support structure. The customer can be presented with precise data that already contains details of any potential delays, additional costs or points of dispute with the installers."

Mangart was established in 2005 and now has 15 employees. The company has extensive experience in designing industrial buildings, especially steel mills. Innovation has always been Mangart's guiding principle and strength and has helped the company to continually grow. Another contributing factor in this respect is the fact that the company is always on the lookout for innovative software solutions capable of optimizing and reducing design costs and deadlines for public construction projects.

